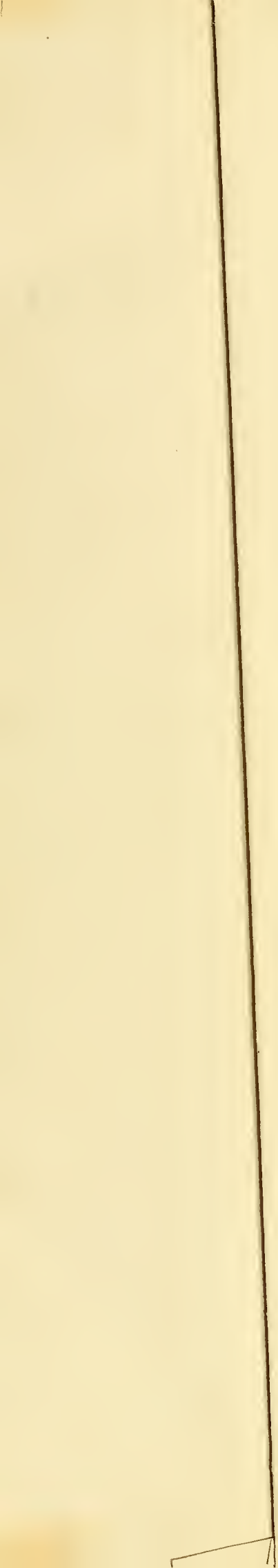

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LIBRARY OF ELECTRICAL ENG'G

Some Engineering Features in the New Federal Building in Chicago.

At last the new Federal Building in Chicago has reached a stage when it may be called practically completed. Many of the government offices have been removed to the new structure, and by the first part of September all of the various departments will be in their respective quarters. In going through this magnificent building one cannot but be impressed not only with its size, but with the remarkable symmetry and beauty of its design, and the attention which has been paid to minutest details of its construction.

The building occupies a site in the very heart of the business district of Chicago, taking up one whole block bounded on the north, east, south and west sides by Adams, Dearborn, Jackson and Clark streets, respectively. The length is 400 feet and the width 328 feet. The height to the top of the corona of the dome is 288 feet, and to the top of the flagstaff 324 feet. The external diameter of the dome is 108 feet, and the diameter of the inner dome 63 feet. The height of the inner dome from the first floor to the corona is 163 feet and the total floor area is 650,000 square feet. The exterior design of the structure is well shown in Fig. 1. The materials of which the building is constructed are granite for all the outside parts, and steel, concrete and plaster for the inside, finely finished with marble, and oak woodwork, according to the schemes for the various rooms and corridors. The foundation is laid upon thousands of piles driven down to bed rock. The outer surface of the dome is composed of small plates of glass, supported by a skeleton work of steel, and underlaid with gold leaf.

In a building of these dimensions the features of interest to the engineer are many and varied, and in the new Federal Building everything has been installed in accordance with the latest practice and with a view to facilitating in every way the work of the operating engineer. Power for the electrical equipment is contracted for with the Chicago Edison Company for a number of years, though it is expected that at a future date an isolated plant will be installed. One of the most complete and effective heating and ventilating systems in the country is to be found in this building also, besides the latest types of high-pressure elevators, refrigerating apparatus, etc.

Fig. 1. The New Federal Building in Chicago.

Electrical Distribution.

As mentioned above, current for lighting and power is taken from the mains of the Chicago Edison Company. It is admitted to the building through steel-encased cables, and passes to the switchboard which is shown in Fig. 6. From this board it passes directly to the main switchboard, which is shown in Fig. 2. As shown in the picture this board, made of blue Vermont marble, is a handsome and substantial one containing 17 panels in all, each seven feet high and two feet wide. Taking these panels in order from left to right, the first 10 panels are for the lighting feeders; panels 11, 12 and 13 are for the power circuits, and are provided with circuit breakers; 14 and 15 are the recording panels, and the last two are totalizing panels.

The building is wired for approximately 20,000 incandescent lamps and a total of about 1,000 horsepower in motors of various kinds for the power equipment of the building. The large area covered by the building necessitated the subdivision of the feeder system into such multiples as could be readily installed in the fireproof construction of a building of this character. The switchboard controls the entire lighting current of the building. The main conduit extends from this point to the dome, where it is divided into four sections or risers for the convenient control of the various floors. For this purpose 70 runs of two-inch conduit are installed beneath the floor, in which are inserted 1,000,000 circular-mil cables, which are used as main feeders for both lighting and power work. On each floor are four wire shafts, and in each wire shaft is the distributing center feeding the branch cabinets on each floor. Fig. 8 is a riser diagram showing the wiring distribution.

Fig. 9 illustrates the work of construction under way, showing the conduit terminating in the framework, arranged to receive the branch cabinets, and also showing conduit runs across the floor, and some of the connections at the floor boxes for desk lights, of which some 1,500 are installed in this building. These floor boxes are a special pattern and were manufactured by the contracting company especially for this work.

The total feet of conduit installed in the building for branch-circuit wiring alone is over 200,000 feet.

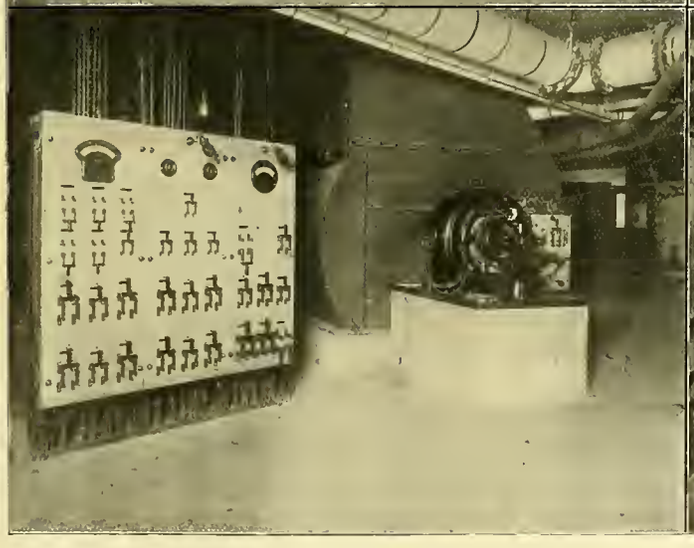

Fig. 2. Main Switchboard.
Fig. 3. Lighting Sub-switchboard and Cabinet.
Fig. 4. Ventilating-fan Equipment and Power Sub-switchboard.
Fig. 5. Pneumatic Mail-tube Station.

SOME ENGINEERING FEATURES IN THE NEW FEDERAL BUILDING IN CHICAGO.

There is approximately 500,000 feet of branch conductor throughout the building.

In addition to the main switchboard in the engine room, there are installed, in different portions of the building, five subswitchboards for convenient control of both lighting and power work, and over 100 sub-cabinets and distributing cabinets. All the above are made from selected blue Vermont marble; all copper work mounted is polished and has a high grade of finish. The government has just completed a very careful test on this equipment and, with all wiring connected throughout the building, a test of 100,000 ohms was secured, which, it is said, is the best test ever obtained on a contract of this size where the number of feet of conductors exceeded 500,000 feet.

Fig. 4 shows the sub-power board, located in the basement, another being located on the ninth floor. Fig. 3 is a view of one of the lighting subswitchboards on the first floor, and also shows one of the cabinets.

Lighting Features.

Ample opportunity is offered in the dome of the building and the various corridors, halls and courtrooms for the carrying out of an elaborate scheme of electric lighting, and the results that have been attained in this line could hardly be improved upon. The most beautiful and impressive effect of all has been secured in the interior of the great dome. As already explained in giving the general dimensions of the building, there are in reality two domes, one within the other, the space between the two being taken up by office rooms. The interior dome extends up to the tenth floor and is not entirely closed over at the top. Just above the opening is hung a large spherical surface built up of steel and plaster, and hung from the upper framework of the exterior dome, the convex surface being down. Upon this surface a painting of some appropriate design will later be added, so that, in looking up from below, the painting will appear through the opening of the inner dome. To light up this painting effectively at night a row of 100 incandescent lamps has been placed in a circle around the upper surface of the interior dome, but hidden from below. The light will thus reflect upward and bring out all the details of the painting.

The interior of the inner dome is of ornamental design, done in stucco work set off by massive pillars. Around the dome, at each landing, is placed a row of incandescent lamps set back in recesses, which, when lighted, appear to the eye from below and accentuate the ornamental features, lighting up the whole interior of the dome at the same time with a blaze of light. The interior dome opens at each landing into the corridors between the inner and outer domes, and in these corridors are hung numerous bracket lights, the soft glow of which may be discerned through the openings from the interior of the inner dome, adding greatly to its beauty.

In addition to all this, there are to be added soon two rows of electroliers, one at the first and one at the eighth floor, to be hung from brackets extending out into the dome. There will be 16 of these electroliers in all, eight on the first floor and eight on the eighth. They will each weigh 900 pounds and the cost of each, it is said, will be nearly $1,000.

The current supply for each of the rows of dome lights is controlled by two panels on each floor in conduit shafts on diametrically opposite sides of the dome. The switches in each of these panels control every other light in its row.

The corridors on the first floor, arched and finished in marble and plaster, are lighted by incandescent lamps in the ceilings set in rosettes, and in looking down the arched vistas of these corridors

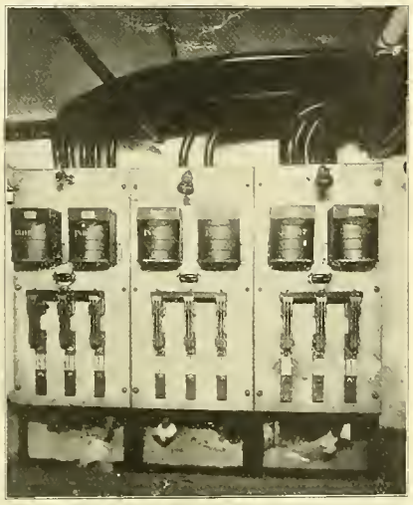

FIG. 6. SWITCHBOARD FOR ENTERING MAINS IN CHICAGO FEDERAL BUILDING.

an effect is obtained which is second only to that in the dome itself. The corridors on the upper floors are not arched, but are lighted effectively by ceiling lights set at frequent intervals and covered by Holophane globes. In the courtrooms studded lighting is principally used, with the addition of a few wall brackets. This lighting is accomplished in such a manner that the light is reflected up to the ceilings and then down into the room, the lights themselves not being in the line of vision of the occupants of the rooms. All told there are approximately 20,000 16-candlepower incandescent lamps connected in the building, as mentioned above. In the dome alone there are now nearly 500 lights in place, with more to be added.

Motor Equipment.

Electric power is used for all purposes throughout the building, with the exception of the elevator equipment and compressor apparatus. Fig. 7 is a motor-riser diagram which shows the number of motors, their capacity and the purpose for which they are employed. The motors all derive their current supply from two power sub-switchboards, one in the basement and one on the ninth floor. There are in all 39 motors now installed. More will be added in a few months for the operation of a mail-conveyor system, which is to be used for conveying mail from the wagon entrances to the various departments. This system will require 25 or 30 motors. The motors now installed aggregate over 500 horsepower. In Fig. 4 is to be seen, besides the basement power board, a typical motor installation for one of the ventilating fans. Most of the motors, as will be seen by the riser diagram, are used for fan and pump work.

Two house pumps located in the basement deserve special mention for the steadiness and efficiency of their operation. They are Gould pumps, each driven by a 10-horsepower General Electric motor. These pumps deliver water to the ninth floor and will throw 300 gallons a minute. The pumps are so arranged that they may be thrown together in case of fire.

Heating and Ventilating.

The ventilation of the building is principally accomplished by mechanical means through the agency of steel-plate fans in the basement and on the eighth floor. There are four complete sets in the basement for supplying air up to and including the second story and also a fan for exhausting the air from the first and second floors. Air is taken in at the intersections of the wings of the building and carried down into the basement to the fans through ducts. The fans are located in a sectional sheet-iron casings in which are located the heating coils, as will be explained later. Each of the four sets of fans supplies air to the section of the building to correspond to the wing in which it is located. In addition, there are located in the dome four complete fan outfits supplying fresh air to the respective wings from the third to the eighth floors, inclusive.

Air is exhausted in turn from the offices and other spaces through ducts, corresponding to the supply ducts, which run to ventilating shafts on the ninth floor. Here are located the exhaust fans which take the vitiated air from all spaces on the third to eighth floors inclusive, other than the dome and the courtrooms.

In the ninth-floor plant is located a fan and heater unit supplying fresh air to the dome and all rooms above the tenth floor. This fan discharges into the dome below the eleventh floor and above the false dome, which is located within the dome proper, and equalizes the pressure of the other systems described. This is done by forcing air into the dome shaft and drawing it into the corridors which open into the dome on all floors. The air thus coming from the dome into corridors passes through registers into the regular system of wing exhausts. Thus the entire dome and corridor space will be under a slight pressure tending to blow air out of the building upon the opening of a door, instead of allowing an influx of cold or hot air into the building.

A special exhaust fan on the ninth floor exhausts the air from the toilet rooms, and the four main court rooms have heater and fan equipments of their own on the eighth floor, each above its respective room. Fresh air to the sub-treasury vaults is taken from the regulator ducts through a separate duct system.

All the fans of this comprehensive system are driven by Sprague motors. The volume of air drawn into the building is 260,000 cubic feet a minute.

Heating is accomplished by both the indirect and

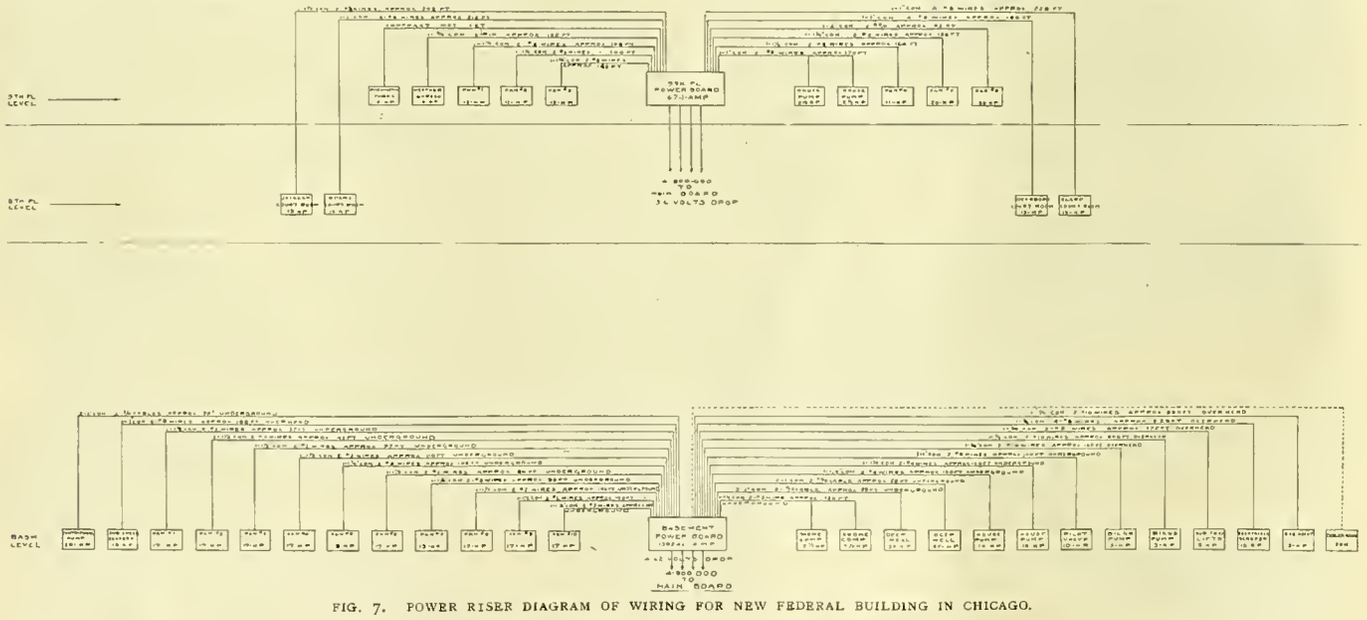

FIG. 7. POWER RISER DIAGRAM OF WIRING FOR NEW FEDERAL BUILDING IN CHICAGO.

direct methods. Each and every supply fan has connected with it a heating, washing and drying device within the iron casing. The heating is done by two groups of steam coils, one located at the intake to the casing, and the other at the intake of the fan a few feet within the casing. The washing is done by nozzles discharging cone-shaped jets. The supply of water is taken from a reservoir and is used over and over again, the loss due to evaporation being made up from the city mains. The drying apparatus consists of zigzag copper illuminators, so arranged that the proper amount of moisture is eliminated from the air. In conjunction with the heating and washing apparatus there is a system which automatically imparts to the air supplied to the courtrooms the proper degree of humidity.

Besides this elaborate system of indirect heating,

FIG. 8. RISER DIAGRAM OF WIRING FOR NEW FEDERAL BUILDING IN CHICAGO.

there are also located in various parts of the building a large number of steam radiators having a combined heating surface of approximately 70,000 square feet.

Boiler Plant.

Five Cahall boilers, aggregating 2,000 horsepower, are located in the basement of the building, operating at a pressure of 150 pounds per square inch. These boilers furnish steam for heating and for the few engines that are used in the building. They are supplied with a mechanical draft, and in order that the chief engineer may know exactly how each fireman has been performing his duty an automatic recording gauge is used in connection with the draft arrangement which records upon a strip of paper a diagram showing exactly how the air has been supplied to the furnaces. This device is expected to accomplish a large saving in coal, since if the fireman is aware that a record of his firing is kept he will be more careful to do it properly. A Green economizer is used in connection with the furnaces.

The boiler room is cooled by air blasts located in front of the boilers. Coal is conveyed by an industrial railway, being taken from the bunker under the sidewalk in small cars and conveyed to a convenient dump in front of the boilers. In the same way ashes are removed from the rear of the boilers to an elevator, which carries them up to the street level.

Pneumatic-tube Mail Service.

Much of the smaller mail matter, such as letters, etc., is transferred between the main postoffice and the railroad stations and postoffice sub-stations by a pneumatic-tube system. Fig. 5 is a view of the pneumatic station in the main postoffice in the Federal Building. Three tubes enter this station, as shown in the picture. These tubes are about eight inches in diameter and receive cartridges or carriers about two feet long, which are lightly but strongly constructed of sheet steel. They are opened through a cover at one end, supplied with a special clamping device, which holds the cover securely in place. One of these tubes runs from the Federal Building to the Illinois Central depot, thence to a substation on Twenty-second Street, from there to the Armour sub-station, and then on to the Stock Yards station. This tube works under a pressure of six pounds to the square inch. The second tube, operating at 10 pounds pressure, goes to the Northwestern depot. The third tube which makes use of the tunnels of the Illinois Tunnel Company, goes to the La Salle Street railroad station and operates at 8½ pounds pressure.

The carriers are inserted in the tubes through an entrance valve supplied for the purpose. When inserted their full length a tripping arrangement admits the air behind the carrier, and it is shot through the tube at a high velocity. Arriving at its destination, it leaves the tube through another opening and is received by a buffer, which takes up the momentum.

The air-compressor plant for supplying this service is located in the basement of the Federal Building, immediately below the station shown in Fig. 5.

Miscellaneous.

There are so many features of interest relative to this plant that space will not admit of a complete description of them all; but there are several things not described in the foregoing which cannot be left without mention. One of the most interesting of these is the electrical equipment of the sub-treasury vaults. There are three of these vaults, one above the other, and reaching from the basement to the second floor. One of these is for gold, one for silver and one for surplus which cannot be stored in the other two. Each is fitted with every safety appliance known to the art. On each is a Chicago Electric Protective Company burglar alarm. The doors are fitted with four time locks, besides a combination lock. Within the main door is a grating having two locks, the keys of which are carried by two separate employes, one man never being allowed to enter the vaults alone. Outside of the main door of each vault is a solid concrete and steel platform which is raised and lowered by an electric motor. The door of any vault cannot be opened or closed when this platform is in its normal position. To open the door the platform must first be lowered a distance of four feet, when the door may be swung back. The platform is then raised again, fitting so nicely against the sill and around the bottom of the door that its presence is scarcely noticeable. To close the vault door the platform must again be lowered. The motor controller which accomplishes this is located a short distance from the vault door, but it is such an innocent-looking affair that its purpose would not be guessed by one not familiar with the arrangement, the motor and gearing being concealed from view. The walls of the vaults are of solid concrete, two to four feet in thickness, intersected in every direction by beams of steel.

A total of 13 hydraulic elevators have been installed in the building by the Otis Elevator Company. There are six main passenger elevators running to the eighth floor, one passenger elevator running to the dome, one freight elevator and five short lifts. All are operated under the high-pressure system—750 pounds to the square inch. For furnishing the hydraulic pressure to the system there are located in the basement one 50-ton high-duty pumping engine and two tandem-compound pumping engines.

Pure water for drinking is obtained from an artesian well and, before being forced up to the various drinking fountains, is cooled to 35° F. by an absorbent system of refrigeration. The water is forced from the well by compressed air by an Ingersoll-Sargent step-up compressor. The hot-water supply for the building is kept at 180° F. by the Johnson system of regulation. Shower baths are provided in the basement for boiler and engine-room employes, and a separate one for the chief engineer.

The electrical contracting work upon the building was all done by the Arthur Frantzen Company of Chicago. R. D. Jones of that company having the installation under his immediate supervision, and E. D. Fuchs, chief draftsman of the company, having under his care the preparation of the drawings. The heating and ventilating equipment was installed by the Charles B. Kruse Heat Company of Milwaukee. Ralph H. Chappell, inspector of the Treasury Department, and formerly of the Engineer Corps of the United States Navy, is the government's engineer on the spot. The chief operating engineer of the building is James S. Folsom, and under him the chief electrical engineer is W. A. Richardson, who has been in the employment of the government for 10 years.

FIG. 9. VIEW IN CHICAGO FEDERAL BUILDING DURING CONSTRUCTION, SHOWING IRON-PIPE WIRING CONDUIT.

The Utah Sugar Company of Lehigh, Utah, will install an electric-light plant.

Canadian Electrical Association.

The fifteenth annual convention of the Canadian Electrical Association was opened in Montreal on June 21st, with nearly 200 delegates present. The meetings were held in the rooms of the Canadian Society of Civil Engineers.

K. B. Thornton, president of the association and superintendent of lines of the Montreal Light, Heat and Power Company, opened the meeting, and in his annual address said that it was several years since the association had last met in Montreal, during which time there had been a great increase in the development of electrical industries. The association had attained its object to a large extent, which was to advance the interests of the electrical profession in Canada. The interest taken by the majority of the members, however, was disheartening. It was therefore desirable that a committee should be appointed to investigate and report what steps were necessary to increase the membership of the association. In the past the benefits to be derived from general intercourse among the members had been largely dissipated by too large a preponderance of the entertainment feature. This should be discouraged and more attention given to the transactions of the convention.

C. H. Mortimer of Toronto, the secretary, presented his report, in which he stated that the present membership was as follows: Active members, 285; associate members, 126; total, 411, showing a gain for the year of 36.

The following papers were on the programme: "Operation of Transformers at Varying Frequencies and Voltages," by M. A. Sammett; "Transformers," by R. T. McKeen; "Selection and Maintenance of Service Meters," by William Bradshaw; "Incandescent Lamps," by A. B. Lambe; "The Operation of Alternators in Parallel," by A. L. Mudge; "Polyphase Induction Motors," by H. A. Burson; "Heating of Enclosed Conductors," by Prof. R. B. Owens; "Economy of Isolated Plants," by K. L. Aitken; "Notes on Steam Engines and Boilers," by William McKay; Question Box.

A special visit and luncheon at the plant of the Allis-Chalmers-Bullock Company at Rockfield was enjoyed and the various sub-stations in Montreal were visited. Special books of complimentary tickets were presented to all delegates by the Montreal Street Railway Company.

The officers elected for the ensuing year are as follows:

President—A. A. Wright, M. P., president of the Electric Light and Power Company, Renfrew, Ont.

Vice-presidents—R. G. Black, Toronto Electric Light Company, Toronto, and John Murphy, Ottawa Electric Company, Ottawa.

Secretary and Treasurer.—C. H. Mortimer, Canadian Electrical News, Toronto.

Executive Committee.—K. B. Thornton, Montreal; A. A. Dion, Ottawa; R. B. Reesor, Lindsay; C. B. Hunt, London; J. A. Kammerer, Hamilton; J. J. Wright, Toronto; W. Williams, Sarnia; Lewis Burran, Quebec; H. O. Fisk, Peterboro; J. W. Purcell, Walkerville.

The association will hold the next convention at Niagara Falls.

Among those in attendance at the convention were the following-named:

L. B. Hastings, Pittsfield, Mass.; William McCaffrey, Toronto; B. G. McBurney, Toronto; V. Boyd, Toronto; Thomas Sadler, Fenelon Falls; E. J. Jenkins, Toronto; E. S. Sifton, London; N. G. MacLeod, Toronto; John J. York, Montreal; W. V. Warren, Montreal; A. B. Smith, Toronto; H. A. Moore, Toronto; William Bradshaw, Pittsburg; R. Y. MacKeen, Toronto; R. M. Wilson, Montreal; A. Esling, Toronto; H. H. Henshaw, Montreal; Louis Yorston; R. E. Branden, New York; J. W. Purcell, Walkerville; W. P. Ambos, Cleveland; H. C. Philpott, Toronto; Thomas Hilliard, Ottawa; J. Herbert Hall, Toronto; P. G. Gossler, New York; Phelps Johnson, Montreal; Ormond Higman, Ottawa; T. H. Bibber, Boston; J. W. Pilcher, Halifax; C. C. Starr, Halifax; Fred Chowen, Stratford; F. Ross, Toronto; Sheldon Cary, Cleveland; Nelson Graham, Sudbury; Joseph H. Webber, Toronto; W. Williams, Sarnia; J. W. Campbell, Toronto; D. C. Melen, Montreal; William A. Burke, Toronto; Eugene Waugh, New York; Daniel Framen, New York; C. W. Schiedel, Waterloo; F. E. Barbour, Montreal; E. R. Frost, Quebec; J. M. Deagle, Cataract, Ont.; A. B. Lambe, Toronto; D. P. Burke, Ottawa; W. L. Macfarlane, Cornwall; C. F. Abbott, St. John, N. B.; R. B. Hamilton, St. Catharines; G. R. Duncan, Three Rivers; Lewis Burran, Quebec; A. E. Wilson, Montreal; D. McQuaid, Montreal; Thomas H. McCouley, Port Arthur; F. S. Jones, Fort William; Charles L. Farrar, Lakefield; H. G. Taylor, W. G. Ross, F. McDonald, H. R. Lockhart, H. T. Chapman, D. Robertson, H. E. Smith, T. W. Casey, M. Neilson and William Reid, all of the Montreal Street Railway; F. S. Keith, Toronto; S. Humphreys, Montreal; F. A. Chisholm, St. Johns; C. Thomson, Montreal; Lacasse Rousseau, Montreal; Acton Burrows, Toronto; T. D. Lonergan, Quebec; J. Beck, Montreal; J. A. Fletcher, Montreal; W. P. Kearney, Montreal; Frank Vaughan, St. John, N. B.; D. H. Hudson, Winnipeg; Robert J. Mercur, Montreal; Henry C. Kelley, New York; John J. York, Montreal; F. John Bell, Montreal; C. G. Keyes, Ottawa; J. M. Robertson, Montreal.

Drainage Canal Waterpower.

At the meeting of the Chicago City Council June 26th Alderman Bennett had passed an order appointing City Electrician Carroll, City Engineer Ericson and Engineer of Sewers Hull a committee on the part of the city, with the request that the Drainage Board of the Chicago Sanitary District add on its account Chief Engineer Isham Randolph and his chief assistant, E. B. Ellicott, "to report to this council the extent to which the waterpower of the Sanitary District should be used for city purposes."

The Development of the Ontario Power Company.[1]

By P. N. Nunn.

Standing upon the upper steel arch bridge and facing the Canadian Falls, one may observe at the foot of the cliff forming the right-hand wall of the gorge a long but unobtrusive building, its farther end obscured by spray from the great cataract. It is of modest though massive design and its colors almost blend with those of the overhanging cliff. This is the power house or generating station of the Ontario Power Company. To the right, high above and behind the power house, upon the bluff overlooking both gorge and cataract, may be seen another great structure, less massive but more ornate, which, on account of its commanding position, is by far the most prominent landmark of the Canadian side. This is the distributing station of the same company, from which the power generated below is controlled, measured and transmitted. Away to the left, around the bend of the river and hidden by the trees of Goat Island, lie the walls, abutments and buildings of the intake and head gates through which the water from Niagara River is diverted for use below. In the park between these extremes, seen just beyond Horse Shoe Falls, stands the power house of the Canadian Niagara Power Company, while to the left another power plant, that of the Electrical Development Company, is rapidly building. [Fig. 1 is a map showing the location of this plant and also the other power developments about the falls.]

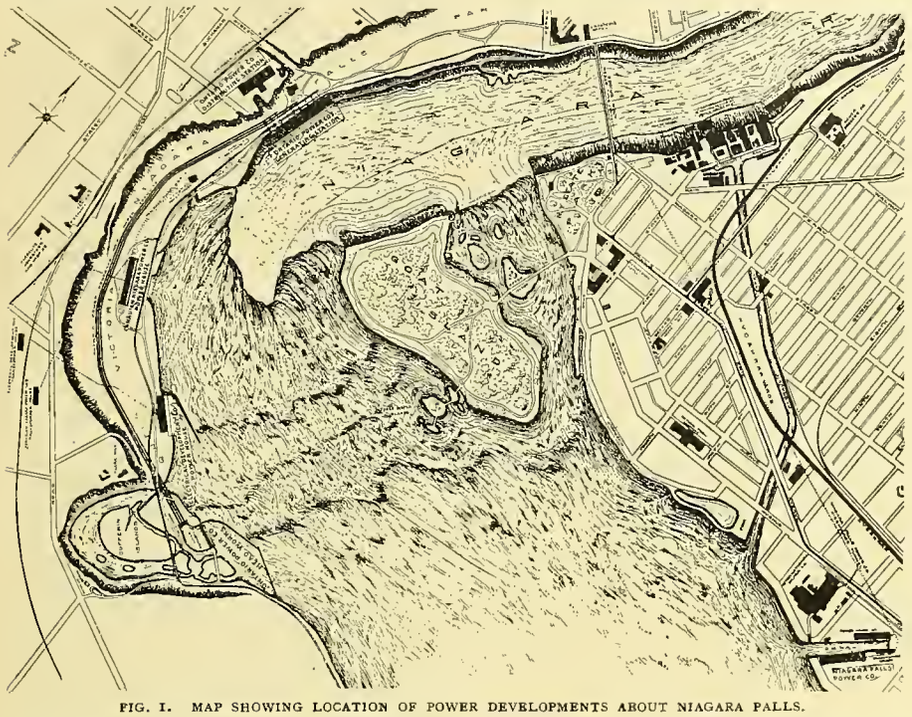

FIG. 1. MAP SHOWING LOCATION OF POWER DEVELOPMENTS ABOUT NIAGARA FALLS.

From the head-gates of the Ontario company three great steel and concrete tunnels or conduits beneath the surface of the park, will convey nearly 12,000 cubic feet of water per second to the top of the cliff above the power house. Thence it will pass through 22 steel penstocks in shafts and tunnels down out through the cliff to an equal number of horizontal turbines in the power house below. From the generators the electrical cables turn back through tunnels to the 22 banks of switches, transformers and instruments of the distributing station above and to the transmission lines beyond, completing an equipment for more than 200,000 horsepower.

The intake works for the entire 200,000 horsepower are now finished. One of the three main conduits is completed, while for the second and third portals and head-gates have been installed and a portion of the excavation made. Six of the 22 penstocks are already in place within their shafts and tunnels and two others are building, while the power house is nearly prepared for the concomitant apparatus. The distributing station is ready for the switchboard of the entire 22 units, for the transformers of eight and for the apparatus of 14. As to equipment, the present month will witness one complete unit being operated, a second being tested, a third being installed and a fourth being completed at the factories, with other units to follow as equipment of such size can be manufactured and installed.

The intake works have been located and designed with especial reference to the ice difficulties which have been the limiting factor in the success of Niagara power. Cake-ice in normous quantities floats down for weeks at a time from the great lakes, and mush-ice is formed in the turbulent rapids primarily by the freezing of spray and foam and secondarily by the disintegration of cake-ice. To avoid the latter the intake is located in the smooth but swift water just above the rapids; to exclude the former the following features have been introduced: A long and tapering forebay [Fig 2], protected at is entrance by the main intake, terminates at its narrow down-stream end in a deep spillway. Upon the river side it is enclosed by a submerged wall, while the other side adjacent to the spillway is occupied by the main screen structure leading to the inner bay and to the portals and head-gates of the three conduits.

The intake, nearly 600 feet long, stretches across the inlet or bay at Dufferin Island, almost parallel with the current in the river. Throughout its length a concrete curtain wall extends down nine feet into the water, here 15 feet deep, so that the gate openings beneath admit only deep water, and this at right angles to the swift exterior surface flow which, sweeping the full length of the curtain, carries the floating ice to the rapids beyond. At the main screen this operation is repeated. This structure, 320 feet long in 20 feet of water, lies across the entrance to the inner bay and parallel with the direction of flow in the outer bay. Again a curtain, formed by the front wall of the enclosing superstructure, admits to the screens only deep water, here also at right angles, while it excludes ice with the surface currents maintained through the forebay by a voluminous spill of surplus water.

At the gate structure, where the water is 30 feet in depth, the tapering portals leading to the electrically operated Stoney head gates are protected with wide-mesh screens, which are also enclosed and safeguarded by a curtain carried by the front wall of the gate house.

Thus the water before entering the conduits must pass in succession three automatically selective steps, each excluding surface water and its floating ice, and two screens, each behind ice runs in heated buildings containing live steam for emergencies. Serious trouble is not believed possible while these provisions are maintained with reasonable care.

Screen frames are removable by an electric crane for cleaning and changing. On account of its location in the public park, the top of the long, narrow screen house, approached at either end by broad steps and landings, is finished as a promenade. From this point of vantage one may have a superb view of the upper rapids. The islands and channels made in the course of this work give great opportunity to make this portion of the park most picturesque.

The height of the water in Niagara River, and therefore the volume here available, is dependent upon the surface elevation of Lake Erie, the erosion of the river bed, and such temporary causes as ice gorges, storms, etc. From calculations based upon comparative observations extending over a number of years, and upon government reports of Lake Erie levels for nearly 50 years, the elevations of the intake have been so selected that at extreme low water and most adverse conditions a full supply of water should be secured.

The main conduits are of 0.5-inch riveted and reinforced steel imbedded in concrete, 18 and 20 feet in diameter, 6,500 feet long, and are buried within the rock and soil of the public park. Through them the water flows at a velocity of approximately 15 feet per second. Just beneath the top of the cliff behind the power house, within a long underground chamber, the arched roof of which supports the conduit above, nine-foot-diameter branches pass from the under side of the conduit through gate valves and become the penstocks, each supplying water at 10 feet per second to a single turbine. Each penstock has two expansion joints, a massive thrust anchorage in the power house foundations and an automatic relief valve and stone catch discharging into the river. The nine-foot valves are electrically operated under distant control from the power house below, and are so constructed that all working parts may be removed for attention while the penstocks are in service.

The spillway at the end of the conduit, to prevent water hammer in case of sudden loss of load, is a little more than the enlarged and elevated end of the main conduit equipped with an enclosed weir and underground discharge. Its peculiar features are its adjustable weir and helical discharge tunnel which, after a steep initial pitch in the taper from the weir, follows a uniform grade and symmetrical curve while circling about to reach the river, thus preserving a smooth unbroken water column of highest velocity and least expenditure of energy. The purpose here is to prevent erosion, restricted flow and excessive air suction, the latter on account of the danger of formation of ice from spray under forced circulation of air.

The generators are of conventional horizontal-shaft type, three-phase, 25-cycle, and deliver 12,000 volts at 187.5 revolutions per minute. The turbines are of Francis or inward-flow type, double, central-discharge or balanced twin turbines designed to deliver 12,000 horsepower under a 175-foot head. Their shafts are 24-inch maximum diameter and each carries two 78-inch cast-steel runners of "normal" reaction. [Fig 4 on page 8 shows a section through the generating station.]

Of the 175-foot head 20 feet is in the 10-foot-diameter draft tubes, because the floor of the power house has been elevated 26 feet above mean water level to provide for the excessive variations to which the water in the gorge is subject. While the bearings are self-oiling, all are equipped with a water-cooling system, and for still greater insurance a piping system for the changing of oil has been so connected that in emergency it is instantly available for forced lubrication.

Although entirely feasible to use the vertical-shaft turbine, and although restricted space at the power house requires greatest floor economy, nevertheless horizontal units are employed on account of their freedom from step bearings, their higher efficiency and their greater accessibility.

Gratifying accessibility has been obtained by compact arrangement of generators and turbines, with ample clearances and good light upon the main floor of the station, and in full sight not only of the immediate attendant, but also of the chief operator from his post upon the gallery above. In the general arrangement of the works symmetry and centralization of control are predominant characteristics. The generating and distributing stations are parallel and nearly 600 feet apart, with 260 feet difference in elevation. On account of limited space the generating station is but 76 feet wide, though when completed it will be nearly 1,000 feet long. Down the center of this building, side by side in a single row, stand the generating units with turbines next their source of supply. The space between them and the rear wall is occupied by a gallery upon which stands the row of oil pressure governors, each almost over the end bearing of its turbine.

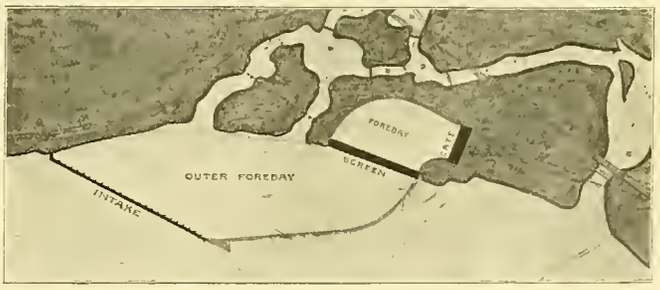

FIG. 2. PLAN OF ONTARIO POWER COMPANY'S INTAKE.

The distributing station, wider and shorter than the power house, is divided into three longitudinal bays or five main sections. The narrow front bay contains the switches, bus bars, etc., at generator pressure; the wider rear bay contains those at transmission pressure. Between these stretches, the main middle bay is divided transversely by a three-floor

[Continued on page 8.]

1. Abstract of a paper presented to the American Institute of Electrical Engineers in Asheville, N. C., June 22, 1905. Mr. Nunn s engineer of the Ontario Power Company.

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DATES AHEAD.

National Electrical Contractors' Association (fifth annual convention), Mechanics Hall, Boston, Mass., July 19th, 20th and 21st; electrical exhibition, July 15th to 22d.

Ohio Electric Light Association (annual convention), Hotel Victory, Put-in-Bay, August 16th to 18th.

International Association of Municipal Electricians (annual convention), Erie, Pa., August 23d, 24th and 25th.

Old Time Telegraphers' and Historical Association (annual meeting), New York city, August 29th to September 1st.

American Electrotherapeutic Association (annual meeting), Academy of Medicine, New York city, September 19th, 20th and 21st.

American Street Railway Association (annual convention), Bellevue-Stratford Hotel, Philadelphia, September 25th to 29th.

A TUNNEL under the English Channel connecting England and France has long been discussed, but nothing has ever been done, owing to the reluctance of the English to be thus connected with the Continent. The matter was recently revived, however, at the conference held in Paris between the Northern Railway of France and the Chatham Railway Company of England. It was thought at this conference that the time is approaching when the existing prejudices will disappear and that the long-deferred scheme for bringing England and France into closer touch will take a practical turn, resulting in an enormous increase of business. Such a step, if ever taken, would undoubtedly mean that electricity would again be given the opportunity to demonstrate its superiority for the operation of tunnel trains.

IT IS suggested, and we think with great propriety, either that English be adopted as the official language of the next International Railway Congress, or that an English-speaking body be formed to consider railroad questions of international interest. The use of two languages—English and French—at the Washington meeting was a great handicap, and, according to a delegate who writes in the London Times, the complication is soon to be intensified by the adoption of German, in order to secure German co-operation. A majority of the railroad mileage of the world is owned and managed by English-speaking peoples, and it would appear to be a very practical and sensible proceeding to adopt English as the sole official language of the congress, or, if this is not acceptable, to form a distinct English-speaking International Railway Bureau. The majority of those who have railroad problems to solve have a perfect right to decline to hamper themselves with the additional perplexities of refinements of meaning in differing languages. English is now the leading language of commerce, and is destined perhaps to be the world-language. Those who employ it should promote its use with intelligence, courtesy and persistence.

AN INTERESTING description is given by a German contemporary of the various cables laid by German authorities for telephone purposes since the year 1897. Four distinct types of cables were described as illustrative of the common German practice. The first cable had a core of four copper wires, each 0.059 inch in diameter, each wire wound with paper to a thickness of 0.169 inch, twisted together in the ordinary way, covered with cotton and coated with two thicknesses of stout tinfoil and a double wrapping of asphalted paper and dressing. The outer sheath consisted of 13 strands of galvanized-iron wires, each one-fifth of an inch in diameter, with two coats of composition, the whole weighing about eight pounds per yard and costing $5,010 a mile. This cable, laid in May, 1897, gave satisfactory results, and the same section was used for six other telephone lines in the four years which followed. In 1902, in order to improve the telephone communication between Germany, Denmark and Sweden, a new cable of much larger section was laid. The shore ends of this line were heavily armored. The Norderney-Borkum cable, laid in May, 1903, has an internal air space and is heavily armored.

AN EXAMINATION of the "Question Box" presented at the Denver-Colorado Springs convention of the National Electric Light Association shows the extent to which this comparatively new feature of electrical conventions has been carried. The work, which was executed by Mr. Homer E. Niesz of Chicago, consists of a volume of 595 pages, containing 3,057 answers to 545 questions, these answers being the work of 227 contributors. The questions are arranged under 26 headings, which divide the various phases of central-station business into separate, consecutive subjects, each one of which is treated fully in the questions and answers given. The questions and answers cover not only the construction and operation of electric-light stations, but also the transmission and distribution lines and various translating devices, as well as the broader questions of advertising, contracts and rates, accounting and management. The book is indexed by subjects, alphabetically arranged, so that answers to any given subject or branch thereof may easily be found by referring to the general index. In addition to the questions answered in full, numerous references are given publications or papers treating the subjects more fully than the limits of the "Question Box" allow.

This volume gives a mass of information that is of real value, for it contains not the opinions and conclusions of one man, but of many men, and from many points of view. The educational value of the book is one of its important functions, and should constantly be borne in mind when considering its growth and development. The information given by one member is valuable to many, and in adding to the fund of knowledge he is enriching at no cost to himself, as all are working along similar lines but in different places. The value of the "Question Box" is especially great to the smaller central stations and those who are not able to investigate fully many perplexities that are constantly confronting them, for in this volume they find the opinions and experiences of other central-station companies who have met and solved the same problems. The possession of this feature of the association work would in itself be worth the expenditure of the membership fees to any central-station company.

THE EXECUTIVE COMMITTEE of the Civic Federation of Chicago, of which Mr. B. E. Sunny is chairman, recently made a report which contains some views of municipal ownership which are interesting and important. The committee is unanimously opposed to municipal operation of public utilities, and it regards municipal ownership of any of them, under present conditions, as impracticable. It does not feel that in the nature of things the city of Chicago can possibly be successful in the management of any of the so-called public utilities. The city has had the management and control of the water department and electric system for lighting for many years, and it cannot be said that, in connection with the water department, at least, it has been successful. The city electric plant has been in operation some 15 years. It has been under experienced and able management. There seems to be a pretty general impression that the city built its own electric-light plant because it could not secure what it regarded as proper treatment from the electric-lighting companies. This, the committee says, is erroneous. The reason for starting the municipal plant was that the city could not make a contract with any electric-light company for arc-light service for a longer period than one year, and the electric-light companies would not risk an investment in poles, wires, underground cables, etc., on a contract running for so short a period. The city was therefore forced to put in its own plant.

In the annual report of the electrical department the statement is made that from 1888 to 1904 the city had saved $312,736, and had also paid for its electric-light plant out of the sum it would have had to pay to private corporations for the same volume of electric lighting. This is made on the theory that the cost of electric lights furnished by a private corporation would have been $200 each in 1888, $175 in 1892, and so on down to 1904, when the price for some lamps was $103 and for others $137.50. It is true that these sums were paid by the city for a small number of arc lamps furnished during the years mentioned, but it does not follow that the city would have been asked to pay any such price for a very large number of arc lamps on a contract running for 10 or 15 years. The cost of operating the 5,000 arc lamps owned by the city, adding interest and depreciation, together with the loss of taxes and other proper charges, is, in the aggregate, in the judgment of the committee, $625,000 per annum. On a contract running for a long period with a private corporation the same service can doubtless be had at from $400,000 to $450,000 per annum.

As indicated by the report, the Civic Federation is no advocate of municipal ownership. It maintains that in the management of the two classes of service referred to, i. e., electric-light plants and waterworks, the city has not been successful to a degree which will warrant it to go into the street-railway or telephone business. Its reasoning seems to be irrefutable.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

The twenty-second annual convention of the American Institute of Electrical Engineers was held in the ballroom of the Battery Park Hotel at Asheville, N. C., June 19th to 23d. The larger part of those in attendance at the convention arrived in Asheville at about 2:30 p. m. Sunday. Through the activity of Mr. Pope all those who arrived on this train had received their badges and were registered before arriving at the station. About 75 were registered on Sunday, and the final record indicated about 150, 100 being members in attendance at the convention and 50 their wives and guests. Numbered badges were issued, and each day a list of those expected and those in attendance was printed and distributed with the number corresponding to the badge appended to each name.

Monday.

The meeting was called to order promptly at 9:30 a. m., Monday, June 19th, and was opened by an address by the president on "The Organization and Administration of National Engineering Societies." Mr. Lieb spoke on the remarkable growth of the Institute and considered the requirements for membership in the four national societies. Mr. Lieb also advocated an increase in the entrance fees for associates to at least $10 and an additional fee of $15 upon transfer, a total of $25 for full membership. Mr. Lieb then considered the annual receipts and disbursements per paying member per year in the four societies. In concluding the president spoke of the local organizations as instituted by Past-president Scott.

The first paper of the day was that on "High-power Surges in Electric Distribution Systems of Great Magnitude," by Dr. C. P. Steinmetz, and was followed by a paper on "An Experimental Study of Commercial Transmission Lines of the Rise of Potential Due to Static Disturbances, Such as Switching, Grounding, etc.," by Percy H. Thomas.

Dr. Steinmetz considered the problem that was brought out by the recent trouble and burn-out in the Interborough system. Mr. H. G. Stott furnished Dr. Steinmetz with all the data necessary for its solution. It was shown that these surges were usually preceded by static disturbances throughout the line and that if means could be employed to operate a selective cut-out or circuit breaker that would automatically cut out the line that was in trouble these severe burn-outs could be eliminated. It was practically impossible for an attendant to find out which feeder was giving the disturbance until it was too late. Such an automatic system has been installed and has proved very satisfactory. Dr. Steinmetz proved analytically the nature and probable magnitude of these surges.

Mr. Thomas' paper being similar in its nature to Dr. Steinmetz' paper, was read, and a discussion of the two papers followed. Mr. Thomas' paper treated the tests made on the lines of the Telluride Power Company, the Missouri River Power Company and the Utah Light and Power Company. Mr. Thomas showed the inadequacy of laboratory tests on transmission circuits and the demand for commercial tests on plants that had been installed. Few plants are available, because it has been impossible to use the lines for testing purposes because of the demand for immediate service. It is for this reason that these tests are of special importance.

The third paper of the morning was Dr. Steinmetz's on "The Constant-current Mercury-arc Rectifier." Dr. Steinmetz treated the subject from the practical standpoint of its utility on constant-current arc-lighting systems, and concluded with a theoretical discussion of the rectifier. The meeting then adjourned till 8:30 that evening.

The local committee, consisting of Charles E. Waddell (chairman), J. H. Finney, I. P. Keeler, E. W. Stone and A. M. Schoen, prepared a programme for the entertainment of the Institute that could not be excelled.

Monday afternoon carriages were provided and the party, including the Institute members, their wives and guests, were driven through the Biltmore estate, visiting the stock farms and dairy thereon.

The evening session was called to order at 8:30, and a paper on "Data Relating to Electric Conductors and Cables," by H. W. Fisher of the Standard Underground Cable Company was read. Mr. Fisher showed that the conductivity of stranded cables was not the same as that of a solid conductor, assuming that the area in each case is the same. He showed that the tendency is for the current to flow along the separate strands and only unite when following some slight short circuit between the strands. The author further showed that there is a magnetizing effect which tends to increase the impedance. Curves were shown to indicate the relations that were found to exist. In conclusion the author expressed his views in regard to guttapercha and paper cables to withstand high temperatures and high voltages. A preference is expressed for paper cables. The author also gave a table to determine the thickness of the paper insulation for working pressures from 1,000 volts to 23,000, indicating in each case both the "factory test" and the "installation test."

The second paper dealt with "Methods of Measurements of High Electric Pressures," by S. M. Kintner. Mr. Kintner discussed the different methods of measurement employed in testing, using the step-up or step-down transformer, voltmeter-resistance or spark gap. The author tried to verify the A. I. E. E. standard needle spark-gap curve and obtained very different results, depending on whether he employed resistance capacity or impedance in the circuit and the nature of the needle points and gap. Mr. Kintner then described a new type of voltmeter as manufactured by the Westinghouse company. This instrument is capable of recording 100,000 volts at present, but modifications thereon will increase its capacity to 150,000 volts. This meter is of the static form, operating in oil of great dielectric density. Mr. Kintner showed that the limiting factor is in the question of insulation as in other high-pressure apparatus.

Mr. John W. Howell then closed the evening's programme with "Comments on Remarks Made by Col. R. E. B. Crompton before the International Electrical Congress at St. Louis." Colonel Crompton claimed that the English lamp engineers had found that better economy had been obtained from 220-volt lamps than from 110-volt and that they were in extensive use in London. Tests made by the author showed little or no uniformity in the candlepower or watts per candlepower of some 25 samples that were tested, and that the average of watts per candlepower was very high, much higher than that of the American lamp.

Tuesday, Railroad Day.

The meeting was called to order at 9:30 a. m., Mr. Lieb presiding. Mr. F. N. Waterman opened with a paper on "Three-phase Traction," being followed by "Heavy Traction Problems in Electrical Engineering," by C. DeMuralt, a paper on the same subject. These authors considered the adoption of three-phase electric traction in place of the present direct-current system from the standpoint of being more economical and giving great flexibility. Three-phase motors would act like flywheels and the energy taken at one time would tend to be returned to the system on down grades. C. O. Mailloux and Dr. Steinmetz expressed their views upon the matter, but differed in the advisability of such a system. The advantage of the three-phase system is the elimination of the commutator and its troubles. The disadvantage, however, is that two overhead wires must be used, which complicate switching and insulation difficulties. On the whole, those that discussed these papers seemed to advocate the three-phase system, the elimination of the commutator being of such vital importance. The successful operation of Valtellina road was cited and the conditions existing discussed.

The next paper was that of Mr. S. T. Dodd on "Weight Distribution on Electric Locomotives as Affected by Motor Suspension and Draw-bar Pull." Mr. Dodd investigated the many cases of different distribution of weight on drivers, tractive effort, etc., which up to the present time have been very uncertain. Tables of data were given and the writer selected four types of locomotives to exemplify his conclusions. In a concluding table the actual distributive factor for these locomotives was calculated.

A motion was made and carried that a special session be held prior to the ball to consider the two papers remaining for discussion. The meeting then adjourned till 8 p. m.

Tuesday afternoon the local committee provided cars to convey those attending the convention to an inspection of the Elk Mountain Cotton Mills and an inspection of the W. T. Weaver power plant, where an improved governor was to be seen in successful operation. This governor was invented by Nathaniel Lombard, inventor of the well-known Lombard governor, and is considered most successful. A reception was tendered to Mr. and Mrs. W. T. Weaver at the power plant. The Weaver power plant is one of four plants that feed the city of Asheville and supply light and power. The present capacity of this plant comprises two 750-kilowatt units.

At 8:15 the meeting was called to order, Mr. W. E. Goldsborough presiding. Mr. McClellan's paper on "Choice of Motors in Steam and Electric Practice" was digested by Mr. E. H. Seaman, due to the absence of the author. Mr. McClellan discussed the problem from practical limitations. The steam locomotive may be stalled, yet with no material strain on its mechanism, while the electric motor can only withstand a certain amount of overload without excessive heating. We then have the limitations that can be reached in the two cases, and on these we must base our ultimate capacity.

The last paper of the day was Mr. L. H. Thullen's, "Electrical Features of Block Signaling." In Mr. Thullen's absence Mr. Dodd digested the paper. The various systems of signaling were discussed from the early ones to the present electrically operated systems, the telegraph block system, the lock and block system, the automatic system, and track circuits were discussed and diagrammatically illustrated. The system on the Boston Elevated railroad, New York subway and the Long Island railroad were explained. The author took up the whole subject and digested it thoroughly. The system involving a bank of lights is advocated. The meeting adjourned at 9:30.

A complimentary ball was given the members of the Institute in the ballroom of the Battery Park Hotel. It was well attended and constituted one of the features of the convention. There were about 75 in attendance, comprising most of the elité of the city.

Wednesday, Electrical-design Day.

Wednesday's meeting was called to order at 9:45, President Lieb presiding. Mr. Thorburn Reid opened the morning session with a paper on "Limits of Injurious Sparking in Direct-current Machines." In 1898 the author advanced the hypothesis that the injury done by sparking at the brushes in direct-current machines was not due, as was then commonly supposed, to the current jumping across the gap between the segment and the brush, but was done while the brush was in contact with the segment, the copper of the segment being first volatilized by the concentration of current energy at one or the other of the segment edges; and to make this clearer for the designer this paper has been presented and contains analytical proofs and statements of the current conditions under which commutation takes place. Data in regard to sparking in large machines is very inadequate.

The second paper of the morning was that of Mr. C. A. Adams on "The Design of Induction Motors with Special Reference to Magnetic Leakage." For purposes of design the writer has developed another method in which the leakage electromotive forces are expressed in terms of the induced counter electromotive forces and the magnetizing current in terms of the torque current. The author claims that the advantages lie in that the results are explicit, as they allow two machines to be compared directly. The writer concluded with curves illustrating the application of certain constants to machines of 10, 100 and 1,000 kilowatts, the air-gap being taken from the empirical formula $\delta = \sqrt[3]{kw.}$

Then followed a paper on "Limitations in Direct-current Machine Design," by Sebastiaan Senstius. Mr. Senstius considered the reactance pressure, commutator and brush-sparking, glowing and picking up of copper, design of armature, and mentioned some limitations as to sizes. The writer limits the peripheral speed of commutators to 3,500 feet per minute and gives a table of limiting sizes of generators, assuming pressures of 125, 300 and 600 and of 1,175, 1,800 and 1,950 kilowatts, respectively. In this table are also to be found dimensions of these machines.

In the absence of Mr. A. B. Field, his paper on "Eddy Currents in Large Slot-wound Conductors" was read by title.

The last paper of the morning, that of Mr. E. F. Northrup on "A New Instrument for the Measurement of Alternating Currents," evoked a good deal of enthusiasm. The instrument and methods of measurements described in the paper were developed to meet the frequent demand for means of calibrating alternating-current instruments whatever their capacity, and to suggest a means of measuring very large alternating currents regardless of their wave-form or frequency. Two small wires of No. 33 hard-drawn silver lie parallel to each other at a distance of 0.158 inch and are held by ivory clamps at their extremities, each lead being connected to binding posts and soldered. A small circular disk carrying a mirror is fastened to the middle points of these wires. A small spring holds the disk in position. The whole apparatus is encased, a window being provided opposite the mirror. Two adjustable screws provide means for regulating the tension in the two wires. The mirror is observed by means of a telescope and scale. The paper explained the operation of this instrument.

Wednesday afternoon the Asheville Electric Company provided cars, and a trolley ride was taken over Asheville, the trip ending at the Golf Club, where a reception was held. In the evening the dining room of the Battery Park Hotel was thrown open to the Institute and a banquet given in its honor. There were about 150 in attendance, and the evening was crowned by the eloquence of the speakers. Mr. T. C. Martin, the toastmaster, the mayor, Dr. Samuel Sheldon, Dr. F. A. C. Perrine, Dr. S. S. Wheeler and Mr. J. W. Lieb were among the speakers. The greatest feature of the evening was a poem by Dr. Sheldon in response to the toast, "Our Technical Institutions." The speakers alluded to the feeling between the North and the South and expressed their hope that this feeling would soon be eliminated through the closer relations brought about by engineering societies.

Thursday, New-development Day.

The meeting was called to order at 9:30, as usual, Dr. F. A. C. Perrine's paper on "Waterpowers of the Southeastern Appalachian Region" being the first one presented. Dr. Perrine spoke on the natural boundaries imposed by the Appalachians, Rockies and Sierras and upon the effect of irrigation upon the supply of water available for waterpower.

Examples were cited and rainfall and run-off data given.

A resolution was passed that a committee be appointed to inform the Department of Agriculture, state Legislature and other necessary departments of the injurious effects produced by forest fires, and that means be undertaken to prevent their occurrence.

Mr. P. N. Nunn's paper on "The Development of the Ontario Power Company" was of great interest. The author described in detail the constructive and engineering difficulties that were encountered in its development and the future expectations of the plant. Mr. Nunn has contributed greatly to the knowledge that exists of power-plant construction and is considered an authority on waterpower plants.

"A New Carbon Filament," by Mr. John W. Howell, was the paper next presented. The filament as described by Mr. Howell differs in its physical characteristics from any of those previously known. This filament has a much greater life and efficiency than the present filament and is the result of experimental research work done at the laboratories of the General Electric Company at Harrison, N. J.

Dr. Perkins then described a small device that he has employed to determine the slip of induction motors. It consists of a steel reed made to vibrate by an alternating electromotive force passing through a magnet. The amount of slip is indicated by reason of a slotted sector being placed in front of the motor.

The concluding paper of the convention was that on "Notes on the Power-factor of the Alternating-current Arc" by G. D. Shepardson, which was read by title only.

Great credit is due to Dr. Samuel Sheldon, chairman of the committee on papers, for the excellent programme and selection of papers presented at the convention. The convention was a great success, as most of the engineers prominent in their respective lines took part, and the discussions were very full and elaborate.

FRIDAY.

On Friday the local committee arranged a trip to Lake Toxaway, some 75 miles from Asheville. Seventy-nine were in attendance, including the Asheville delegation. This trip was a great success and was well attended by the young ladies of the city, who enlivened the party with their merriment.

ATTENDANCE.

Among those present were:

J. W. Lieb, Jr., New York; R. W. Pope, New York; Samuel Sheldon, Brooklyn; John H. Finney, St. Louis; Wm. Hand Browne, Jr., New York; S. T. Dodd, Schenectady, N. Y.; Gano S. Dunn, Amperc, N. J.; H. W. Fisher, Pittsburg, Pa.; W. E. Goldsborough, New York; Carl Hering, Philadelphia, Pa.; G. W. Hubley, Louisville, Ky.; V. Karapetoff, Ithaca, N. Y.; S. M. Kintner, Pittsburg, Pa.; P. J. Kruesi, Chattanooga, Tenn.; Charles A. La Fever, Battle Creek, Mich.; P. N. Nunn, Niagara Falls, N. Y.; F. A. C. Perrine, New York; Thorburn Reid, New York; William Stanley, Great Barrington, Mass.; C. P. Steinmetz, Schenectady, N. Y.; H. G. Stott, New York; Edward R. Taylor, Penn Yan, N. Y.; F. N. Waterman, New York; Schuyler Skaats Wheeler, Ampere, N. J.; G. N. Eastman, Chicago, Ill.; A. A. Dion, Ottawa, Canada; John W. Howell, Newark, N. J.; Calvin W. Rice, New York; Morgan Brooks, Urbana, Ill.; T. C. Martin, New York; C. L. De Muralt, New York; C. O. Mailloux, New York; J. F. Dusman, Baltimore, Md.; William P. Abendroth, Schenectady, N. Y.; H. B. Gear, Chicago, Ill.; Cecil D. Poole, New York.

Lightning Damages Electrical Circuits in Southwest Missouri.

In the Joplin (Mo.) Globe of June 17th there is an account of damage done to the power circuits of the Southwest Missouri Light Company by lightning on the preceding day. Nearly every circuit was affected, and it took 12 hours to effect the necessary repairs. The description, although not technically exact, is sufficiently so to be of interest. Following are extracts from it:

"The play of the electrical storm between the city and the plant of the Southwest company at Grand Falls was terrific, and the lightning arresters on the big cables carrying the power to the city were insufficient to convey the great overloading of the wires. As a result, every feed wire of the company was melted, the lines being burned out in six or seven places."

"What happened to the service wires of the Southwest company was this: When the lightning struck the service wires it developed a quantity of electricity too great for the wires to carry. A portion of the excessive current leaped across the space to the lightning arresters, and thus reached the ground. But the safety devices thus provided were, even with their great power of resistance and enormous capacity, unable to carry off the surplus current, and the copper wire conveying the service current was melted and burned up, with the excessive quantity of electrical power placed thereon.

"The voltage to produce this result must have been enormous. Estimates made yesterday show that it exceeded 3,216,000. The wires are of a size to resist safely an amperage of 5,000. The accumulated amperage that burned out the big wires was in excess of this. To develop this great force, under the demonstrated rules governing such conditions, required an initial voltage, or velocity, of over 3,000,000."

"A peculiar feature of the damage to the equipment of the Southwest company is that not a fuse was burned out, nor a transformer nor dynamo injured in the slightest. The damage was due solely to the fact that the lightning arresters were not equal to the task of bearing away the enormous amperage created by the lightning. Some of the wires were burned out at one place, others at various points along the line."

The Development of the Ontario Power Company.

[*Continued from page 5.*]

switchboard section into two long transformer rooms. The projecting central section provides space for operating offices. Along the center of these two rooms the transformers stand in groups of three, corresponding in position and capacity to their respective generators. Thus similar apparatus is arranged in rows parallel one with another and with the generating units. [Fig. 5 is a section through the transformer room.]

At the generating station three inclined cable tunnels, one already built, carrying clay ducts, begin at the rear wall beneath the gallery and extend up through the cliff and, as standard subway, on to the distributing station. The main cables, except as diverted by these tunnels, follow the shortest and most direct routes from generators to transformers. They do not converge for the accommodation of switchboard at one or more centers where congestion, which in many installations causes the most disastrous accidents, prevents separation or adequate insulation. On the contrary, they are laid quite regardless of switchboard, the switches and instrument transformers of which are then placed as required by the cables.

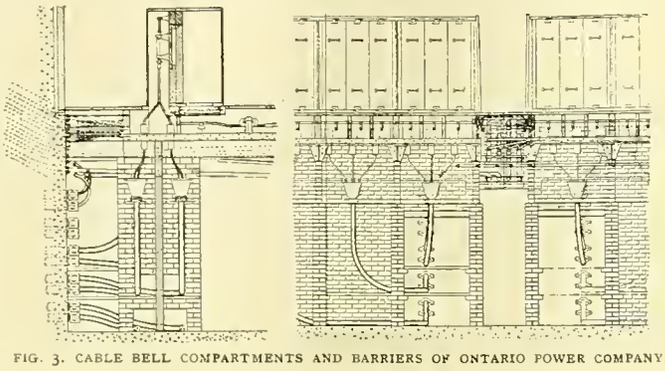

FIG. 3. CABLE BELL COMPARTMENTS AND BARRIERS OF ONTARIO POWER COMPANY.

Unit values corresponding to the generators in capacity and position are maintained throughout. Thus each generating unit has its individual cables, switches and switchboard, section of bus bars, transformers, interrupters and high-pressure switches complete to the transmission, enabling its independent operation as an isolated power plant, or through the selector switches and duplicate sectional bus-bars, the operation of all units in any combination of groups as readily and perfectly as their operation in parallel. To this end a unit length of distributing station of similar relative position is devoted to the circuit and apparatus corresponding to each generator.

Where the cable tunnels commence the power house and gallery are widened toward the cliff. Immediately above the tunnel entrance are the main generator switches, and on one side the duplicate turbine-driven exciters and their governors, and on the other the motor-actuated main field rheostats.

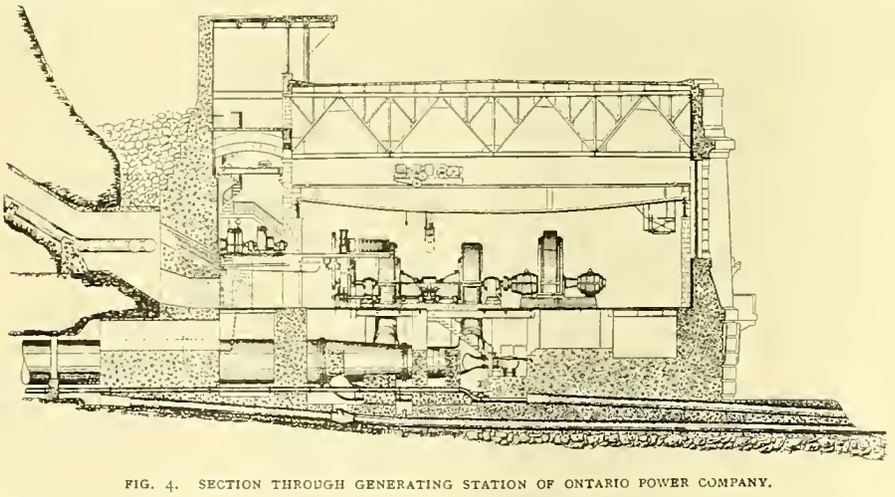

FIG. 4. SECTION THROUGH GENERATING STATION OF ONTARIO POWER COMPANY.

In front of the switches are a few panels of switchboard carrying exciter rheostats and switches, controls for actuating penstock valves and the necessary circuits and apparatus for a limited local distribution. Relief valves and small drainage pumps are the only operating machinery beneath the main floor, while upon it, in addition to the generating units, there are only duplicate electrically driven pumps supplying the storage tank and transformer cooling coils at the distributing station. For air circulation and ventilation and to avoid dampness from spray as well as to insure cool generators in hot weather, a cold air supply to each generator is provided from a sub-floor chamber communicating with external shafts and heated air escapes through large roof ventilators.

At the distributing station the low pressure bay contains upon the main floor the 12,000-volt automatic oil circuit breakers in double column, and in the chamber beneath on the sectional duplicate bus bars and their immediate connections. In the transformer rooms the transformers stand in pits six feet below main floor level, and parallel with them adjacent to the high-pressure bay are corresponding pits for static interrupters or other protective apparatus. Beneath both and between their foundations are accommodated the several systems of water, oil and drain piping and the main cableways to the transformers above. Each transformer is fitted with a record-making thermometer giving the continuous history of its internal economy.

The switchboard section occupying the center of the distributing station has four floors, of which the basement serves as a center for the piping systems and gives room for conduits and cableways for wiring. On the main and the mezzanine or gallery floors marble slabs carry record-making and integrating instruments, terminal boards with fuses for the control cables and other adjuncts of the switchboard above. Upon the upper floor is the switchboard and controller chamber, and here instrument stands and control pedestals supplant both the conventional marble slabs and the later bench board. Each of the 22 instrument stands, which are arranged approximately in a semicircle about a central point, corresponds to a definite unit, carries nine indicating instruments and faces its 12-point control pedestal.

Centralization of responsibility and authority, at defined points within the immediate personal care of a minimum number of chief operators, is, next to simplicity of arrangement, the prime requisite of efficiency of organization and of economy of operation.

The concentration within a single room of all instruments and control—the brain of electrical operation—provides the operator in a quiet and secluded place both full information and perfect control of every electrical circuit and situation of the system, and enables him to stop, start, regulate or synchronize each unit; to throw its output through its transformers to its transmission as if from a complete isolated plant, or to throw it upon either bus bar while supplying its transformers from this same or the other bus bar. The location of the room high up at the geometrical center of the distributing station places the operator at a point of vantage surrounded by four classes of apparatus. Thus located he may with a few steps survey his entire field; look down upon switches, bus bars and arresters of the high tension; see at a glance every low-pressure switch, or watch trouble in either transformer room.

At the generating station the corresponding vantage point is the gallery, where on one side the operator has the motor-driven rheostats and a few paces distant the commutators and governors of the exciters, and on the other side in plain sight the row of main governors with their adjuncts; while from the little switchboard before him he

has electrical control of penstock gates and, when necessary, manual control of turbine speeds, exciter pressure and field charge. Moreover, from this position he can see all generators and turbines and, by signal at least, can direct his assistants; little, in fact, is likely to call him to the main floor unless it be an occasional refractory journal or collector brush.

The basement of the central bay along the side next the low-pressure side forms a wiring chamber supporting a railway track upon the main floor above. Through this wiring chamber transverse to the general direction of the main cables and opening at its center into the control section, these cables and those for both continuous and alternating

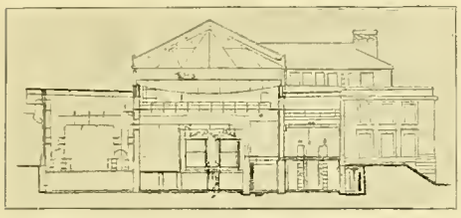

FIG. 5. SECTION THROUGH TRANSFORMER ROOM OF ONTARIO POWER COMPANY.

current local service are carried into the basement beneath the control section and, rising through the recording floors, end at terminal boards below their respective instruments and relays. Carried thus far, distant control has been still further applied by the use of motor-driven rheostats for both generators and exciters, electrically operated circuit breakers for field circuits and speed controllers for governors whereby, as previously mentioned, turbines may be started, stopped or regulated from the control chamber as well as from the gallery at the generating station.

The isolation of electrical apparatus and conductors by incombustible walls or barriers against spread of oil or arcs, for protection from fire and from each other, is of importance proportional to the power and investment involved. Neglect of this precaution has caused many of the most disastrous electrical accidents and has recently taught several bitter lessons. Some rather extreme measures here taken for its more complete application may be of interest. The five sections or rooms, heretofore mentioned, forming the distributing station, are of concrete and steel fireproof construction, separated by full-height masonry walls with intervening air spaces. No windows and but few doorways (these latter protected by fireproof doors generally closed) penetrate these walls.

The transformer pits already mentioned, each containing a bank of three transformers, are isolated and extended to a height of 23 feet by masonry fire walls. Each individual transformer is in a boiler iron casing designed to withstand 150 pounds per square inch explosive pressure. Each case communicates through the eight-inch pipe from its top with a special drain for free vent in case of accident, as proposed before the Institute some time ago; but here the supply is cold oil instead of water as then proposed. With these precautions it is believed that the transformers have been surrounded with an environment unprecedented as to safety.

The power from each generator is conducted to its switch through three single-conductor braided cables carried by line insulators and isolated by shelf barriers in a subway beneath the floor. From the switches the three conductors pass to a bell chamber [Fig. 4] where between individual barriers they are united into two parallel three-conductor lead-covered and armored cables before entering the tile ducts of the cable tunnel. Around the few bends at manholes each cable remains always within its compartment, between horizontal or vertical barriers as required. At each point where a circuit enters the distributing station a manhole, maintaining the same segregation and communicating with the bus-bar chamber, is provided for the change from three-conductor to single-conductor cable. After entering the building the cables pass between vertical barriers as before, beneath and through the floor to the switches above.

Bus-bar structures are composed entirely of concrete with mortised reinforced concrete shelf barriers between buses. Connecting leads pass through the wall forming the center of the structure, and thence in compartments formed by vertical barriers of the same material, directly up to the switches above. Instrument transformers are also installed within similar individual compartments and these whole structures, like those of the switches, are closed by fireproof doors. Control cables are laid in metal conduit throughout their courses except in the wiring chamber beneath the track where they are arranged upon metal shelf pans filled with dry sand into which connecting conduits dip.

Of the features here presented it is believed that the type of intake, the symmetry of arrangement, centralization of control and almost perfect isolation of apparatus represent, to some degree at least, distinct advances in power plant design; and while few works of such dimensions may be built for many years, if ever, it is possible that in a way some of the purposes and methods thus briefly presented may, until superseded by the next advance, be of some service as suggestions to other designing engineers of similar works. The unusual, even enormous volumes, both of water and of power, involved not only in the individual units, but also in the aggregate, have presented new problems heretofore unprovided for in standard sizes of apparatus, thus necessitating the development of larger capacities and the creation of new types. Hence the work of designing and building has been burdened with incessant test, re-design and adaptation unknown in more conventional engineering. Therefore, it is believed that upon no similar work in this country, since that of the Niagara Falls Power Company years ago in the infancy of electrical power, has devolved such a burden of investigation, invention and original design.

It has been suggested by an officer of the Institute that any account of this work would be incomplete without mention of those mainly responsible for it. Justice to all is here impossible, but a few may be named. Mr. O. B. Suhr has from the beginning been in charge of the engineer crops, and to him is largely due the harmony of design. Mr. V. G. Converse, Mr. C. H. Mitchell and Mr. J. B. Bailey are chiefs of the electrical, mechanical and field departments respectively and Mr. J. R. Harsch of the clerical work of the engineers. But more than all else in the establishment of this great and daring enterprise stands out the attitude maintained toward their engineers by Messrs. J. J. Albright and Edmund Hayes, the originators and majority owners, who, in strong contrast with the harassing interference by which uninformed investors frequently spoil the best efforts of engineers, have in this case given not only absolute freedom of action, but also steadfast support.

Lake Shore Railroad Wreck.

Three men who were well known to those in the field of electrical industry met death in the Lake Shore wreck at Mentor, Ohio, on June 21st. They were: Charles H. Wellman, general manager of the Wellman-Seaver Engineering Company and of the Wellman-Seaver-Morgan Company; Thomas R. Morgan, second vice-president and works manager of the Wellman-Seaver-Morgan Company, and Edward E. Naugle, president of the E. E. Naugle Tie Company. The first-named were of Cleveland and the last of LaGrange, Ill. The details of this terrible disaster are only too well known.

Charles H. Wellman was born June 12, 1865, at Nashua, N. H., his father being superintendent of the Nashua Iron Company. In October of 1881 he secured a position at the works of the Morgan Engineering Company of Alliance, Ohio, where he served his time as machinist and draftsman. In 1885 he became chief draftsman at the Otis Steel Works, Cleveland, Ohio, and soon thereafter was placed in charge of the open-hearth department. In 1890 he became superintendent of the Wellman Steel Company at Thurlow, Pa., leaving there in

THOMAS R. MORGAN.

CHARLES H. WELLMAN.

1895 to become open-hearth superintendent of the Illinois Steel Company at South Chicago. In 1896, with Mr. S. T. Wellman, who is now president of the Wellman-Seaver-Morgan Company, and with Mr. John W. Seaver, now chairman of the latter-named organization, he organized the Wellman-Seaver Engineering Company, becoming engineer and general manager of the company. At the time of his death he was general manager of the Wellman-Seaver-Morgan Company.

Thomas R. Morgan was born in 1859 in South Wales and came to this country at the age of six. His father organized the Pittsburg Steam Hammer Works, and later removed to Alliance, Ohio, engaging in the business which later became the Morgan Engineering Company. Mr. Morgan's practical experience began in his father's works in Pittsburg, and, after finishing his studies in Mt. Union College, he entered the works at Alliance, becoming superintendent of the works at the age of 16, general manager at 21, and at 25 was secretary and general manager of the company. In 1897, on the death of his father, he disposed of his interests and severed his connection with the company, and later engaged with the Wellman-Seaver Engineering Company. In 1902, in recognition of his services and ability, the name of the company was changed to the Wellman-Seaver-Morgan Engineering Company, of which he was at that time secretary and works manager. On consolidation with the Webster, Camp & Lane Company of Akron, Ohio, the company name was changed to the present title, the Wellman-Seaver-Morgan Company, Mr. Morgan being second vice-president and works manager at the time of his death.

Both Mr. Wellman and Mr. Morgan were men of wide acquaintance and of prominence in their

E. E. NAUGLE.

chosen fields of work. Their sudden death comes as a shock, not only to their large circle of friends, but with especial force to their business associates and to the employes of the company.

Mr. Naugle was well known, particularly by those in the electrical trade, from his connection with the E. E. Naugle Tie Company, which is one of the largest producers of poles for electric-light, telephone and telegraph work; he was the president of the company. Previous to the formation of the E. E. Naugle company Mr. Naugle was a member of the firm of Naugle, Holcomb & Lobb. He was a man of strong character and of an energetic disposition. Of genial and kindly nature, he was well liked by everyone with whom he came in personal or business relations. Mr. Naugle was 46 years of age at the time of his death and leaves a wife and four young children, two boys and two girls. He is also survived by three brothers—A. T. Naugle of Chicago, J. A. Naugle of Guaymas, Mexico, and J. W. Naugle of Menominie, Mich.

William Barclay Parsons of New York city, who was chief engineer for the construction of the New York subway, was on the train but escaped injury. He had been in Cleveland at the invitation of President Andrews of the Cleveland Electric Railway Company, to speak before the subway committee of the Chamber of Commerce. This is said to be the fifth railroad accident in which this distinguished engineer has been involved.

Mrs. Samuel Insull and little son, Samuel Insull, Jr., her sister, Miss Esther Bird, and maid, Miss Kingsville, were also on the fated train, but fortunately escaped uninjured. They were joined the next day in New York by Mr. Insull and sailed for a European trip.

President Horace E. Andrews of the Cleveland Electric Railway Company was at Mentor when the train was wrecked, and rendered effective service in taking care of the dead and wounded.

Theater Dimmer Trouble.

A reader in Nebraska asks the following question: "In our city we have an alternating current of 1,040 volts. We changed the voltage on the secondaries at the opera house from 52 to 104. The opera house has a dimmer with five handles, or rather levers, and upon turning the current on these lever handles become charged, so that a man can hardly handle them. It was not noticeable until the voltage was changed. The handles are ordinary black hard rubber."

ANSWER.

From the description given of the trouble it seems probable that defective insulation is at the bottom of the matter, for it is hardly possible that there is any static charge that can accumulate and give the shock. This seems true, because the current was not felt until the voltage was raised. It is quite likely that there is a defect in the insulation somewhere and that there was a slight leakage current at 54 volts, which was not felt. At the higher voltage, however, the current became perceptible to the operator. The apparatus should be carefully examined for any ground or defect which will allow the current to flow through the handles.

NATIONAL-INTERSTATE TELEPHONE ASSOCIATION.

The ninth annual general gathering of organized Independent telephone men and the first annual convention of the National-Interstate Telephone Association was closed at 5:30 p. m., on June 21st, in the Auditorium Hotel, Chicago. The meeting was the most representative gathering of men representing the large Independent telephone industry ever held, and aside from the extremely sad incident recorded in the Western Electrician last week—the sudden death of Mr. S. P. Sheerin of Indianapolis, on the floor of the convention—was a most complete success.

Delegates were present from 21 states, besides the District of Columbia, Cuba and Indian Territory, and there was present a representative from the select committee on telephone systems of the Dominion of Canada. The roll call of states showed a healthy condition and constant growth in the Independent movement.

The manufacturers and supply men exhibited nearly every known device for the use of telephone men, and showed every courtesy to the association and its members.

Tuesday Morning's Session.

After the ratification, by the members of the National Independent Telephone Association and the announcement that the members of the Interstate Independent Telephone Association had already taken such action, of the work of the committee which effected the consolidation of the two organizations, Col. J. D. Powers of Louisville, Ky., as temporary chairman, called to order the first meeting of the National-Interstate Telephone Association. A. L. Tetu of Louisville, Ky., acted as temporary secretary. With a few remarks Mr. Powers introduced Howard S. Taylor of Chicago, who, as the personal representative of Mayor Dunne, heartily welcomed the visitors to Chicago and spoke words of encouragement for the Independent movement. Mr. S. P. Sheerin of Indianapolis then arose to respond to the welcome for the association, but after speaking only a few words was stricken with apoplexy and died in a few minutes. Mr. Sheerin's remarks and the details of the tragedy were printed in the Western Electrician last week.

The convention adjourned at once to meet again at three p. m. to take proper note of Mr. Sheerin's death.

Tuesday Afternoon's Session.

At the afternoon session the following committee was appointed to draft resolutions on the death of Mr. Sheerin: Jesse W. Weik (chairman), J. G. Splane, J. B. Ware, George W. Beers, E. B. Fisher, Ed. L. Barber, E. E. Clement, James B. Hoge, Theodore Gary and J. D. Powers.

Colonel Powers, who was in the chair, said that knowing the sturdy character of Mr. Sheerin and his business qualities and knowing what he believed would be his wish in the matter, he would take some further action necessary to facilitate the meeting on the following day. This consisted in the appointement of a number of committees provided by the constitution as follows:

Amendments to the constitution.—Theodore Thorward of Indiana, H. A. Price of Michigan, E. W. Dunnaway of Texas, W. G. Thompson of Ohio, P. T. Spencer of California.

Credentials.—J. G. Splane of Pennsylvania, Richard Valentine of Wisconsin, J. S. Bellamy of Iowa, G. M. Saltzgaber of Ohio.

Nominating.—Stanley S. Lichty of Iowa, W. Roy McCanne of Missouri, W. Gilbert Thompson of Ohio, E. B. Fisher of Michigan, J. C. Harper of Wisconsin, Charles E. Wells of Kansas, P. Kerr Higgins of California, A. C. Davis of West Virginia, H. K. Cole of Kentucky, S. B. Rosson of New York, W. L. Moellering of Indiana, E. W. Dunaway of Texas, E. R. Conklin of Illinois, W. H. Bryant of Alabama, E. E. Clement of Washington, D. C.

Committee to confer with manufacturers' committee.—Ed. L. Barber of Ohio, J. G. Splane of Pennsylvania, Richard Valentine of Wisconsin, C. Y. McVey of Ohio, O. N. Snider of Ohio.

After making arrangements for flowers to be sent to Mr. Sheerin's funeral, adjournment was taken until nine o'clock on Wednesday.

Wednesday Morning's Session.

Shortly after nine o'clock on Wednesday morning the convention was called to order by Colonel Powers. There was a large attendance. The first thing taken up was the report of the committee appointed to make suitable note of the death of Mr. Sheerin. Jesse W. Weik of Indiana, chairman of the committee, read the following, which was unanimously adopted:

"The sad and untimely death in this hall yesterday of the Hon. Simon P. Sheerin, president of the New Long-distance Telephone Company of Indianapolis, has cast a deep and melancholy shadow over the otherwise auspicious proceedings of this, the ninth annual convention of the Independent telephone interests, and the first meeting of the National-Interstate Telephone Association of the United States.

"The sudden and tragic taking off of our brother only serves to emphasize the truth of the adage that death loves a shining mark. In the entire field of telephony a more conspicuous champion of the Independent movement, a more zealous laborer for our common cause and mutual good could not have been found. He knew no season. At all times and in all places he proved his devotion to our dearest and best interests; and so faithful and unremitting were his efforts it may truthfully be said he died in the harness—in the very act of appealing to the greatest constituency on earth, the American people, for our just rights and a square deal.

"He was a man of fertile resources and deep usefulness. The son of a mechanic and himself a laborer over the anvil in his father's shop, he early demonstrated his skill and ability. His associates and neighbors, impressed by his faithfulness and worth, chose him to fill one of the important offices, that of recorder in Cass County, Indiana. From that he was promoted to the more noteworthy position of clerk of the Supreme Court. But meanwhile his reputation had grown beyond the confines of his state, and in 1888 he was selected and served until 1896 as the secretary of the Democratic national committee. In whatever station he occupied, to whatever post he was chosen, he demonstrated that he was in every case equal to the demand. His rise in life and his successful civic career are admirable illustrations of the great possibilities that lie within reach of the American youth endowed with a clear head, a brave heart and a strong right arm.

"His private life was clean. His habits were above reproach. Always genial and affable, he was none the less, when occasion demanded it, brave, assertive and tenacious. He was generous and forbearing and his heart overflowed with sympathy for others whom sorrow or misfortune had overtaken. But above all things, he was loyal and true. Once admitted to his friendship, he bound you with hoops of steel. Nothing could make him do a dishonest act or join with others in a questionable transaction. He held that the faith and trust of his friends were dearer to him than money or any kind of preferment.

"In his death Independent telephony has suffered an overwhelming and incalculable loss. Were he living he would still be with us shoulder to shoulder in the great struggle for fair competition and clean, wholesome business methods.

"The convention having been adjourned over yesterday out of respect for the memory of the deceased, therefore be it

"Resolved, that copies of this memorial be entered on the records of the association and furnished to the sorrowing and bereaved family."

Col. J. D. Powers then said that having disposed of a sad duty the convention must now make every effort to facilitate matters in order that the object of the meeting might be accomplished, and that the principal subjects on the programme might be taken up and considered in the necessarily shorter time. Colonel Powers make a long address, in which he was repeatedly applauded. He spoke of the honest business methods by which the Independent telephone movement had now come to be recognized as a great industrial power.

James B. Hoge, President.

New Officers Elected.

The committee on credentials reported its findings and the delegates who had registered at the secretary's office were seated.

E. B. Fisher of Grand Rapids, Mich., reported that the nominating committee had selected the following-named gentlemen to fill the elective offices of the association for the ensuing year. The association was unanimous on the motion that the secretary cast one ballot for each nominee, and great applause greeted the reading of each of these names:

President—James B. Hoge of Cleveland, Ohio.

First vice-president—Theodore Gary of Macon, Mo.

Second vice-president—John Van Liew of San Francisco, Cal.

Secretary—A. L. Tetu of Nashville, Tenn.

Treasurer—J. G. Splane of Pittsburg, Pa.

Mr. Hoge at once took the chair. He thanked the association for the tribute paid him and his colleagues, and for the evident approval of the plan under which they had been working. He said there was excellent co-operation all along the line and said that to the officers of the various state associations was due a large measure of the credit for the harmony and excellent results obtained in bringing about the consolidation. His formal address, as prepared, is in part as follows:

Address of James B. Hoge.

The National-Interstate Telephone Association is convened today for the first time. This, however, is the ninth year for the Independent telephone interests of the country to come together in convention. Each year has shown them stronger and better equipped to handle the business intrusted to their care. The results of this meeting will indicate in a measure only our strength today, due to the fact that we are not yet fully organized.

Nine months ago, at a meeting in St. Louis, the National Independent Telephone Association amended its by-laws so as to form a more perfect organization. The convention was scarcely over before it was suggested from many sections of the country that a consolidation between the National and the Interstate associations should be effected.

Theodore Gary,
First Vice-President.

A. L. Tetu, Secretary.

Ed. L. Barber,
Member Executive Committee.

Geo. W. Beers,
Member Executive Committee.

Richard Valentine,
Member Executive Committee.

OFFICERS OF NATIONAL-INTERSTATE TELEPHONE ASSOCIATION.

In December the Interstate Independent Telephone Association had its meeting. A committee was appointed to meet with the committee that had been previously selected by the officers of the National association, and on January 19, 1905, a consolidation was agreed upon and a constitution adopted. Since that time the committee in charge has been doing what it could in an inexpensive way to bring about a better organization.

The year has recorded the death of the Hon. James M. Thomas, former president of the National association, and a prominent figure in association work. It has been one of active work for the Independent companies. A number of new franchises have been secured and others are pending, among them being San Francisco, Cal., Spokane, Wash., Nashville, Tenn., New York city, and a number in New England and elsewhere, everything now indicating that exchanges will be built in the near future in the few remaining cities where our competitors have had a free hand to manage the business as seemed to them best, and to charge fabulous rates to assist in carrying on warfare in other cities where they had competition by giving away service.

A number of the manufacturing companies supplying the Independent companies with equipment have built new factories, while other factories have been so enlarged so as to enable them to take care of the growth. Many consolidations have been made between companies in counties and states that were so situated as to enable them to operate with greater economy on a consolidated basis. Each state that has an organization has in nearly every instance been divided into districts, which have subdivided their territory between members, who are fully developing same. Statistics have been gathered which will be clearly shown at the roll call of states.

Following out the plan of our constitution, committees have been appointed on the following subjests: Standard forms of accounting; standard operating rules and regulations; standardization of equipment; best methods of advertising; arrangements necessary between operators and manufacturers to protect Independent companies. The foregoing committees will report the results of their work to this convention.

There never was a time when the operators, manufacturers and others having interest in the Independent telephone development appeared to be so closely in touch with each other or to feel the importance of standing together as at present. It is of importance to all that we form a closer union, that we work out all economies possible, that we pool our interests and assist each other.

There is no wire-using company that has shown the strength in so short a time that the Independent telephone movement has shown in the United States. The amount of capital invested in the Independent telephone field is only about 60 per cent. of what its competitors have to represent the same number of units. This has been made possible by our entering the field after much of the expensive experimental work had been done, and due to the fact that the work was done more economically, due to local influence being able to get many privileges that a foreign-owned corporation could in some cases not get at all, and in others only at extravagant prices.

The telephone was first installed on a commercial basis in the United States in 1876, it being handled exclusively by the original inventors until the patents expired in 1894. Then the Independents entered the field; then it was that the American people commenced to reap the real benefits from the invention. It has been greatly improved upon since, and today the Independent companies are operating a majority of the telephones in the United States, the total number of telephones having increased between 1894 and 1904 over 1,500 per cent. In some states the growth has been even greater. Is it any wonder that it has kept us all busy financing to keep up with the growth.

It is frequently urged that the trouble with the telephone business is the enormous growth it has each year. The telephone business, like every other business, will reach a limit of development; after that time the system will grow as the territory that it serves grows, which in many cases can be taken care of from surplus earnings after paying dividends; but that point will not be reached until you have fully developed your business just the same as well-organized street-railway and gas companies have always aimed to do. After that it is a matter of putting on more cars and extending a track here or there, laying a few new mains and setting new meters connected to existing pipe lines. That business can all be made profitable. There is also going to be an opportunity to do many more things that might be called a by-product, such as furnishing fire and burglar protection.

The engineers designing our apparatus and the manufacturers producing it have been constantly improving the service and have made it possible to give the best service to be had at a minimum cost for construction, and capable of being operated at a minimum operating expense.

Japan in her war with Russia has shown us the benefits of proper organization. It looks as ridiculous for an Independent company to flirt with the Bell company for sale or an alliance as it would be for Admiral Togo, after he and his forces have practically annihilated the Russian navy to propose to one of the Russian agents the annexation of Japan to Russia upon the verbal assurance of the agent that Japan would get a fair deal.

How can we help each other and at the same time benefit ourselves? The Independent companies have in the past met all obstacles placed in their way. They can be depended upon now. Do not get weary in well-doing and follow after strange gods who make promises to do all sorts of things under the pretense of being greatly interested in your welfare. We have heard practically every argument that can be enumerated, and yet nothing worth mentioning in the way of permanent damage to our cause has been accomplished. In a few instances they have made it necessary for the local people to get franchises and build new exchanges for their own protection and benefit and connect their new properties with the Independent system; one of the notable places being Toledo, Ohio, where the Independent company was purchased by the Bell company in the late '90's and operated by it as an Independent plant for some three years. During that time they took city councils there from all over the country to show what a horrible thing duplicate telephone service was and how the Independent company was unable to succeed with Bell competition. A new Independent franchise was granted and a plant built, which today is operating over 9,000 telephones, while the Bell company has thrown away the plant it purchased and has about 4,000 telephones left in its original exchange; or I might cite South Bend, Anderson and Muncie, Ind., and a number of places in Illinois and other states.

The Independent officers and stockholders have for years been making the claim that there would be two great telephone companies the same as there are two telegraph companies. Did it ever occur to you that we are fast approaching the realization of that prediction? Today we have almost a continuous system from the eastern slope of the Rocky Mountains to the Atlantic Coast. True, we cannot talk from Western Nebraska and Eastern Colorado through to Philadelphia and Baltimore on the east, but on the other hand our competitors are only promising to furnish that service at an early date through new apparatus their engineers are working on. There are engineers in the Independent field who claim to have solved the problem that will enable us to do even greater things. Whatever the final results may be, you can rest assured that the numerous engineering corps of the Independent manufacturing companies augmented by a number of strong outside engineers, together with a large number of operating engineers, can be depended upon to more than keep the Independent companies abreast of the times.

We have found in Ohio that it is comparatively easy, where necessary, to readjust rates. The public can be depended upon to do the fair thing if they are given value received and are told what is fair. We have also found that many of our companies were neglecting certain business that could be handled at a good profit, as much of the work necessary had already been done to take care of the increase. One company I have in mind of over 2,000 subscribers has, without increasing its investment over $20,000, increased its net earnings over $9,000. This increase is net earnings made a net profit of over four per cent. on the common stock. Now, this was not done without careful thought on the part of the management, the same as the manager of a manufacturing company, bank, mercantile establishment, or any other branch of business is compelled to do in order to successfully handle his business.

Don't give your service at less than cost, but give it at an honest per cent. of profit. I heard of a steam-railway company some days ago that had been charging $1.75 for round trip between two given points when an electric line paralleled it between these two points and made a rate of $1 for the round trip. The steam-railway company then cut its round-trip rate from $1.75 to 75 cents, but the electric line continues to get the business, as the people appreciate prompt service and remember the rate made by it, paying no attention to the cut made by the old company as a war measure.

It has been impossible for your committee to visit all the state associations or to do a number of other things that would have been productive of much good. The executive committee felt that it was wise to hold expenses down to a minimum until after the convention could be held in regular form, and then the matter could be presented for your careful consideration. Each delegate here is intrusted with the responsibility of his respective state as to the outcome of the organization in the future. It will be but a short time before we will be able to talk over our system from Texas and the other western states to Philadelphia, Baltimore, New York and New England points. Are we going to be prepared for it? The committees appointed must consider all of these problems, and each delegate should give due consideration in acting upon the reports presented. We represent over 500,000 stockholders today, who, with their families and friends, together with our employes, compose a vast army that no power on earth can defeat if we have proper organization.

There is strength in proper organization. At the signing of the Declaration of Independence Franklin said: "We must all hang together or we will hang separately." Are we prepared to form an association similar to the union formed when that now famous declaration was signed?

Other Business.

Mr. E. B. Fisher, one of the oldest men in the telephone field, here gave an excellent talk on what he called "the old guard"—the men who had been in the harness for the good of the Independent cause from the beginning.

Dwight B. Sapp of Ohio, E. B. Fisher of Michigan, F. L. Beam of Ohio, George W. Beers of Indiana and Bert G. Hubble of New York were appointed a committee to draft memorial resolutions on the death of Judge J. M. Thomas, which were later adopted.

Mr. Hoge, the new president, is one of the most widely known men in the field of Independent telephony. He is one of the little coterie of which the late Mr. Sheerin was for so long such a prominent figure. Mr. Hoge is secretary of the United States Long-distance Telephone Company, operating in the central states, and of the Cuyahoga Telephone Company of Cleveland, Ohio. He is also a prominent member of the so-called conference committee which has in charge the wide extension of Independent long-distance lines throughout the country. He was the former president of the National telephone association, having been elected last fall at St. Louis, Mo.

Mr. Hoge is, while one of the oldest men in the harness in Independent telephony, one of the youngest in point of years. He started in life as a telegraph operator for the Cleveland, Loraine and Wheeling railroad, and from there went into the banking business, and then into the telephone field. He is one of the younger group of financiers and promoters.

Mr. Gary, recently elected first vice-president, was the former president of the Interstate telephone association. He is prominently identified with a number of Independent telephone companies in Missouri and the Southwest. Mr. Van Liew, second vice-president, is one of the most prominent Independent operators on the Pacific Coast, and Mr. Tetu, the secretary, is prominently identified with the development of the South. The treasurer, Mr. James G. Splane, president of the Pittsburg and Allegheny Telephone Company of Pittsburg, is a well-known financier.

Committee Reports and Papers.

The subject of an insurance company for the Independent telephone companies was not taken up, as Mr. J. S. Brailey of Toledo, Ohio, who was to have read a paper on the subject, could not be present. A paper entitled "The Development and Future Tendencies of the Telephone Art," by E. E. Clement of Washington, D. C., was presented, but on account of short time was not read.

Samuel G. McMeen of Chicago presented his paper on "Combined Telephony and Telegraphy." This is a subject in which the delegates took much interest. Upon assurance that the paper would be printed in the technical journals it was agreed that it be not read. This paper was printed in full in the Western Electrician last week. The convention extended a vote of thanks to Mr. McMeen for the paper.

The report of the committee on standard forms of accounting was read by the chairman, Mr. H. E. Bradley of Philadelphia. The convention was greatly interested in this report. There was a long discussion as to the adoption of the form presented, and finally it was decided that if the president saw fit he should appoint a committee to consider the report and present at the next annual meeting a printed set of standard forms of accounting for adoption and use by the members of the association.

Standard Toll Sign.

The paper by W. F. Laubach of Akron, Ohio, on "Standard Toll Signs," was read by Secretary Tetu. This paper and the report of the committee on the best methods of advertising were considered together, as both dealt largely with the matter of a standard sign to be used uniformly by all the companies in every state in the association. Mr. Laubach said the words "Independent" and "telephone" must constantly be kept before the public. The report on advertising recommended that the magnitude of the Independent telephone systems be brought more closely to the attention of the public by means of the press and through literature in pamphlet form.

This committee, composed of J. H. Hudson, Thomas Loftin, E. W. Dunaway, V. A. Sears, G. T. Everett, W. H. Hauck, H. A. Douglas, John Schweiger, John Jolly, M. B. Overly, F. C. Smith, W. J. Melchers and C. J. Simmons, recommended the adoption by the association of the red, white and blue shield with the words "Independent Local and Long Distance Telephone." The committee also recommended the establishing of an advertising bureau.

The sign recommended by the committee was

exhibited and many others were also shown. Iowa had a very distinct sign in the form of a maltese cross and Michigan had a shield which omitted the red and was also very distinct. Both these signs found admirers, and their merits were strongly supported by the respective delegations. The sign recommended by the committee, however, although not so distinct as to the lettering, was favored by a majority on account of the "independence" suggested by the red, white and blue. After lengthy discussion a vote was taken and the red, white and blue shield was adopted by a good majority. Iowa moved that the vote be recorded as unanimous and Michigan seconded the motion.

The standard sign to be used by all the companies is shown in the accompanying picture, except that the perpendicular black stripes on the

STANDARD INDEPENDENT TELEPHONE SIGN.

body of the shield are red. The other parts are blue and white. Any company may add its name or other suitable inscription above and below the shield. There was some question as to the copyrighting of signs, and Mr. Clement of Washington, D. C., said he would look up the new law on this subject and report to President Hoge, who was authorized to act in the matter of copyrighting the sign.

The paper on "The Value of Telephone Securities," by A. B. Greenshields of Philadelphia was read by the secretary. It was received with applause and many of the delegates thought it should be printed in pamphlet form and distributed locally because of the good effect it would have on Independent securities. A number of men discussed the paper and in their remarks suggested ideas for strengthening these securities with financial institutions which, they believe, are not correctly informed on the stability of the Independent movement and the value of the plants. Among those who spoke on this subject were Fisher of Michigan, Stoltz of Indiana, Young of Ohio, Gary of Missouri, Hoge of Ohio, and Thompson of Ohio.

Standardization of Equipment.

The committee on standardization of equipment reported that it had met and organized by the election of Edward E. Clement of Washington, D. C., as chairman and W. C. Polk of Kansas City, Mo., as secretary. Besides these the following were present or represented: O. H. French by C. Y. McVey of Cleveland, George W. Beers of Fort Wayne, C. E. Wilson by J. W. Kelley, Jr., of Philadelphia, Edmund Laud of Grand Rapids, John A. Armstrong of Louisville. Sidney H. Browne, C. H. Ledlie, M. H. Clapp and J. J. Cromer were absent. This committee decided that the subject committed to it would require much time and work, since the opinions of state bodies and of operating as well as manufacturing engineers must be obtained before any successful attempt at formulation of standard rules or specifications could be made. The following resolution was therefore offered:

"Resolved, that the association should and is hereby recommended to constitute a permanent committee on 'standardization of equipment,' whose duty it shall be to gather information from the various state organizations and operating companies and to consult with the manufacturers to the end that they may report to the association or the executive committee for adoption a set of standard rules and specifications. It is the sense of this committee that the best interests of the association would be subserved and the work of standardizing facilitated by the establishment and maintenance of a central and national bureau of engineering, testing and experimental work; in short, an association laboratory for reliable expert reports and opinions. This should preferably be supported by subscriptions or by fees, or both."

The report of the committee was adopted and then the session was adjourned for lunch.

Roll Call of States.

On Wednesday afternoon the roll call of states was taken up and this proved interesting and of value to the delegates. Several of the states had no representative present at this session and a few were not ready to make a report as they had not been organized long enough to gather sufficient statistics to make an accurate report. Those which responded, however, made it plain that the conditions generally are good. In most states the Independent systems are growing rapidly and some of the states already have two and three times as many subscribers as the competing company. Several of the speakers told their experiences in building and maintaining exchanges capable of competing with the Bell company, and these were of value to the delegates from less-developed states. Some of the responses indicated that several large cities which have heretofore been without Independent telephone service are soon to be connected up.

Some of those who responded to the roll-call were as follows: W. H. Bryant, Mobile, Ala.; P. P. Spencer, Los Angeles, Cal.; C. A. Camp, Henry, Ill.; E. R. Conklin, Peoria, Ill.; P. C. Holdoegle, Rockwell City, Iowa; George W. Watson, Kansas; H. K. Cole, Kentucky; E. E. Clement, Washington, D. C.; E. B. Fisher, Grand Rapids, Mich.; J. J. Nate and Messrs. Richardson and Valentine, Wisconsin; R. K. Wier, Mississippi; J. A. Hudson, Missouri; F. H. Woods, Lincoln, Neb.; H. F. Ferris, Utica, N. Y.; Frank L. Beam, Ohio; Charles West, Pittsburg, Pa.; L. F. Lundy, South Dakota; A. L. Tetu and Luke Lea, Nashville, Tenn.; E. W. Dunaway, Texas; L. H. Hutchins, Huntington, W. Va.; George W. Beers, Indiana.

Mr. Clement, in the course of his remarks, gave some interesting information about Washington, D. C. He said in part: "Until within the last year or two we actually had grounded circuits in regular use in Washington, in the city which has the best electric-railway service in the country. We have still a lot of old Blake transmitters stuck around under old contracts here and there; but within the last two years—the last six months, the last one—there have been built four new exchanges by the Chesapeake and Potomac, which is the Bell licensee, with common battery, which give good service. They are pushing the private branch exchange end of the business. They have got branch exchanges through the departments, and they make a very strong argument against anyone who wants to come in as a private concern for the purpose of building a new system. Of course we have no local councils there; we have no local body which represents us as the councils do in the states. We depend upon committees of Congress. We have three commissioners appointed by the president, and we must make our attacks through Congress. That is one way in which we can succeed in getting a company in there and eventually bringing our long-distance lines into the District of Columbia, which, I think, is extremely important, getting outside exchanges in direct touch with the government. The government is spending $100,000 to $150,000 a year with the Chesapeake and Potomac Company there. We have a plan which we are working on. I don't know that I should go into details at this time, but it is a plan which involves the co-operation certainly at no distant day of all the companies which would be benefited by long-distance transmission to Washington. It is being handled and will be forwarded by representative men in the movement, and I think no step has been taken which did not contemplate the ultimate backing of the entire enterprise, if I may call it so, perhaps of the association and perhaps of the companies represented by the association. We hope possibly to get results this next year."

Concluding Business.

The committee on "Standard Operating Rules and Regulations" submitted a long report of 60 typewritten pages. The report was not read at the convention, but requests were made that it be printed. The report is an exhaustive one and provides rules for the conduct of every department and covering all points in the operating field. The names attached to the report are: C. E. Tarte, chairman; W. L. Moellering, secretary; J. P. Boylan, William Handlan, A. L. Tetu and A. B. Conklin. A committee will be appointed to consider the report.

The various states were then called upon to present their names for members on the advisory board. On response from some of the states the following-named men were placed upon the board: S. S. Lichty, Iowa; E. B. Fisher, Michigan; Theodore Gary, Missouri; T. H. Pollock, Nebraska; F. L. Beam, Ohio; J. W. Barnes, West Virginia. Other names will be added to this list as the states select their representatives.

Invitations were then read from cities desiring to entertain the next convention. These invitations were from the following: Board of Trade of Atlantic City, Board of Commerce of Detroit, Mich., Put-in-Bay, Ohio, Chamber of Commerce of Nashville, Tenn., Chamber of Commerce of Niagara Falls, Chamber of Commerce of Cleveland.

Luke Lea, a representative of the Chamber of Commerce of Nashville, Tenn., spoke of the efforts which are being made by the Independents to get into Nashville, and said that while he was not taking sides in the telephone question, the men he represented looked with favor upon the Independent movement. They want to know more about it, and want the next convention in Nashville as a means of strengthening public sentiment in favor of an Independent system in that city.

The choice of a place for the next convention will be made by the executive committee.

The convention then adjourned without day.

Executive and Other Committees.

On the day following the close of the convention the new officers met and selected the several committees provided by the constitution, as follows:

Executive Committee.—W. D. Barnard of Pennsylvania, Ed. L. Barber of Ohio, J. D. Powers of Kentucky, Theodore Gary of Missouri, John Van Liew of California, George W. Beers of Indiana, Richard Valentine of Wisconsin, Charles C. Deering of Iowa.

Committee on Litigation and Legislation.—Dwight E. Sapp of Ohio, Breckenridge Jones of Missouri, E. E. Clement of Washington, D. C., J. B. Ware of Michigan. One member from Illinois is to be selected later.

Auditing Committee.—J. G. Splane of Pennsylvania. George W. Beers of Indiana.

The executive committee held a meeting and perfected plans for raising funds to carry on the work of the association and strengthening the organization in the various states and districts. An aggressive campaign is to be carried on. It was decided to have the headquarters of the association in the city at which the president resides—for this year in Cleveland.

A department of publicity was created, the details of which are to be perfected by the president. It may be said here that the plans for giving publicity to the convention just closed, as carried out by the committee in charge, were very commendable. This work was efficiently performed by Mr. W. B. Woodbury, who for some years was a newspaper man and for the last five years has been with the Cuyahoga Telephone Company of Cleveland, being at present the assistant general manager of that company.

It was also decided to have an assistant secretary, who shall be paid a salary and give his entire time to the work of the association. Mr. John A. Harney of Cleveland was appointed to this position.

Before adjourning a party of telephone men was made up to attend the funeral of Mr. Sheerin, which was held at Indianapolis on June 23d.

Entertainment and Exhibits.

On account of the death of Mr. Sheerin, all entertainment features which had been planned by the manufacturers and supply men for the delegates were abandoned. An elaborate banquet had been arranged for on the evening of the 22d, at which many of the most prominent financiers and promoters in the Independent telephone field were to have spoken.

The exhibit of telephone supplies and appliances was the largest ever seen at a telephone convention. The entire sixth floor and part of the fifth and parlor floors were occupied by these exhibits. The greater part of Wednesday was given up by the delegates to inspecting the various exhibits. The convention extended a vote of thanks to the manufacturers and dealers for their hearty co-operation.

Delegates and Visitors.

Following is a list of the delegates, alternates and visitors who attended the Chicago convention of the National Interstate Telephone Association. Besides these, there were many, including manufacturers, representatives of the press and others not directly interested in operating companies, whose names are omitted:

Alabama—W. H. Bryant, Home Telephone Company, Mobile; J. E. Zeluff, Central Telephone Construction Company, Birmingham.

California—P. Kerr Higgins, United States Long-distance Telephone and Telegraph Company, Los Angeles; P. T. Spencer, Alhambra, Downey and Whittier Telephone Companies, Los Angeles; Gus Wardman, Whittier Home Telephone and Telegraph Companies, Los Angeles.

Colorado—George B. Paxton, Denver.

District of Columbia—Edward E. Clement, Washington.

Cuba—R. Roland Conklin, Cuban Telephone and Telegraph Company, Havana; Samuel W. Jarvis, Cuban Telephone and Telegraph Company, New York office; H. M. Talbot, Red Telephonica de la Havana, Havana.

Illinois—L. V. Bowen, Carroll County Independent Telephone Company, Savana; A. B. Conklin, Interstate Independent Telephone and Telegraph Company, Aurora; C. A. Camp, Henry Telephone Company, Henry; E. R. Conklin, Interstate Telephone and Telegraph Company, Aurora; L. H. Donaldson, Eaton Telephone Company, Owaneco; Hart F. Farwell, Home Telephone Company, Bloomington; C. W. Forbes, United Telegraph, Telephone and Electric Company, Chicago; Ed. D. Glandon, Pike County Telephone Company, Pittsfield; L. F. Hyneman, Lexington Home Telephone Company, Lexington; L. A. Herrick, Stephenson County Telephone Company, Freeport; E. C. Hennis, Knox Telephone Company, Sandwich; Ross Linville, Pike County Telephone Company, Pittsfield; C. E. Leffler, Lexington Home Telephone Company, Lexington; A. W. Miller, Varna Telephone Exchange, Varna; A. T. Maxwell, Illinois Tunnel Company, Telephone Department, Chicago; W. H. Ramsey, Auburn Telephone Company, Auburn; Albert Schuler, Streator Independent Telephone Company, Streator; I. C. Sabin, National Telephone and Electric Company, Clinton; A. J. Vernier, Eastern Illinois Independent Telephone Company, Kankakee; B. F. Wasson, National Telephone and Electric Company, Clinton.

Indiana—Thomas Bromley, Delaware and Madison Counties Telephone Company, Muncie; J. H. Bell, Hoosier Telephone Company, Salem; J. A. Brown, Winchester Telephone Company, Winchester; O. H. Barnkill, Winchester Telephone Company, Winchester; George W. Beers, Fort Wayne; R. O. Dorland, Laporte Telephone Company, Laporte; H. S. Grant, Century Telephone Construction Company, Indianapolis; C. E. Koontz, Breman Telephone Company, Breman; William L. Moellering, National Telephone and Telegraph Company, Fort Wayne; Webster Parry, Richmond Home Telephone Company, Richmond; D. O. Orr, Attica Telephone Company, Attica; Frank White, Home Telephone Company, Portland; Jesse W. Weik, Greencastle Telephone Company, Greencastle; John E. Yarling, Peru Home Telephone Company, Peru; W. W. Haus, Laporte Telephone Company, Laporte; J. R. Johnston, Home Telephone Company, Elkhart.

Iowa—I. M. Albertsen, Woodbine Telephone Company, Logan; J. S. Bellamy, Mutual Telephone Company of Des Moines, Des Moines; George N. Bandy, Hawkeye Telephone Company, Des Moines; Charles C. Deering, Boone County Telephone Company, Boone; H. A. Douglas, Cedar Rapids and Marion Telephone Company, Cedar Rapids; P. C. Hol-

doegel, Central and Mutual Telephone Company, Rockwell City; C. S. Hamm, Davenport and Tipton Telephone Company, Tipton; C. H. Judson, Council Bluffs Independent Telephone Company, Council Bluffs; H. A. Kinney, Woodbine Telegraph Company, Woodbine; Harvey S. Kinney, Woodbine Telephone Company, Woodbine; S. S. Lichty, Corn Belt Telephone Company, Waterloo; E. H. Martin, Martin Telephone Company, Webster City; George D. McElroy, Corn Belt Telephone Company, Vinton; I. S. Mahan, Lemars Telephone Company, Lemars; E. Duke Newen, Central Iowa Telephone Company, Iowa Falls; Joseph M. Plaister, Fort Dodge Telephone Company, Fort Dodge; Harold Reed, Woodbine Telephone Company, Woodbine; P. T. Quinn, Corn Belt Telephone Company, Waterloo; James H. Shoemaker, Corn Belt Telephone Company, Waterloo; F. H. Stacy, Rural Telephone Company, Anito; J. C. Thomas, Jefferson County Telephone Company, Fairfield.

Kansas—W. P. Hemphill, Independent Telephone Company, Topeka; W. H. Nelson, Exchange Telephone Company, Smith Center; William F. Siko, Wellington Independent Telephone Company, Wellington; Charles E. Wells, South Water Telephone and Electric Company, Marion.

Kentucky—J. A. Armstrong, Independent Long-distance Telephone and Telegraph Company, and Louisville Home Telephone Company, Louisville; J. E. Bergin, Paducah Home Telephone Company, Paducah; H. K. Cole, Kentucky and Indiana Telephone and Telegraph Company, Owensboro; J. D. Powers, Independent Long-distance Telephone and Telegraph, Louisville.

Massachusetts—Vinton A. Sears, Automatic Telephone Equipment Company, Boston.

Michigan—George C. Britton, Citizens Telephone Company, Grand Rapids; E. B. Fisher, Citizens Telephone Company, Grand Rapids; J. H. Fildew, Union Telephone Company, Alma; H. H. Hutchins, Saugatuck and Ganges Telephone Company, Ganges; H. E. Jeffrey, Union Telephone Company, Mt. Pleasant; W. J. Melchers, Union Telephone Company, Alma; E. Land, Citizens Telephone Company, Grand Rapids; R. B. McPherson, Livingston Home Telephone Company, Howell; H. A. Price, Saginaw Valley Telephone Company, Bay City; William Robinson, Citizens Telephone Company, Muskegon; George S. Root, Lake Shore Telephone Company, Hart; Charles E. Tarte, Citizens Telephone Company, Grand Rapids; W. S. Vivian, Michigan Independent Telephone Traffic Association, Grand Rapids; Joseph B. Ware, Citizens Telephone Company, Grand Rapids; T. E. Taggart, Valley Telephone Company, Vassar.

Mississippi—I. H. Goodnight, Central Mississippi Telephone Company, Louisville; R. K. Wier, Starkville Telephone and Power Company, Starkville.

Missouri—William H. Bassett, Kinloch Long-distance Telephone Company of Missouri, St. Louis; S. E. Chaney, Independence Home Telephone Company, Independence; Ernest B. Denison, Kinlock Long-distance Telephone Company of Missouri, St. Louis; M. W. Calladay, Holden Telephone Company, Holden; Theodore Gary, Home Telephone Company, Macon Telephone Company, Murrill Telephone Company, Macon; W. W. Grayson, Kinlock Long-distance Telephone Company of Missouri, St. Louis; J. S. Haley, Independence Telephone Company, Independence; A. B. Hughes, Hardin Telephone Exchange, Hardin; J. A. Hudson, Columbia Telephone Company, Columbia; W. J. Cavinaugh, Kansas City Home Telephone Company, Kansas City; Houck McHenry, Capitol Telegraph Company, Jefferson City; W. Roy McCanne, Kinlock Long-distance Telephone Company of Missouri, St. Louis; C. J. Meyers, Kansas City Long-distance Telephone Company, Kansas City; J. J. Newell, Citizen's Telephone Company, St. Joseph; W. C. Polk, Kansas City Home Telephone Company, Kansas City; O. C. Snyder, Kansas City Telephone Company, Kansas City.

Nebraska—John T. Burk, Omaha; E. C. Everett, Platte County Independent Telephone Company, Columbus; John M. Ewing, Nebraska City Telephone Company, Nebraska City; J. H. Gesler, Union Telephone Company, Mansa; A. M. Munn, Nebraska City Telephone Company, Nebraska City; Frank H. Woods, Lincoln Telephone Company, Western Telephone Company, Lincoln.

New York—Garrison Babcock, Home Telephone Company, Albion; Harvey F. Ferris, New York State Independent Telephone Association, Utica; Shirley E. Johnson, New York city; H. A. Nuttall, Buffalo; Sam B. Rawson, Albion Home Telephone Company, Albion.

Ohio—George Adams, Millersburg, Wooster and Orville Telephone Company, Millersburg; E. L. Barber, Wauseoo; Frank L. Beam, Ohio Independent Telephone Association, Columbus; H. A. Berry, Marion County Telephone Company, Marion; J. P. Boylan, Cuyahoga Telephone Company, Cleveland; L. C. Codden, Gallipolis Telephone Company, Gallipolis; William R. Fee, New Citizen's Telephone Company, Batavia; C. Burr Forrest, Gallipolis Telephone Company, Gallipolis; O. F. French, Cuyahoga Telephone Company, Cleveland; C. E. Grauel, Painesville Telephone Company, Painesville; M. M. Herron, Millersburg, Wooster and Orville Telephone Company, Millersburg; C. L. Hilderbrant, Clinton Telephone Company, Wilmington; W. A. Horning, Chardon, Leroy and Thompson Telephone Company, Chardon; James B. Hoge, United States Telephone Company, Cleveland; Charles H. Hood, Tuscarawas County Telephone Company, New Philadelphia; Charles E. Hollander, Newark Telephone Company, Newark; Frank Knapp, Local Telephone Company, Norwalk; C. Y. McVey, Federal Telephone Company, Cleveland; H. P. Miller, Home Telephone Company, Dayton; George H. Metheany, Lima Telephone and Telegraph Company, Lima; D. M. Odafer, Marion County Telephone Company, Marion; M. B. Overly, United States Telephone Company, Cleveland; Morton Perdue, Stark County Telephone Company, Canton; Ralph Remier, Ohio Independent Telephone Association, Columbus; J. B. Rhodes, Zanesville Telephone and Telegraph Company, Zanesville; G. M. Salzscaber, Van Wert Home Telephone Company, Van Wert; Dwight E. Sapp, Mt. Vernon Telephone Company, Mt. Vernon; C. E. Stinson, Toledo Home Telephone Company, Toledo; F. S. Chapman, Kenton Telephone Company, Kenton; Morris Taylor, Eastern Ohio Telephone Company, East Rochester; I. H. Thedieck, Sidney Telephone Company, Sidney; Clinton Thorpe, Clinton Telephone Company, Wilmington; W. Gilbert Thompson, Hamilton Home Telephone Company, Hamilton; Otto Troutman, Millersburg, Wooster and Orville Telephone Company, Shreeve; S. E. Ward, Mansfield Telephone Company, Mansfield; W. B. Woodhury, Cuyahoga Telephone Company, Cleveland.

Pennsylvania—J. N. Anderson, Pittston; Charles F. Bender, Pittsburg and Allegheny Telephone Company, Pittsburg; Charles A. Berg, Maryland, Pennsylvania and West Virginia Telephone and Telegraph Company, Uniontown; H. E. Bradley, Pennsylvania State Independent Telephone Association, Philadelphia; H. S. Houck, Union Telephone Company, Erie; John W. Kelly, Jr., Keystone Telephone Company, Philadelphia; S. G. Latta, Elk Telephone and Telegraph Company, Wilcox; A. W. Lee, Huntington and Clearfield Telephone Company, Clearfield; Charles J. Mayer, Pittsburg-Johnstown Long-distance Telephone Company, Johnstown; A. C. Shoemaker, Pittston; J. G. Solane, Pittsburg and Allegheny Telephone Company, Pittsburg; E. D. Schade, Johnstown Telephone Company, Johnstown; Charles West, Consolidated Telephone Companies of Pennsylvania, Allentown.

South Dakota—P. R. Crothers, Dakota Central Telephone Company, Brookings; L. F. Lundy, Castlewood Telephone Company, Castlewood; C. C. Maxwell, Arlington-Hetland Telephone Company, Arlington; J. L. W. Zietlow, Dakota Central Telephone Company, Aberdeen.

Tennessee—N. D. Smith, Jackson Home Telephone Company, Jackson; A. L. Tetu, Nashville Home Telephone Company, Nashville.

Texas—E. W. Dunaway, Citizens Telephone Company, Paris; Horace Gooch, Amarillo Telephone Company, Amarillo; Brigs Young, Citizen's Telephone Company, Paris; B. F. Fitz Gerald, Texarkana Telephone Company, Texarkana.

West Virginia—J. Walter Barnes, Consolidated Telephone Company, Fairmount; Lloyd Bugley, Bugley Telephone Company, Neston; A. C. Davis, West Virginia Western Telephone Company, Parkersburg; W. C. Handlan, National Telephone Company of West Virginia, Wheeling; Lou H. Hutchinson, Huntington Mutual Telephone Company, Huntington.

Wisconsin—C. B. Enochs, Vought-Berger Company, La Crosse; W. F. Goodrich, La Crosse Telephone Company, La Crosse; J. A. Murray, Baraboo Telephone Company, Baraboo; William Vanmittlesworth, Citizen's Telephone Company, Racine; Richard Valentine, Wisconsin Independent Telephone Association, Janesville; H. C. Winter, Dane County Rural Telephone Company, Dane County; G. W. Wilder, Cambridge Telephone Company, Cambridge.

Canada—F. Dagger, Select Committee on Telephone Systems to House of Commons, Ottawa, Canada.

DELEGATES AND VISITORS TO NATIONAL-INTERSTATE TELEPHONE CONVENTION IN CHICAGO, JUNE 21, 1905.

Telephone Convention Notes.

As usual, Raber & Watson were represented at the convention.

A. T. Naugle represented the E. E. Naugle Tie Company of Chicago.

Forée Bain, the well-known patent expert of Chicago, was a welcome visitor.

The Current Electric Company of Chicago was present in the person of Mr. Harter.

President Belden of the Belden Manufacturing Company strolled in on Wednesday.

The Central Electric Company made no exhibit, but Mr. Mason was in daily attendance.

A. C. Cox & Co. of Chicago were on hand exhibiting a line of their various specialties.

The Chicago Writing Machine Company showed a line of its widely known adjustaphones.

F. A. Lundquist, the Globe Automatic telephone-exchange expert, was in daily attendance.

The Monarch Electric and Wire Company made an exhibit of its wire and construction material.

A line of enamel steel telephone signs was shown by the Burdick Sign Company of Chicago.

Samples of insulating tape were distributed by E. S. Hilton of Morgan & Wright, Chicago.

Self-locking tackle blocks were exhibited by Porter & Berg of Chicago, with H. Loud in charge.

Western Manager Donohue and Mr. Hammond were on hand for the American Electric Works.

The Valentine-Clark Company, as usual, appeared in the persons of Messrs. Valentine and Clark.

The Sterling Electric Company made a very excellent exhibition on the main floor of the Auditorium.

The John A. Roebling's Sons Company was in evidence with its usual large number of representatives.

Telephones, switchboards and accessories were well displayed by the Eureka Electric Company of Genoa, Ill.

The Western Telephone Manufacturing Company of Chicago had an attractive exhibit located on the parlor floor.

The Pearne-Krum Company of Chicago, manufacturer of telephone transformer systems, exhibited its product.

A new product that attracted much favorable attention was the Everstick anchor, manufactured by the Everstick Anchor Company of Quincy, Ill. This anchor combines some valuable new features which were well set forth by Messrs. J. Blackburn and J. J. Howard.

Burt C. Hubbell, president of the Consolidated Telephone Company of Buffalo, was in constant attendance.

The American Steel and Wire Company, as usual, made a very attractive exhibit, which was in charge of Mr. Bough.

Mr. G. H. Miller, as has been his custom in conventions of the past, was present with a line of Miller anchors.

J. J. Nate of the Stromberg-Carlson Telephone Manufacturing Company was a well-known figure at the convention.

C. W. Farr, E. W. Hurst and J. C. Bowen looked after the Farr Telephone and Construction Supply Company's interests.

Mr. William M. Smith, secretary and treasurer of the Chicago Insulated Wire Company, found time to look in on Thursday.

The Addressograph Company of Chicago had some of its machines in operation, with J. B. Hall in charge of the exhibit.

H. C. Avery and George M. Painter of the American Stone Conduit Company, Chicago, mingled with the delegates and visitors.

William Goltz, president of the Haller Machine Company, Chicago, one of the largest makers of electric signs, was in attendance.

George L. Lindsley, president of the Lindsley Bros. Company, Chicago, the well-known cedar-pole firm, represented the Lindsley interests.

Frederick L. Merrill, Chicago district manager of the Dielectric Manufacturing Company of St. Louis, was everywhere at the convention.

Among the exhibits on the parlor floor was that of the Dean Electric Company of Elyria, Ohio. A complete line of its apparatus was exhibited.

The International Electric Meter Company of 330 West Randolph Street, Chicago, distributed some attractive literature, descriptive of its meters.

W. L. Runzel and J. M. Lenz represented the Runzel-Lenz Electric Manufacturing Company, Chicago, makers of telephone cords, switchboard cords and cables.

The Ewing-Merkle Electric Company of St. Louis exhibited a line of Sumter telephones in charge of L. G. Le Bourveau, manager of the telephone department.

Always popular with the telephone fraternity, Chris. J. Litscher and Ernest A. Quarfot, did their usual efficient work in the interest of the Illinois Electric Company.

Skelley desk-set holders made for one or two telephones were exhibited by the Manufacturers' Distributing Company of Cleveland, with Mr. M. Wheelock in charge.

Manager G. F. Randall of the American Clock Company, Chicago, had a new feature of interest to telephone men in the way of electric clocks synchronized over telephone wires.

The M. B. Austin Company of Chicago showed in operation the Meinema selective ringing lockout system, with Mr. Meinema, the inventor, in charge, Mr. M. B. Austin also being present.

Name plates, manufactured by the Electro-Chemical Engraving Company, were exhibited by Alfred Hilton Cassidy, western representative of this company, with offices at 185 Dearborn Street.

Thomas G. Grier was on hand in behalf of the American Circular Loom Company; he distributed a clever bit of advertising in the shape of a unique card bearing the national hymn "America."

Peirce specialties were talked of by Mr. C. L. Peirce, Jr., of the Peirce Specialty Company. This company made no exhibit, but its specialties were shown in connection with several other exhibits.

Among the new concerns at the convention was the Wilson Long Distance Telephone Manufacturing Company. Robert Bines, president of the company, explained the merits of this new telephone.

The Electric Gas Lighting Company of Boston, the well-known interior telephone specialists and makers of the Samson battery, made a very interesting exhibit, which was in charge of J. A. Haines.

Some new departures in interior telephones were displayed by the Ackerman-Boland Telephone Company of Chicago. Mr. W. F. Taylor was in charge, with Secretary Charles N. Ackerman also in attendance.

The Baird selective ringing and lock-out system was an interesting exhibit shown by the Baird Manufacturing Company of Chicago. Transmission arms, call registers and time stamps were also exhibited.

President E. B. Overshiner and staff of the Swedish-American Telephone Company of Chicago as usual appeared with a very comprehensive exhibit at the company's old location on the parlor floor, just above the rotunda. Mr. Overshiner also exhibited a gasoline automobile in which he is interested. This machine was offered as being particularly useful as a vehicle for telephone-line inspection.

"Bennett" of the Osburn Flexible Conduit Company was in daily attendance. C. E. Corrigan, vice-president of the company, too, was in Chicago last week, but was unable to remain for the telephone convention.

The Vought-Berger Company of La Crosse, Wis., with C. D. Enochs and John G. Ball in charge, exhibited a line of its products and attracted much attention by its legalized lottery of a telephone desk set and cabinet.

Selective central relays, especially for use on rural party telephone lines, were shown by the T. & A. Selective Call Company of Geneseo, Ill. Mr. E. A. Terpening represented this company and made many new friends.

The Waterbury Company exhibited a line of lead-covered cables. John B. Adams of New York, manager of the cable department, and T. L. Hiles of the Chicago office were energetic in promoting the interests of this company.

President F. G. Jones and Manager J. A. Kenny looked after the American Electric Fuse Company's interests. The company's principal exhibit consisted of Kaisling switchboard protectors. Many other American specialties were shown.

H. C. Dodge, well known to the telephone fraternity, was everywhere in evidence in the interests of the new American Electric Sign Company. These signs were in operation at a number of the exhibits and made attractive displays.

Moon terminals and junction boxes were attractively exhibited by F. H. Wood, sales manager of the Moon Manufacturing Company of Chicago. H. E. Procunier, president, and W. L. Procunier, superintendent, also found time to attend.

Western Manager P. B. Yates of the Gould Storage Battery Company made many friends for his company at the convention. The Gould batteries are now in a large number of telephone exchanges, to say nothing of light and power plants.

The National Carbon Company, represented by M. H. Moffett, assistant sales manager, and A. V. Ward, Chicago salesman, made an extraordinary hit by the distribution of its souvenir flashlights to the special friends of the company.

An interesting exhibit was that of the Denio General Electric Company of Rochester, N. Y. This consisted of a fire-alarm system, operated in connection with telephone lines. John A. Nolan and Garrison Babcock represented this company.

The American Electric Telephone Company made its usual very complete showing of apparatus, with the following-named gentlemen in attendance: P. C. Burns, J. G. Ihmsen, Perry Eubanks, J. C. Henderson, Max W. Zabel, together with Messrs. Hauptman, Roberts and Ewing.

President Cummings of the Central Telephone and Electric Company of St. Louis made a very interesting exhibit. Mr. Cummings reports a prosperous condition of his business. This company made many friends during the St. Louis World's Fair.

Claude Matthews was present in the interests of W. N. Matthews & Bros. of St. Louis. Stombaugh anchors was his theme, and anyone who heretofore was unacquainted with this well-known product was sure to have had it brought to his attention before leaving the convention.

The Standard Underground Cable Company was represented by Messrs. J. R. Wiley, western sales manager, of Chicago; T. E. Hughes, southeastern sales manager, of Philadelphia; E. J. Pietzcker, southwestern sales manager of St. Louis, and W. M. Rogers and J. E. O'Neill, both of Chicago.

One of the always energetic attendants at the convention was Western Manager W. W. Smythe, Jr., exhibiting a line of fiber conduit manufactured by the Fiber Conduit Company of Orangeburg, N. Y. Envelopes of data valuable to conduit users were distributed, and were received with favor.

The telephone systematization department of the Edwards-Hine Company of Grand Rapids, Mich., had an interesting exhibit of bookkeeping and filing systems for telephone companies. Messrs. C. C. Wilmot and H. G. Bedford represented this company, with Mr. W. H. Edwards also in attendance.

The Electric Appliance Company of Chicago was, of course, on hand, and, as usual, did some interesting advertising "stunts." The Electric Appliance advertising wagon at the fire show at the White City was a fine illustration of modern methods of electrical advertising. President Low was in command, assisted by a numerous staff.

The International Telephone Manufacturing Company of Chicago displayed an exhibit which was very interesting, especially to the exchange managers who are figuring on increasing or re-equipping their exchanges. The company exhibited all of the parts of its complete line of telephone apparatus, including its "growing" exchange system. The International was represented at the convention by Henry Shafer, president; W. E. McCormick, vice-president; F. L. Middleton, sales manager, and Sales Agents J. C. Murray and H. H. Davenport.

Mr. Kirkpatrick of the McRoy Clay Works was a prominent personage at the convention. "Kirk's" sign, "The McRoy Standard is the Aim of Our Competitors, but only our Customers get Them," stirred up quite a little talk. Mr. Kirkpatrick's clever card advertising usually makes a hit at conventions. Rumor has it, too, that he secured four very handsome orders during the convention.

Western Manager Atkin of Chicago, assisted by John A. White of the Electric Storage Battery Company of Philadelphia, was in daily attendance at the telephone convention. Incidentally, it may be stated that General Manager of Sales Blizzard was in Chicago last week and also dropped in at the convention.

The National Battery Company of Buffalo distributed an interesting line of advertising matter at the National telephone convention. This company is making a specialty of storage-battery power plants for telephone companies. One of its finest installations is that of the Frontier Telephone Company of Buffalo. This plant was illustrated in a recent issue of the Western Electrician.

The frog trademark stick-pin distributed by the F. Bissell Company of Toledo, Ohio, was greatly in demand and was seen everywhere. This company had in attendance Messrs. F. Bissell, Walter Bissell, J. Alex Naverre, manager of the pole department, Frank Knierim and S. Walker. The company exhibited a line of its Security specialties, together with its Novelty sleeve potheads.

The Turner Brass Works of Chicago exhibited its new telometer, which attracted wide attention. This device is a rapid-service box requiring the deposit of the coin to signal the office. When central deposits the coin in the safe it registers the number of coins automatically and in view of the subscriber. A full line of the well-known Turner torches was also shown. The exhibition was in charge of P. J. Hertz.

General Manager A. L. Waterbury of the sales department of the American Conduit Company was in evidence at the telephone convention. The American company made a fine exhibit of electrolysis-proof bituminized fiber conduit in one of the parlors on the sixth floor. What speaks most for this company, however, is the miles and miles of underground conduit which it has installed in all parts of the United States.

One of the most welcome guests at the telephone convention was Electrical Engineer J. S. Miller of Colorado Springs. Mr. Miller will be remembered pleasantly from his connection with the Denver National Electric Light Association convention, where he officiated as one of the hosts. Mr. Miller was entertained during his stay in Chicago by Western Manager J. R. Wiley of the Standard Underground Cable Company.

J. A. Tornquist, president of the Tornquist Electrical Manufacturing Company of Davenport, Ia., exhibited a full line of double and single-pole protectors, knife switches, etc. A feature of the Tornquist switches is the lacquered red-slate base which, it is said, adds to the appearance of the switch and it stands better electrical tests than the common dark slate. The construction of the Tornquist switches are all copper, no brass being used.

One of the devices which attracted much attention was the post-hole digger exhibited by the Western Steel Gate Company of Two Rivers, Wis., with C. W. Van de Walker in charge. This device is automatic in its action, all the directions necessary in its operation being "just push down, pull up and let go." Any size hole may be dug with it. A much-sought-after souvenir, in the shape of an attractive bookmark, was also distributed by Mr. Van de Walker.

A device that was the center of much interest was the Malthaner alternating-current generator exhibited by the Malthaner Electric Manufacturing Company of Minneapolis, Minn., with Mr. C. Malthaner in charge. This company has but lately entered the field, and its product comprises some new and valuable features that will commend it to users, who will do well to investigate its merits when in the market. Combined with economy of maintenance, it has to recommend it, compactness, simplicity and efficiency.

General Manager C. W. Stiger of the Stromberg-Carlson Telephone Manufacturing Company arrived on Thursday. The Stromberg-Carlson company made a comprehensive exhibition. Without going into detail, it may be said that switchboards, telephones and accessories were talked by the following-named gentlemen, co-operating with Mr. Stiger: J. P. Cracraft, sales manager; C. W. Shafer, E. A. Reinke, E. C. Lewis, C. S. Sifferd, of the Chicago office; A. O. Stigberg, engineer; Paul D. Myers of Illinois; William Bowen of Iowa; D. C. Gould of Nebraska, and E. P. Shaffer of Indiana.

The North Electric Company of Cleveland was one of the best advertised manufacturing companies at the telephone convention. Co-operating with

President C. H. North was Western Representative I. J. Kusel, Manager of Advertising David Gibson, Ohio Representative George B. Pratt and Michigan Representative C. D. Boyd. The North Electric Company has recently acquired the services of Mr. Gibson, who now has full charge of a department, with the title of "manager of advertising." Mr. Gibson's work as a newspaper man was noticed by the North company, and led to his being offered his present position.

Always a mark of prominence was the baggage tag showing the trademark of the American Electrical Supply Company of Chicago. As a type of a hustling, energetic, get-there, supply house this company has already taken a prominent position in the electrical field. At the exhibit rooms of the company Manager F. D. Phillips extended a cordial welcome to all visitors and was ably seconded by a genial and efficient staff, comprising the following gentlemen: William R. Price, W. J. Dukes, E. J. Johnson, J. J. Schaller, Bert Mockenhaupt, C. A. Robinson and Charles Ritter. President C. Edward Browne also found time to drop in.

The Automatic Electric Company of Chicago was naturally pleased over the fact that President Rowland R. Conklin, president of the Cuban Telephone and Telegraph Company, accompanied by Chief Engineer Talbot and S. M. Jarvis, visited the automatic exchanges at Columbus and Dayton on their way to the National telephone convention, and in less than four hours after arrival placed an order for installation of an automatic exchange on the island of Cuba of 5,000 lines, with an ultimate extension of that number to 15,000 lines. In addition to this, the above-named gentlemen also placed a small order for a 500-line automatic exchange for installation in the Cuban town, Mariana. This telephone company is operated under a franchise granted by the Cuban Congress.

Manager G. W. Crawford of the Telephone Wood-working Company of Tiffin, Ohio, was at the convention. This company has made a remarkable record during the few months of its existence. The idea of organizing this company for the purpose of specializing the production of telephone woodwork emanated from General Manager C. E. Stinson of the Toledo Home Telephone Company. The Telephone Wood-working Company, under the direct management of Mr. Crawford, has a splendidly equipped factory at Tiffin. The favor with which this enterprise has been received by the telephone manufacturers of the United States is a tribute to the large expenditure of money with which the company backs up its belief in modern methods as applied to specialization, coupled with its executive officers' telephone experience.

The question, "Who is Loeb?" was answered emphatically at the convention by his appearance with a comprehensive presentation by the Rock Island Battery Company of Rock Island, Ill. The Rock Island dry battery is the latest in the battery market. The Rock Island company believes that the dry-battery field is one of rapid increase, and, with its battery possessing some remarkable characteristics, it feels that it is entitled to a fair share of business. Judging from the reception given Mr. Loeb, the Rock Island company seems to have ahead of it an excellent future. Assisting Mr. Loeb was George W. Conover of Chicago, the well-known purchasing agent for telephone companies. Mr. Conover presented an interesting exhibit of the Gray telephone pay station, of the Gray Telephone Pay Station Company of Hartford, Conn. Mr. Conover also represented the Chicago Engineering Company.

General Manager C. E. Stinson of the Toledo Home Telephone Company was numbered among the distinguished guests at the convention. Mr. Stinson has made his mark as an executive and organizer of dividend-paying properties by his work with the Toledo Home Telephone Company. Not only has the cost of operating and maintenance of this company's plant been reduced, but an increase of 1,000 telephones for the last year has been added to its construction and equipment with a reduced pay roll compared with the corresponding month in the year 1904. Not only has the maintenance of the property been satisfactory, but it has been greatly improved, as the number of cases of trouble reported for 1905 were 51 cases per day against 182 cases of trouble for 1904. The strongest evidence of Mr. Stinson's managerial efforts is the fact that in May, 1904, the company's stock was quoted at 16, with the bonds at 66. In May, 1905, the same stock was quoted at 60, with bonds at 92½. The number of employes, too, had decreased from 208 to 184 in the same time.

The Kellogg Switchboard and Supply Company of Chicago made no exhibit, but was well represented at the convention. Under the direction of Advertising Manager Gunn the company did some neat advertising "on the quiet" through its distribution of one of the handsomest souvenirs at the convention in the form of the Kellogg watch fob. This fob carries most prominently the initial "K" in gold, and was much sought after. A feature of the commercial gatherings at the convention was the Kellogg banquet, given by the company to 60 or so of its leading employes, including the heads of departments, engineers, salesmen, traveling and local, and foremen of the various departments. Manager of Sales J. C. Lewis presided and a number of toasts offered and responded to; the Kellogg banquet was pronounced a decided success. Specially deputized to handle the Kellogg company's interests at the convention were the following-named gentlemen of its staff: R. S. Mueller, O. Morsman, C. E. Roberts, W. R. Hind, J. M. McGee, H. N. Farris, R. J. McHugh, W. P. Booth, I. W. Pope and Advertising Manager W. J. Gunn.

The Automatic Electric Company of Chicago, occupying Suite 622, showed its automatic telephone equipment, which has been adopted by many prominent and progressive independent telephone companies. On the exhibition board the company's automatic switches were exhibited, and connected thereto were six wall instruments and two desk sets for demonstrative purposes. The prominent and interesting feature of its exhibition, which was always the center of a group of telephone operatives, was a new four-party-line system with lock-out and selective ringing, which has just been worked out in its engineering department. By the use of the harmonic system of ringing, only the party wanted was rung, and the other three parties on the same line were locked out. This latest development of the automatic system created lots of interest among the telephone men, and is only one of the many things which the critics of the automatic have persistently claimed could not be accomplished on the automatic system. Those in charge of the exhibit who demonstrated the work of the system were J. F. Crook, H. S. Durant, A. J. Rousseau and C. L. Fisher of the sales department, H. H. Woodworth, advertising manager, and A. Skalowski of the engineering department.

Standard Forms of Telephone Accounting.

The committee on standard forms of accounting has given careful consideration to the accounting subject, and although it realizes that the various conditions existing in the different telephone companies throughout the country make it almost impossible to lay out an absolutely uniform system of accounting, it is of the opinion that the following outlined system will at least give a very valuable working basis and can be enlarged on and carried out in more detail to suit local conditions; and if accounts are properly kept along the lines laid out will enable any company to render an intelligent statement of its affairs.

It should also be realized by the members of this convention that a standard system of accounting cannot be formulated with the expectation that all companies will immediately change their present method without a thorough examination of the advantages of a new system; and we recommend that a permanent committee of three or five members be appointed to consider suggestions for the improvement of the system, making such changes as may be necessary from time to time, and to act as an advisory board.

We recommend that the accounts kept in a general ledger be divided into four main groups, viz., construction, operating, maintenance and general accounts. The following is a synopsis of all general accounts to be used in connection with this system:

Dr.

1. Plant.
2. Buildings and Real Estate.
3. Accounts Receivable (Rentals, Etc.)
4. Unexpired Insurance.
5. Unexpired Directory.
6. Interest on Bonds.
7. Treasury Stock.
8. Treasury Bonds.
9. Construction.
10. Maintenance.
11. Operative Expense.
12. General Office Expense.
13. Salaries and Wages.
14. Freight and Cartage.
15. Bank Accounts.
16. Stable Expense.
17. Warehouse Supplies.
18. Furniture and Fixtures.
19. Petty Cash.
20. Tools.
21. Discounts, Concessions, Etc.
22. Officers' and Clerks' Salaries.
23. Collecting.
24. Soliciting.
25. Taxes.
26. Insurance.
27. Light.
28. Heat.
29. Water.
30. Legal.
31. Damage and Accident.
32. Stationery, Printing and Postage.
33. Advertising.
34. Directory.
35. Traveling.
36. Pole and Right-of-way Rentals.
37. Interest.

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38. Capital Stock.
39. Bonded Indebtedness.
40. Unearned Rentals.
41. Surplus.
42. Bills Payable.
43. Accounts Payable (Vouchers, Etc.)
44. Accrued Interest on Bonds.
45. Accrued Taxes.
46. Unclaimed Wages.
47. Earnings, Accounts (Rentals, Tolls, Etc.)

The accounts as above listed represent the complete ledger accounts, excepting sub-divisions under the headings of construction, maintenance and operating, as will be hereafter listed. It should also be understood that accounts Nos. 22 to 37 inclusive are general-expense accounts, and in many cases portions of the different charges to these accounts will be transferred or prorated to the sub-division accounts under construction, maintenance or operating expense as they may apply. For instance, account No. 24, entitled "soliciting," should only be charged with that portion of the cost of soliciting which is employed in the maintaining of present business. That portion of the cost of soliciting employed in gaining new business is to be charged to the sub-division "soliciting" under construction. The same will apply to damage and accident, legal, traveling and interest.

The following is a list of the sub-division accounts under the heading of construction:

Construction.

(A) Pole Lines.—This account to include the cost of poles, cross-arms, insulators, hardware, and all sundry material, including also the cost of setting and painting poles, freight, cartage, wages and cost of handling.

(B) Wires and Cables.—This account to include the cost of all circuit wire, tie wire, drops, house brackets, cable, cable hangers, sleeves, cable terminals, and all labor employed, including freight and cartage, up to and including the house bracket.

(C) Interior Wiring and Equipment.—To this account will be charged the cost of complete telephone instruments, house cable-covered wire, office wire, inside fittings, junction boxes, lightning arresters, and all labor employed in installing same.

(D) Subways.—This account to include the cost of manhole frames and covers, I-beams, conduits, cement paving, latteral bends, lumber, and all freight, cartage, labor and sundry materials used in the construction of subways.

(E) Exchange Equipment.—This account to include the cost of new switchboard, cable, cross-connecting board, storage batteries, charging machines, ringing machines, freight, drayage, and the labor in installing same at the central exchange. This account to be used when the plant is extended or improved, and in no case should be confused with repairs to exchange equipment under maintenance.

(F) Booths and Pay Stations.—This account to include the cost of all booths, coin boxes, signs and fixtures installed at central offices and pay stations, freight, drayage and labor employed.

(G) Private Branch Exchange.—This account to include the cost of private exchange, switch board, and the cost of installing complete; and the complete cost of inter-communicating systems, including labor and all materials used, all interior wiring and telephones installed in connection with private exchange switchboard to be charged to sub-division C under construction.

(H) Soliciting.—Charge salaries of solicitors for extension of plant as represented by the net gain in telephones. That is to say, if 100 telephones are installed and 50 telephones taken out during a month at a soliciting cost of $100, charge $50 to construction and $50 to maintenance; subscribers changes to be considered as take-out.

(I) Right-of-way.—This account to include the cost of all rights and permits exclusive of franchises, to construct, operate and maintain pole lines or other equipment along or over private or municipal property.

(J) Franchise.—This account to include the cost of city or town franchises, granting the right to construct and operate telephone lines and systems and extensions of original property, including all expenses incidental thereto.

(K) Toll Lines.—This account to include the cost of all circuits and pole lines, including labor, freight hauling and sundry materials, erected strictly for toll purposes.

(L) Construction Salaries.—Charge to this account all salaries applicable to construction work which cannot be distributed in the foregoing sub-division.

(M) Construction Expense.—Charge to this account all miscellaneous items of expense not directly covered by any other sub-division.

Note.—Further sub-divisions of cost of construction may be made if deemed necessary.

Maintenance.

(A) Repairs to Pole Lines.—This account to include the cost of repairs to and replacements of materials as listed under construction, including freight and hauling and all cost of labor employed.

(B) Repairs to Wires and Cables.—This account to include the cost of repairs to and renewals of materials as listed under this heading in construction, including freight, hauling and all labor employed.

(C) Repairs to Interior Wiring and Equipment.—This account to include the cost of repairs to and replacements of materials as listed under construction, including freight, hauling and all cost of labor employed.

(D) Repairs to Subway.—This account to include the cost of repairs to and replacements of material as listed under construction, including freight and hauling and all cost of labor employed.

(E) Repairs to Exchange Equipment.—This account to include the cost of material and supplies for the repair of the switchboard, cable, cable shaft and terminal room, distributing board, cross-connecting frame, repairs to charging machines, ringing machines, batteries, and the renewal of batteries and all labor employed.

(F) Repairs to Booths and Pay Stations.—This account to include the cost of repairs to and replacement of materials as listed under construction, including freight, hauling and all labor employed.

(G) Repairs to Private Branch Exchange.—This account to include the cost of repairs to and replacements of materials and equipment as listed under construction, including freight, hauling and all cost of labor employed.

(H) Repairs to Buildings.—Repairs to company's buildings.

(I) Tool Repairs.—To include the cost of all tools when purchased to take the place of tools destroyed or lost, and repairs to same.

(J) Miscellaneous Expense.—To provide for all repairs not otherwise specified.

(K) Repairs to Toll Lines.—This account to include the cost of repairs to and replacement of material as listed under construction, including freight and all cost of labor employed.

Operative.

(A) Salaries and Wages, Local Exchanges.—Operators, supervisors, monitors, attendants, etc.

(B) Salaries and Wages, Long-distance.—Toll operators, supervisors, monitors, attendants, etc.

(C) Stationery, Printing and Postage.—This account to include the cost of all stationery, printing and postage used in the operating department for compiling records, monthly and daily reports, etc.

(D) Light.—This account to include a fair pro rata of total light bills which is considered applicable to operating according to existing conditions. Balance of light bills to be charged to the general expense account "Light."

(E) Heat.—Charge a fair pro rata of total heat bills which is considered applicable to operating according to existing conditions. Balance to be charged to the general expense account "Heat."

(F) Water.—Charge a fair pro rata of total water bills to this account as in the case of "Light" and "Heat."

(G) Power.—Charge entire power bill to this account.

(H) General Operating Expense.—This account to include the cost and expense of dining-room supplies, hospital, hospital supplies, medical services, traveling expenses and other items incident to the operating department. In the event of meals being sold to operators, or other employes, the proceeds to be credited to this account.

(I) Rent.—A proportionate amount of rent applicable to operating department.

1. Report of the committee on Standard Forms of Accounting, presented to the meeting of the National-Interstate Telephone Association at Chicago, June 21st, by H. E. Bradley, chairman; C. J. Meyers, secretary and Charles F. Bender, Charles West, W. W. Grayson, N. S. Vivian, J. B. Ware, P. T. Spencer, H. B. Sale and W. VanMiddlesworth.

Indiana Telephone Items.

The German Telephone Company of Craigville has filed articles of incorporation, capitalized at $10,000. The company proposes to establish and operate a telephone exchange in Craigville and extend the system throughout the northern part of Wells County. John H. Barger, William J. Deihl, Alfred S. Abbott, Walter Reed and Daniel C. Huffman are the directors.

Oscar L. Garber, president of the Converse Electric Company, has filed a petition with the board of control of Marion for a franchise for a long-distance telephone line to the city of Marion. Mr. Garber stated that the Converse Telephone Exchange had an average of 100 calls for Marion every day and that the sale of the United Telephone plant in Marion to the Central Union Company cut off all communications with Marion, except over wires operated by the Central Union Company. A room in the Western Union Building has been rented for an exchange and a plant will be installed as soon as a franchise is granted. The wire between Converse and Marion has been strung on poles used by Wilson & McCulloch as a private telephone line to the city limits of Marion. The city officials are said to favor the new company, and it is thought a franchise will be granted.

The Central Energy Telephone Company's plant in the city of Frankfort has been bought by the Bell telephone interests. The consideration is said to be about $150,000, and the Bell people are to take possession on July 1st. The deal was consummated by the purchase by the Bell company of the entire 1,000 shares of stock, the brick building in which the plant is located, together with the real estate and the franchise, held by the Independent company, granted by the city, which is claimed to be perpetual. The Central Energy plant was owned by Eli Marvin, George Dinwiddie, D. A. Coulter, W. H. Coulter and James McClanrock. The plant was built at a cost of $125,000. The Frankfort company gave as an excuse for selling that it had been severely crippled by the Bell company buying up a number of the Independent plants in this state and that its toll service was at the mercy of the Bell company. The New Long-distance Telephone Company of Indianapolis has a long-time contract with the Central Energy company for toll-line service and the managers thereof propose that the contract shall be carried out to the letter. The plant of the Central Energy company is said to be one of the finest in the state, being practically new. It has 1,300 telephones in operation and has connection with every town in the county and all cities in the state.

The Home Telephone Company of Wabash, Ind., has sold its franchise for an exchange at Lagro to Taylor, Dellinger & Sons of Bloomfield, Ohio, and the exchange will now be operated independently. The Central Union Telephone Company is striving for a franchise at Lagro.

The esteem and respect in which Simon P. Sheerin, president of the Indianapolis Telephone Company and the New Long-distance Telephone Company, was held both by his associates in the business management of these companies and the employes thereof, was expressed by resolutions on his death, passed by the combined board of directors of these two companies and by the employes thereof. And as a mark of respect to the memory of Mr. Sheerin, no connection, either local or long-distance, was made by these two telephone companies for a period on the morning of the burial. The opinion is expressed in local telephone circles that the death of Mr. Sheerin, while it will be felt as would that of perhaps no other man in those circles, will not affect the New Long-distance telephone situation in the least. Lewis Hollweg, vice-president of the Indianapolis Telephone Company, said the policy of the company will be based upon the same broad Independent lines that have been employed heretofore, the object of which is to give the people good telephone service at moderate cost. The opinion is generally shared that Mr. H. B. Sale, who has been largely entrusted with the detail work of the two companies, will succeed to the general management of the companies, and it is not unlikely that he will be selected to succeed Mr. Sheerin in the high official positions which he held. S.

Telephone News from the Northwest.

The two rural telephone companies at Turton, S. D., have separated and each will operate an exchange of its own.

The Deerwood (Minn.) and Bay Lake Telephone Company has been organized by O. C. Coffin of Deerwood and others.

The Apollo Telephone Company is being organized at Rice, Minn.

The Tri-state Telephone Company has secured admission to Rochester, Minn., for a toll connection, after having been refused a franchise.

The Hunter Telephone Company of Hunter, N. D., has increased its capital stock from $5,000 to $10,000.

James Bennett of St. Peter, Minn., has been elected financial manager of the Nicollet County Telephone Company, with headquarters at St. Peter. C. C. Nelson of New Sweden will be general manager.

The Northwestern Telephone Exchange Company of Red Wing, Minn., has cut over a new switchboard in a complete new office building. The new board is central energy.

The Shakopee Telephone Company has completed a rural exchange with central quarters at Bloomington, Minn.

The Home Improvement Company will install a telephone system for Crystal and Hoople, N. D.

W. J. Dwyer of Medina, N. D., has been granted a franchise for a telephone system there.

The New State Telephone Company of Sioux City, Iowa, has concluded a deal whereby it absorbs all the toll lines, rural lines and local exchanges of the Monona Telephone Company of Onawa. The total valuation of the property is about $60,000.

The West Milford (Iowa) Farmers' Telephone Company has filed articles of incorporation with $3,000 capital. F. D. Smith of Ames is president and E. Livingston of the same city, secretary.

The contract for erecting a new exchange building for the Nevada (Iowa) Mutual Telephone Company has been let to Gretsinger & Bobo. R.

Ohio Telephone Notes.

The Toledo syndicate that purchased a large block of bonds and common stock of the Cuyahoga Telephone Company some time ago has disposed of most of it to investors in that city who are friendly to telephone securities. The bonds amounted to $428,000 and the common stock over $350,000. Of the former, $128,000 was treasury bonds and $300,000 will be issued. This will raise the outstanding indebtedness of the company from $2,400,000 to $2,700,000. The common stock will come from the Federal Telephone Company and members of the syndicate. The sale of these securities will give the company money to pay for the extensive improvements and the installation of the new telephones that have been subscribed.

Plans are being formulated for the liquidation of the Federal Telephone Company, as already mentioned, and, it is thought, they will be completed before fall. The greater part of the debt of $3,000,000 is due the members of the Everett-Moore syndicate. It is probable that a value will first be fixed on all the stocks and bonds owned by the company, and then members will be asked to take these and pay pro rata according to the amount of securities they owe. This would settle the debt and give the members whatever is coming to them in stocks and bonds of the various subsidiary corporations. The stockholders will be offered the same opportunity.

During the last month the Central Union Company has opened new exchanges in the following places in this state: Centerville, Pitchin, Spring Valley and West Lafayette. Toll stations have been opened at Flint, Johnson's Island and Cedar Springs.

The Morristown Telephone Company of Morristown has been incorporated with a capital stock of $3,000 by R. M. Eaton, John Jeffrey and others.

In the suit of William T. Burns against the Citizens' Telephone Company of Columbus the Circuit Court reversed the Common Pleas Court and decided that conduits may be laid in the streets without compensation to abutting property owners. All that is necessary is a sufficient bond from the company to insure property owners against any damage.

The purpose of the new Carlisle Telephone Company, incorporated last week, is to make extensive improvements in the system already in operation in New Carlisle. The business had not been operated by a corporation, it seems.

The Morgansville Telephone Company has been incorporated with a capital stock of $50,000 by Jackson Jones, W. J. Warne and J. C. Glass.

An increase in capital stock from $15,000 to $25,000 has been made by the Auglaize Telephone Company of Waynesville. The Mt. Sterling Telephone Company of Mt. Sterling has also increased its capital stock from $15,000 to $50,000.

Articles of incorporation have been issued to the North Baltimore Telephone Company of North Baltimore, with a capital stock of $35,000. E. A. Reed, James Niven, W. R. Nutt, T. P. Sylvan and J. T. Daniels are the incorporators.

The Bell Telephone Company announces that it now has 142,237 stations in Ohio, a gain of 12,226 since January 1st, or at the rate of 40,000 for the year. C.

Kansas Telephone News.

The Mutual Telephone Engineering and Supply Company of Wellington has been granted a franchise to build a telephone system in Burden, Kan. Work will be begun at once.

The Cuba Telephone Company has been organized to build an exchange in Cuba, Kan.

The Republic County Independent Telephone Company has completed its system, having about 100 telephones at Wayne, Kan.

The Burrton-Inman Telephone Company has just completed its exchange in Inman, Kan. It has about 100 subscribers besides several hundred rural telephones.

The Gueda Springs Telephone Company has been organized to build an exchange in Gueda Springs and rural lines to connect. The company will build to Oxford and South Haven.

The Mulburry Telephone Company has been granted a franchise to build an exchange in Mulburry, Kan., and rural lines to connect. K.

The Telephone on the Pacific Slope.

J. W. Cunningham and Carl Smith of Alpha, Wash., are arranging to connect the towns of Alpha, Waterville, Yuba and Chelan, Wash., by a telephone line.

The Independent Telephone Company of Seattle, Wash., will build an extension to its line from Dungeness to Port Angeles, a distance of about 20 miles. At that point connection will be made with other long-distance lines.

The Home Telephone and Telegraph Company has been incorporated at Portland, Ore., with a capital stock of $3,000,000 by C. E. Sumner, A. K. Wilson and Albert Andrews. William M. Godfrey will act as superintendent of construction for the system, which it is intended to complete within the next eight months.

The Klickitat County Farmers' Telephone Company has been organized at Goldendale, Wash., by the election of the following officers: President, J. S. Eddyings; vice-president, N. C. Netier; secretary, F. H. Vunk; treasurer, A. M. Wiley. The company will build six telephone lines and will put in about 300 telephones. Arrangements have been made to connect the system with long-distance lines.

The Sunset Telephone Company of San Francisco, Cal., is making considerable imorovement to its lines in Southern California. In Pasadena new telephones of standard type are being installed, over 1,200 new instruments having already been put in. A new multiple switchboard has also been installed at Pasadena. Four thousand dollars is to be expended on the system at Fullerton.

The Home Telephone Company of San Francisco, Cal., has asked for a franchise to maintain and operate a telephone system in the city and county of San Francisco. The petition pledges the company to begin work within four months from the date of the granting of the franchise: to expend $2,000,000 within 12 months after beginning work, $3,000,000 within 24 months and $4,000,000 within 36 months, and to complete the work of installing a system within three years. The company is to file a bond of $250,000, to be forfeited to the city unless all conditions of the franchisie are carried out. A.

Bell Contract Agents in Denver.

The annual meeting of the contract agents of the Bell telephone companies of the United States was held in Fraternal Order Hall, Denver, on June 20th to 23d, inclusive. About 50 telephone men were present, nearly every Bell licensee company of the country being represented. Papers were read and very thoroughly discussed, two advance discussions being prepared in each case by men from different sections of the country, and these —constituting really three papers on each subject— were followed by a general discussion. Following is the list of titles of subjects discussed and the names of those who prepared the main papers:

"Rural Lines," by F. W. Story, Boston.

"Value of Educational or Experimental Service," by W. W. Burritt, Newark, N. J.

"Value of the Busy Test," by W. F. Baker, New York.

"Advertising," by Howard T. Vaille, Denver.

"The Opposition," by W. H. Adkins, Atlanta, Ga.

"How Can the Contract Department Best Promote Toll Traffic?" by C. A. Spaulding, Buffalo.

"The Instruction of the Agent," by B. W. Trafford, Philadelphia.

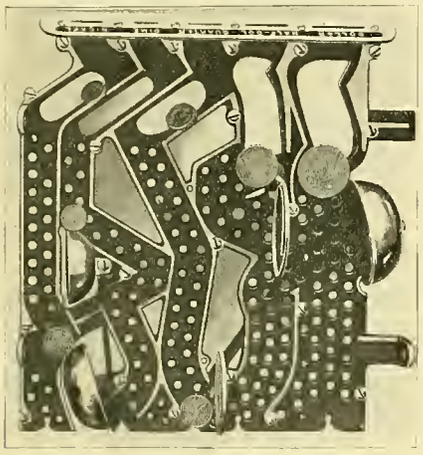
The meeting was brought to an end by an enjoyable banquet at the new Hotel Savoy. E. J. Hall, the first vice-president of the American Telephone and Telegraph Company, acted as toastmaster. Afterward the Colorado Telephone Company, the host of the occasion, entertained the visitors on an excursion to Colorado Springs and Cripple Creek and a visit to the El Paso gold mine. Following is a list of the names of those present:

W. H. Adkins, Atlanta; H. G. Bates, New York; Bert Ball, Philadelphia; William F. Baker, New York; H. F. Barch, Cleveland; George C. Brooks, Indianapolis; C. E. Bryan, Baltimore; W. W. Burritt, Newark, N. J.; J. A. Connell, Pittsburg; H. J. Curl, Kansas City; W. P. Ellis, Philadelphia; A. T. Eyermann, St. Louis; H. F. Ettinger, Philadelphia; George C. French, Milwaukee; Reddington Fiske, Kansas City; J. E. Gordon, Albany; E. J. Hall, Boston; Hugh H. Harris, St. Louis; H. E. Hawley, Albany; O. J. Holbrook, Chicago; C. T. Keller, Boston; F. Knight, Houston; A. D. Lane, Omaha; Joseph Lawton, Providence; O. R. McKenzie, Syracuse; E. H. Mulligan, Chicago; A. R. Pardington, Brooklyn; W. G. E. Pierce, Chicago; G. H. Pratt, Omaha; A. M. Ramsay, Chicago; F. W. Story, Boston; C. B. Shaffner, Harrisburg; F. E. Smith, Elmira; C. A. Spaulding, Buffalo; C. R. Truex, New York; Frank H. Thompson, Kansas City; Hugh L. Thomas, Salt Lake City; H. A. Vance, Cheyenne, A. Von Schlegell, Minneapolis; H. T. Vaille, Denver; N. E. Westlake, Cincinnati; C. H. Wilson, New York; E. M. Burgess, Denver; E. B. Field, Jr., Denver; H. W. Bellard, Denver; J. E. Macdonald, Denver; Philip Hamlin, Denver; W. F. Brown, Denver; H. A. Rhodes, Denver; F. W. Cozad, Denver; A. H. De Nike, Denver; C. L. Titus, Denver; W. P. Allen, Denver; G. H. Althouse, Denver; W. R. Slaight, Denver.

Telephone Pay Stations.

The rapid development of long-distance telephone business makes desirable the use of five-slot pay stations by means of which the telephone patron may pay on the spot a sum of money for the service to correspond to the length of conversation necessary, whether it be a nickel, dime, quarter, half dollar or dollar. The Gray Telephone Pay-station Company of Hartford, Conn., a pioneer in this field, presents an up-to-date line of such apparatus, including pay stations for all classes of service neatly arranged in cabinets or in the form of wall sets. The accompanying illustration shows the gravity principle of the Gray automatics.

The automatic feature of the stations will appeal



TELEPHONE PAY STATION.

to all. The fact that the user has simply to drop in the coin and the money makes its own signals as it passes down the chute, insures satisfactory and rapid service. In eliminating all movable parts, springs, air pumps, levers, etc., and accomplishing results without the use of electrical connections, the company is able to furnish the trade with a station that affords the lowest cost in maintenance.

All stations, whether large or small, have the same code of signals, and there can be no confusion. A single bell means a nickel, two bells means a dime, one clock gong means a quarter, two clock gongs means a half dollar, and one deep bell and rattle means a dollar.

Each company using one of the stations is furnished with a lock series, operated and controlled by a master key, of which it has the exclusive use and control. The locks are built of extra strength and security.

Smaller stations with only four slots for coins up to and including a half dollar, are also furnished for places where a dollar call would not be likely to be wanted.

District Telephone Managers Meet in Detroit.

The district managers of the Michigan State Telephone Company met in convention at Detroit last week. There were 67 managers present as the guests of the general management at the main office. This was their first annual convention, and they elected James F. Land (general manager) president and W. I. Mizner, secretary.

Several papers were read by members and a general discussion of experiences was held. As a direct result of this meeting a systematic effort will be made throughout the state to enlarge the rural service. Farmers will be encouraged to build the lines and keep them up, the company to furnish the telephones and switchboard service. The convention closed with a banquet.

Bell Telephone Output.

The American Telephone and Telegraph Company's output statement for May, just issued, presents the following comparisons:

May—	1905.	1904.	1903.
Gross output	168,764	103,897	102,066
Returned	53,212	51,721	32,815
Net output	115,552	52,176	69,251
January 1 to May 31—			
Gross output	777,065	508,372	512,456
Returned	231,115	203,046	192,952
Net output	545,950	305,326	319,504
Outstanding May 31	5,026,514	4,084,843	3,469,824

The Lake Champlain (N. Y.) Telephone and Telegraph Company has filed a certificate of incorporation with a capital of $250,000. This company will operate from Eagle Bridge, through Essex, Rensselaer and Washington counties, N. Y., and in Addison, Bennington and Rutland counties, Vt. The directors are Henry E. Hawley of Albany, F. W. Storey of Boston, O. O. Dennis of Whitehall and E. D. Raymond of Fairhaven, Vt.

GENERAL TELEPHONE NEWS.

The Laingsburg Telephone Company, located at Laingsburg, Mich., has decided to increase its capital stock from $25,000 to $100,000.

S. J. Baer, who has been western representative of the American Telephone and Telegraph Company in Topeka, Kan., has been appointed assistant general manager of the Missouri and Kansas Telephone Company in Kansas City, Mo.

The Syracuse Home Telephone Company of Syracuse, Ind., has decided to sell its plant. Syracuse is a town of 1,700 inhabitants, and the system now has 215 telephones connected. At Lake Wawasee nearby there are located many summer cottages, which offer opportunity for further extensions.

Over $46,000 has been voted by the Finance Ministry of Great Britain as a subsidy toward the extension of the telephone system throughout the Egyptian Delta, between Cairo and Alexandria and the chief provincial towns, such as Tantah, Kafr-ez-Zaiyat, Damanhur, etc.

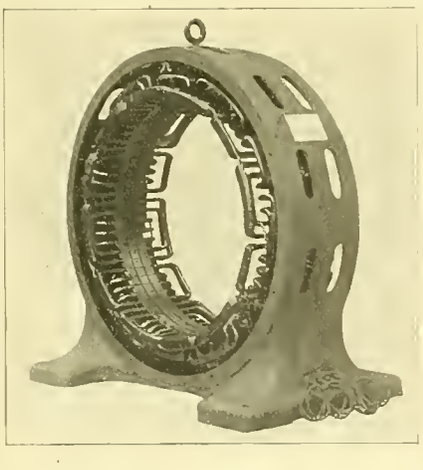
The following-named are among the telephone companies which have been incorporated recently: Citizens' Telephone Company, Marvin, Kan.; Terril Co-operative Telephone Company, Terril, Iowa; Riverdale Mutual Telephone Company, Riverdale, Kan.; Fairview Telephone Company, Olustee, Okla.; Greenridge Mutual Telephone Company, St. John, Kan.; Western Rural Telephone Company, Harper, Kan.; Panola Farmers' Telephone Company, Panola, Ill.; Citizens' Local Telephone Company, Erma, N. Y.

The fire and police telegraph system of St. Louis has 170 telephones in use, for which a rental of $5 for each wall telephone and $10 for each desk instrument has been paid annually. This is exclusive of the telephones rented by the city and connected directly with the city exchange. It is said that T. F. Almon, superintendent of the department, has ordered the instruments of the private exchange removed, to be replaced by telephones bought outright by the city at the rate of $7.50 for the desk and $3.50 for the wall telephones.

Westinghouse Belted-type Rotating-field Alternators.

A line of belted-type, self-contained, rotating-field, alternating-current generators, as shown in the illustrations, has recently been placed on the market by the Westinghouse Electric and Manufacturing Company. The machines are built for single, two and three-phase circuits, in sizes from 30 to 200 kilowatts. The single-phase generators are manufactured for 220, 440, 1,100 and 2,200-volt circuits at 7,200 alternations, and besides these the polyphase machines are wound for 6,600 volts and both 3,000 and 7,200 alternations. In this type of generator the armature is stationary, a construction which facilitates the insulation of its windings, and provides that the field current, instead of the armature current, pass through the brushes and collector rings. Alternators of this type are therefore especially adapted to high voltages or large current output.

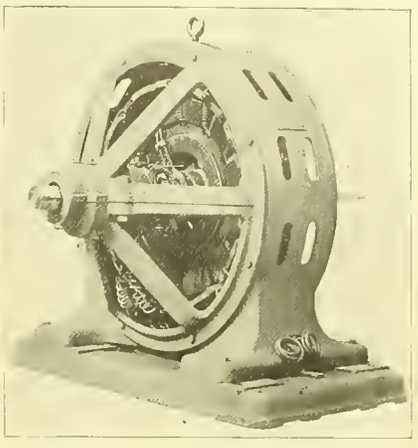
The frame of the stationary armature is cast in one piece with slots machined on the inside for holding the punchings which receive the windings; these are composed of wire, strap or bars, depending on the size and voltage of the generator. Open



STATIONARY ARMATURE OF BELTED-TYPE ALTERNATOR.

slots are employed in machines up to 75 kilowatts, with coils held in place by hard-fiber wedges. In the larger machines partially closed slots are used. Horizontally split brackets which carry the bearings are bolted to this cast-iron frame. The bearings are generous in their dimensions and are self-oilings, having oil rings and an oil gauge on each, thus giving superior running qualities. All generators have bed plates with large foundation areas and suitable belt tighteners. These generators may also be arranged for direct connection to an engine or waterwheel. The single-phase generators have compensating field windings supplied with rectified alternating current.

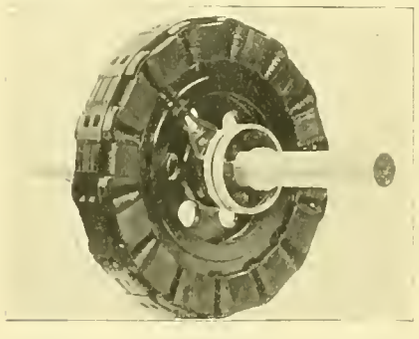
Every means has been utilized for the rapid dissipation of heat from all parts of the machines. Open spaces in the laminated field register with those in the armature, and during operation air is



BELTED-TYPE ROTATING FIELD ALTERNATOR.

drawn in through the field spider and forced out through the stationary core and windings, thus insuring low operating temperature. Excellent regulation is obtained by properly proportioning the armature and field windings in preference to saturating the magnetic field.

The single-phase generators have compensating field windings supplied with rectified alternating current. A commutator on the shaft adjacent to the collector rings, has its brushes connected to the secondary of a series transformer in the arma-



ROTATING FIELD OF BELTED-TYPE ALTERNATOR.

ture circuit and its segments to the self-exciting field coils. The compensating winding is so designed that the generator can be adjusted for a practically constant voltage from no load to full load or for an increase in voltage.

The performance of these machines shows a high degree of excellence in efficiency. The proportions of the machines are those which both theory and practice have demonstrated to be the best. The high grade of material used throughout, taken in connection with the perfection of general mechanical and electrical design, make these generators all that can be desired, both in performance and construction.

Chicago Street-railway Situation.

Representatives of the traction companies appeared before the local transportation committee of the Chicago City Council and Mayor Dunne a few days ago and presented their proposition for the tender of the traction lines to the city. A serious disagreement resulted between the traction representatives and the mayor. A difference of opinion has also arisen among the supporters of the mayor's ideas, on the transportation committee.

The matter on which the mayor and the traction companies could not agree was as to the time at which the intangible property of the companies—their rights under the "99-year acts"—were to be valued in case of a sale to the city. The companies insisted no fair figure could be placed on these rights until the Supreme Court of the United States had decided exactly what these rights are.

The mayor's position was that it would be possible to estimate values on three alternative propositions. One supposing that the decision of Judge Grosscup would be sustained; one supposing that the companies' "twig and branch" theory would be sustained, and one supposing that the city's claim that the companies had no "99-year rights" would be sustained. These three sets of values, he insisted, could be estimated now, and the city pay as the Supreme Court finally might decide.

The mayor's plan now is to start an independent

system of street cars covering all parts of the city. He has devised a plan for a 100-mile system to take the place of the 10-mile Adams Street line for which B. J. Arnold recently made plans, and for the construction of which bids have been asked. Presumably to carry out this new plan the mayor asked the council to rescind the advertisement for bids for the 10-mile system and the council granted the request. It is said, however, that the projecting of the 100-mile plan will be opposed by many of the aldermen and possibly by a majority of the transportation committee.

The traction companies say they are willing to resume negotiations as soon as the mayor will agree to postpone the valuation of our franchise rights until the Supreme Court decides exactly what those rights are.

E. L. Dupont of Detroit, Mich., a man of considerable traction experience, has been in Chicago advising with Mayor Dunne, and it is rumored that he may be retained as supervising engineer in the mayor's plan for building a new system.

Purchased Electric Power in Factories.[1]

By E. W. Lloyd.

The subject "Purchased Electric Power in Factories" has received considerable attention from engineers in the last few years, and I believe it is now the consensus of opinion that the use of motors for driving machinery in factories is the most economical, practical and flexible known to date. The question as to whether the current for driving these motors can best be furnished from an isolated plant in the factory or from the lines of the central-station company furnishing power in the district, depends upon the rate per kilowatt-hour charged by the company when the installation conditions are the same. I believe the time is near at hand when the greater part of factory power loads will be furnished from central-station service, as such great improvements have been made in central-station generating apparatus in the last few years that the selling price of electric current for power purposes has been reduced to the point where we can successfully compete with private plants.

I do not think central-station managers have much difficulty in obtaining power customers up to 10 or 15 horsepower, as the cost of running motors of this size is generally below the cost of running a steam engine or other prime mover now on the market, particularly when all of the items that go to make up the operating cost are taken in consideration. Even though the cost of furnishing current to small sonsumers were a trifle greater from the central-station service, we should have very little difficulty in obtaining this class of businss, as a factory owner would rather not be bothered with the power question, and prefers to pay a little more if he is satisfied he will have no trouble. It is, therefore, with the larger installations of motors in factories that run from central-station service that this paper will treat.

The question as to whether a factory will run from central-station service or whether it will generate current from its own plant is not always decided by the rate per kilowatt-hour which the central-station company proposes to charge for the current. To anyone who has had experience with installations of motors driving machinery, where one large motor was used, it is known that no economy can be obtained over engine drive with profitable rates for central-station service. It may be possible with the use of a few motors in a large plant running 15 to 24 hours a day with a low rate per kilowatt-hour, that central-station power can compete with engine drive; but the average plant does not run more than 10 hours a day, and, therefore, the rates of a central-station company doing a profitable business cannot compete successfully with these conditions. It is therefore, necessary to consider other sides of th factory power subject than merely the question of price per kilowatt-hour.

The most important fact that has been developed to-day in connection with this subject is that the proper motor installation has everything to do with the economical furnishing of electric current from central-station service. I think central-station managers will agree that in a great many cases where factory power was lost to them the fault lay in the fact that the motor installation eliminated none of the wastes in the plant that were in evidence when it was driven from an engine. A great many cases of this kind have come to my notice, and I am fully convinced of the truth of these statements. While it is no doubt difficult to convince factory managers that the installation of a great many motors is the only economical method of driving, this is being accomplished by a number of companies, and it is becoming less difficult each day to demonstrate the efficiency of individual or good group-drive installations of motors. The elimination of all friction loads in a factory makes a wonderful difference in the kilowatt-hour consumption. I believe the time is coming when machinery of almost every description will be equipped with electric motors before it is put into service. It is a well-known fact that the efficiency, flexibility and output of a tool is materially increased with the use of individual motors. While it is true that the installation of individual motors increases the connected horsepower load in a given factory over and above what it would be, should group-drive installation be made. it is also true that the current consumption is considerably less on the individual-motor installation There are engineers throughout the country who advocate individual-motor installation, but I believe the subject has not received the proper consideration from all central-station companies, and the sooner it is brought forcibly to their attention that this type of installation will do more to increase their power load than any other one thing, the more universal the practice will become. The selling by some companies of electric current at very low rates, even to the extent of losing money on this current, is not necessary with proper motor installations. Extremely low prices for electric current in some localities are detrimental to the station business in others, and I do not think they are necessary if the proper attention is given to the engineering features in obtaining power business.

The agent sent out by the central-station company to obtain large business must have some training before he is competent to get business. It is necessary to make a special study of factory conditions. Starting in the engine-room he must understand the coal consumption of different types of boilers and the steam consumption of the different types of engines. While it is very likely he can obtain from most factory managers the coal consumption in the plant, it is very necessary that the agent know whether this coal consumption is correct or whether it is abnormal, considering the engine and boiler installation. If the coal consumption per horsepower be high it is a point in favor of central-station service. It must be taken into consideration that in a great many plants they do not always keep a correct record of the plant costs, and, in view of this fact, it is necessary to know what items go to make up these costs. The mere costs of fuel and labor are not by any means all of these costs. The items enumerated below are those that can generally be considered as making up the total cost of operating an isolated plant:

Salary of engineers; salary of firemen; salary of electrician; fuel; removal of ashes; water; oil; repairs to boilers; repairs to engines and dynamos; lamps; carbons; tool account; miscellaneous expense and supplies, waste, packing, etc.; general expense; depreciation (10 per cent. to 15 per cent.); interest on investment; insurance; rental value of space; damage resulting from heat and vibration; risk to employees and the public through accidents and boiler explosions; taxes.

In addition to the above plant costs, it is often necessary to add the following: Maintenance of rope or belt-transmission lines; unnecessary investment in shafting and hangers, and salary of millwrights.

If the factory manager has not kept a correct account of the above items it is necessary that the agent be familiar with plant costs and also with the operation of the machinery in the plant, and be able to estimate these costs. He must, furthermore, understand the operation of different kinds of machinery and know approximately what power each machine takes. This may seem a difficult proposition for the station manager who has to hire solicitors, but an intelligent agent can accumulate a surprising amount of information in this direction in a year. There is so much matter published by the different manufacturers of apparatus and also by the different technical journals on the subject of motor installations that a great deal of matter can be obtained from these sources. It is extremely difficult to determine at times what the average power consumption on a given plant would be if the friction loads were eliminated. Taking indicator cards from an engine for one day, or even for one week, does not determine the average load nor the friction load throughout the year, as the factory may have dull periods when the average load will be less and the proportionate friction load more; not only that, but the large friction load on the average plant cannot easily be determined, owing to the impossibility of cutting off all the running belts and countershafting. In arriving at the power consumed by a factory having engine drive it should be remembered that, should the proper motor installation be made, a large percentage of the friction loss would be eliminated. If the agent is familiar with the character of the business carried on by the manufacturer desiring figures on central-station service, he can obtain very accurate information on the probable kilowatt-hour consumption, by making an observation of the character of the work done by each machine and probable hours of running. He can then arrive at a fairly accurate estimate of the kilowatt-hours per day required by each machine. A machine may run all day and still not average more than 50 per cent. of the maximum.

One of the most difficult propositions an agent will meet is where a factory is equipped with fairly efficient engines and where there are a great number of machines in operation. The factory manager objects seriously to spending a great deal of money on small motors for the operation of his plant, and it is often necessary to guarantee results from such an installation for a short period in order to convince him that you are accurate in your estimate of the kilowatt-hours per month.

Another of the most difficult tasks we have is convincing a customer that his average load is not equivalent to his connected load, nor is his maximum load the average. It is surprising what a large number of people persist in these views.

Factory managers are appreciating more and more every day the advantages of electric drive, and it is not nearly so hard a job to induce them to-day to change over to motor drive as it was a few years ago, when there were comparatively few large plants in the country equipped in this way.

In equipping a factory with motors it is also necessary to use a fairly efficient motor. If poorly-designed motors are used there can be a great loss of current in the motors themselves, and while it is true that manufacturers are making the average motor more efficient today than it ever was made, it is well to consider the matter of efficiency and see that the motors to be used are of a good make. This point is not always given proper consideration by the central-station agent or the factory owner. Very frequently the factory owner has some friend in the motor business who induces him to use motors that are not as efficient as they should be.

It is not always the question of electrical efficiency, however, that should govern the make of motor to be used. If the motor is poor mechanically, it can cause more trouble in the course of a year than would the lack of electrical efficiency. The average factory superintendent does not understand electricity, and when motors are first installed in his factory, and he has trouble with the motors from different causes, he is very apt to become prejudiced against central-station service on this account. The troubles with brushes, commutators, brush-holders and bearings are most frequent where direct-current motors are used. With alternating-current induction motors troubles are of infrequent occurrence and do not require the consideration and attention the direct-current motor does.

The speed of the motors for driving machinery should be considered and the method of driving machines should receive the careful consideration of the agent handling the job. While it is not absolutely necessary that the central station install these motors, I believe they should have some voice in the matter, and the factory owner convinced that the advice of the central-station company is for his best interests in making the installation practical and economical. Where the company has a construction force for carrying on commercial electrical construction this department can be used to great advantage in this work. A part of this construction force can be educated in the installing of motors, and efficient work on their part will do a great deal toward keeping the customers satisfied.

In connection with motor installations in new factories, it should be borne in mind that there will be a considerable saving in the first cost of the building and equipment by the removal of heavy line shafting. The cost of belts and pulleys and their maintenance is also eliminated to a large extent by the use of motors.

When endeavoring to convince a factory owned that he should accept central-station service, his attention should be called to the fact that there are other reasons besides saving in cost of current that should convince him that this service is to his advantage—such as the elimination of smoking chimneys; inability to get coal should there be strikes; breakdown of the transmission shafting, stopping the entire plant; breakdowns of engines or boilers; the liability of accidents in the plant from explosions or other accidents; cleanliness; the absence of belts, vibration and heat; and, as before stated, the increased efficiency, flexibility and economical operating of the machines throughout the factory operated by motors. The output of a tool can be materially increased by such installations, and, therefore, the investment in tools decreased for a given output. Furthermore, there is the reliability of service from the central station at any time during the twenty-four hours. Should he have a particular contract where it is necessary to run a few machines in order to turn out goods, he can run this part of his factory very economically, it being only necessary to use such motors as are direct-connected to the machines that are required to do such work. There is also the fact that should his business increase it is only necessary to expend a small amount of money in order to increase the capacity of his power plant, instead of buying a new generating unit or of running a very large engine on an uneconomical load for a number of years.

While it may seem that an agent having all of the above qualifications and knowledge relative to machinery in power plants would be an expensive adjunct to the force of a central-station staff, experience has demonstrated to a number of companies that this man can be developed in a surprisingly short time by education and by putting before him compiled information from the company's books on the consumers already furnished current from central-station service. Do not stunt the growth of your business by withholding information from your agents. The compiling of this information should, I believe, be carried out on the same lines by all members of this association.

1. Introduction to a report read at the Denver-Colorado Springs convention of the National Electric Light Association, June 8, 1905. Mr. Lloyd is connected with the Chicago Edison Company.

The prefecture of the Seine, Paris, will award contracts involving expenditures of $3,897,000 for the construction of city tramway lines.

CORRESPONDENCE.

Great Britain.

London, June 14.—Particulars have just been published of two large colonial electrical engineering jobs that have been carried out by British firms, which, in face of the general outcry that English firms are not pushing enough outside the United Kingdom, show that this accusation does not apply to the electrical industry. One of the works in question is the Johannesburg electricity works, which have been designed by the English firm of consulting engineers, Mordey & Dawbarn, for the municipality. The works have been designed for both lighting and traction, and the aggregate capacity of the generating plant is 13,000 horsepower. The center of the town and the tramways will be supplied direct with continuous current, while the remainder or outlying portions of the town will be supplied mostly on the single-phase system, the generation being at 3,000 volts, two-phase, 50 periodicity. There will be five continuous-current generating sets and three two-phase sets of 2,000 horsepower. Gas engines will be employed.

The other installation to which reference is made is the Calcutta tramway undertaking. As a matter of fact, electric tramways are being developed in the East to a considerable extent by British firms, and to mention two, Singapore and Hong Kong, have been equipped in this direction within the last 12 or 18 months. Calcutta, however, is looked upon as the largest and most important system yet installed in that portion of the globe. The lines in Calcutta have been working for many years by steam and horse traction, but a complete reconstruction has now taken place. The total route mileage of the new system is 25 miles. The trolley system has been adopted. The generating station contains three 500-kilowatt generating sets working at 550 volts. Owing to the mixture of the population in Calcutta, two classes of cars have been provided—one an ordinary single-deck tramcar and the other open-sided trailers—in which the poorer natives travel. The firms which have carried out the Johannesburg and Calcutta jobs, respectively, are Siemens Bros. & Co. and Dick, Kerr & Co.

Lord Rayleigh, F. R. S., the distinguished scientist, has been awarded the Albert medal by the Society of Arts in recognition of the influence which his researches, directed to the increase of scientific knowledge, have had upon industrial progress by facilitating, among other scientific applications, the provision of accurate electrical standards, the production of improved lenses, and the development of apparatus for sound signalling, etc.

In the House of Commons there exists what is known as the cables committee, which is composed of a body of gentlemen closely allied to the general trading business of the country, whose chief object is to urge at all possible times a reduction in the cable rates abroad. Incidentally, this committee is strongly in favor of a more complete state control of the telegraph companies than at present exists. A few days ago a deputation which included representatives from all parts of the kingdom and which was championed by the above-mentioned cable committee waited upon the chancellor of the exchequer to request the consideration of a further reduction in the rates of cabling to India, China and West Africa. In the case of the latter a 50 per cent. reduction was suggested, and for India the reduction asked for was from 2s. 6d. to 1s. 6d. per word. The general tone of the speakers was that the cable companies were making profits which were far too enormous, but the chancellor of the exchequer, in a somewhat deliberate speech, pointed out that we in Great Britain have to thank the private cable companies for the very excellent cable system which we now possess, and of which we were all so proud. As a matter of fact, an agreement had previously been come to to reduce the Indian rate to 2s. per word, a reduction which would take effect from October 1, 1905. There was also the possibility of a reduction of the Egyptian rate, but beyond this he did not think they could anticipate any reductions in the near future.

As I have previously pointed out, the big electrical power scheme for London has passed through the committee stage of the House of Lords. Last week the final stage in that House was reached, viz., third reading, and an effort was made to secure some modification of the terms of the bill. This effort was unsuccessful, however, a not very surprising thing when the half-hearted manner in which the request was made is taken into account. There now remains the three stages in the House of Commons, which will be a much more difficult task than the similar proceedings in the House of Lords, in view of the strong support which the London local authorities can rely upon in the lower House.

The accounts of the London County Council tramways, which have recently been issued, show a very satisfactory result, especially when the very unsatisfactory conditions under which the undertaking is now being worked are taken into account. The net profit upon the electric lines, after allowing for interest, sinking fund and renewals, was a little over £35,000. It should be pointed out that at present the main generating station is not completed, current being obtained from temporary supplies. The total mileage now in the hands of the council is about 47 miles, of which 26½ miles have been reconstructed for electric traction. By adding the rents obtained from the company operating the lines in the north of London the council at the end of its last financial year, March 31, 1905, found itself with a surplus of some £150,000.

G.

New York.

New York, June 24.—The high temperature in the subway, especially at the stations, and the vitiated condition of its atmosphere, has led to a decided falling off of traffic, and to not a few cases of what is described as heart disease. A few tentative trials are therefore to be made, under the direction of the rapid-transit commissioners, in the way of installing refrigerating plants at points in the subway, and also to use ventilating fans either to exhaust the foul air, or to provide a fresh supply. All are agreed that something must be done quickly, but the proposal to have the refrigerating plants is severely criticized.

Justice Blanchard of the Supreme Court has decided against the taxpayer, who, in the interests of certain members of the Board of Aldermen, sought an injunction restraining the Board of Estimate from dealing with the pending schemes for 18 new subways. He finds that neither the city charter nor the state constitution gives the aldermen the sole control of local-traffic conditions, nor does the charter define exclusively the duties of the Board of Estimate, which, by the new law, is authorized by the state to deal with traction matters.

One of the provisions of the proposed crosstown subway on Thirty-fourth Street reads: "The general mode of operation shall be by electricity, or some other power not requiring combustion within the tunnel, and the motors shall be capable of moving trains at a speed of not less than 40 miles per hour for long distances, exclusive of stops."

The Municipal Ownership League has requested Governor Higgins to urge early legislation, to allow the people of New York to vote at the next election on the question of the public ownership of future subways and lighting plants.

An organization of insurance men has been started with a view to obtain the conviction of certain men who make a living by pretending to be injured by trolley cars, and who manufacture the necessary evidence to obtain damages from the companies. Mr. Theodore Waters told the organization that he had, in trying to obtain evidence against these persons, caused himself to be taken to the hospitals for alleged injuries, and a few hours later he was besieged by so-called witnesses and lawyers. The evils, he said, also existed in Chicago and in Philadelphia.

The Pennsylvania Railroad Company has ordered an exceedingly powerful electric locomotive for hauling trains up the heavy grades in the North River tunnel, when completed. If the experiment is successful, similar locomotives will be used in the East River tunnel. The general design of the engine will follow that of those used in the Baltimore and Ohio tunnel at Baltimore.

Last week the sale of the property of the Long Island Traction Company for $1,500,000 was announced. The purchasers are the Long Island Railroad and the Interborough Rapid Transit Company, and the contracts were signed on Monday. August Belmont and Ralph Peters, the presidents of the two purchasing companies, become directors of the Long Island Traction Company.

Details which are not very explicit have been handed out as to the recent trials of the electric motors on the Rockaway division of the Long Island railroad. A five-car train, equipped with motors at each end, achieved a speed of 57 miles an hour on the trial.

At the Stevens Institute, on Thursday night, Professor Ganz exhibited the interesting device known as the telephonograph, invented by Professor Poulsen of Copenhagen. This device automatically records a telephone message in the event of there being no one available to receive it.

Rumors are current of the possible formation of a merger between all the traction line running out of Jersey City and the companies interested in the trolley tunnels now under construction, two of which are almost completed. The scheme also includes a direct high-speed electric line from Manhattan to Newark, N. J., to make the entire journey in 30 minutes.

S. E. Ostrom and other Brooklyn men have incorporated the New York and Rockaway Telegraph and Messenger Company, with a capital of $10,000.

The Sprague Elevator Company of 17 Battery Place has been the successful bidder for a new passenger elevator at the Cumberland Street Hospital. There were two other, but higher, bids.

Plans are being perfected for the placing of fire, police and ambulance calls at all the elevated and subway stations in the city.

The Fire Department has received a report from its electrical engineer recommending the installation of a storage-battery plant for operating the fire-alarm system of Brooklyn.

Some electrical wiring, including conduits, distribution boxes, switches, etc., is required for the new chemical building at the College of the City of New York. The work, however, is to be awarded without public advertisement, following a special resolution of the Board of Aldermen.

The Department of Water, Gas and Electricity is asking for bids, returnable on July 19th, for furnishing, constructing and installing eight electrically driven pumps for the high-pressure fire service at Brooklyn stations. The time allowed for the completion of the work is 220 days, and the security required is $70,000; but the bids may be split into two parts, with a reduction in the amount of the security. Bidders must submit plans showing the style of motors and pumps proposed and the nature of the foundations to be provided. Proof must be given that all the apparatus is of a reliable character. The installation of any experimental or untried types of machinery will not be allowed. Forms and other details can be obtained at the office of the department, No. 13 Park Row, Manhattan.

D. W. W.

Dominion of Canada.

Ottawa, Ont., June 24.—The government of Newfoundland has submitted to the Legislature of that colony a bill imposing an annual tax of $4,000 on every telegraph cable landed on the coast of the island; a tax of one per cent. on the traffic receipts of every telegraph company doing business in the colony; a tax of $4 on every telephone operated there, and a tax of $4,000 on every space-telegraph company doing commercial business. It is claimed that a company has established three wireless stations in Newfoundland without authority, and the colonial government believes the company is now doing commercial business with the stations at Cape Cod, Cape Breton and passing steamers. The Angle-American Cable Company will be taxed for five Atlantic cables at $4,000 each, but the extensions to Canada will be regarded as part of the same cables.

In the railway committee of the Canadian Senate the Ottawa Electric Company's bill to increase its capital, and providing authority to amalgamate with other existing electric companies, over which such a hot fight occurred at an earlier stage in the present session of the Dominion Parliament, was passed on June 14th without amendment. When this bill was before the Commons the city of Ottawa objected to the company being allowed to establish a monopoly in the electric-lighting business of the Canadian capital. Since then, however, the city has bought out the Consumers' Electric Company, the plant of which is to be owned and operated by the city as a means of ensuring competition to the public. The Ottawa Electric Company has tried to satisfy the city by offering the municipality a seat on the company's board of directors, saying that after a six-per cent. dividend has been declared all surplus earnings shall be devoted to the reduction of the rates.

Government ownership of the Canadian Niagara Falls power and transmission lines is the enterprise that many citizens of Ontario expect to see carried out by the new local government of the province. The report of the commission appointed by the municipalities of Ontario lying within 100 miles of the falls to enquire into the best means to be adopted to secure cheap power will be made public shortly, and sufficient has been let out to warrant the statement that the commission will recommend that the government make the development and transmission of power a public enterprise.

W.

New England.

Boston, June 24.—With a view to eliminating entirely all danger from fire in the Boston tunnels there has been constructed, from designs made by the Boston Elevated Railway Company's officials, a steel car lined with aluminum and protected with asbestos at all necessary points. This car was recently tested and found to be satisfactory, and others of the same sort will be built and added to the equipment until the entire train service of the tunnel is of this type.

Joshua M. Sears, son of the late J. Montgomery Sears, has been appointed trustee for the firm of Burnett, Cummings & Co., street-railway promoters, who filed on May 25th a voluntary petition in bankruptcy with uncertain assets and liabilities of over $1,000,000.

Owing to inclement weather the imposing electrical pageant prepared for the evening of June 17th, Bunker Hill day, was postponed.

The General Electric Company has obtained permits to build three large apartment houses, with all modern conveniences, in close proximity to its Saugus River plant in Lynn, Mass., to contain in all about 600 tenements. These will be rented to employes who wish to live near the factory. They will be ready for occupancy in the fall.

The railroad commissioners have approved the Boston Elevated Railway Company's plans for a two-mile elevated track extension from the Dudley Street Terminal to a new terminal at Forest Hills.

Henry C. Page, who has been for some time manager of the Berkshire Street Railway Company, has been appointed manager of the Springfield Street Railway Company under the new control of

the New York, New Haven and Hartford Railroad Company.

The stockholders of the Bodwell Water Power Company of Milford, Me., which is to form the nucleus for the new corporation which is to generate and sell electricity in Penobscott Valley, have elected directors and officers. Charles V. Lord is president. Nearly $1,000,000 will be spent in building dams, power houses and transmission lines. The project is the largest which has been launched in Eastern Maine for a long time and will give employment to a large number of men. B.

Southeastern States.

Charlotte, N. C., June 24.—The town of Sanford, N. C., is considering the plan of purchasing the electric-light plant, the property of the late A. F. Spencer, the plant being valued at $19,000.

The Winchester and Washington City Railway Company has bought a $10,000 waterpower on the Shenandoah River near Charlestown, W. Va., and will develop the site. An electric railway may also be constructed from Harper's Ferry to Winchester via Charlestown, W. Va. A line will also be built from Berryville to Bluemont, Va., and possibly on to Washington, D. C.

The Nashville (Tenn.) Railway and Light Company is receiving a consignment of 23 new trolley cars of various designs.

A merger has been completed of the Columbia (S. C.) Electric Railway, Light and Power Company and the Columbia Water Power Company. Edwin W. Robertson has been elected president of the new company. A new mortgage will be executed to cover a bond issue for the purchase of the waterpower company, leaving a considerable sum for permanent improvements contemplated.

The Albemarle Light and Water Company of Albemarle, N. C., has been chartered with $25,000 capital to furnish light and water to private and municipal corporations. J. S. Efird, J. M. Morrow and others are the incorporators.

The town of Covington, Ga., has awarded the contract to W. R. Jennison of Atlanta for installing the new machinery for the electric-light plant which is to be rebuilt, it having been demolished by a boiler explosion.

The promoters of the Appalachian Interurban Railway Company, to run from Hendersonville, N. C., to other towns in that section, are still at work on the preliminary details of the enterprise. J. W. Wofford of Hendersonville is interested.

The Postal Telegraph office at Charlotte, N. C., has just been supplied with many new and modern appliances and instruments to meet the demands of the business in that section.

The Cape Fear Power Company at Buckhorn Shoals, near Fayetteville, N. C., will have developed about 4,000 horsepower and have the same ready for transmission by August 1st in all probability.

A 35-year franchise has been granted to the Hickory (N. C.) Electric Railway Company, which will operate cars probably by October 1st, using power from the plant of the Thornton Light and Power Company. L.

Mexico.

City of Mexico, June 22.—The work of installing the machinery for the new electric-lighting plant at Montemorelos is about completed. This plant is owned by Berlanga Brothers.

The syndicate of London (Eng.) capitalists who own the Encinillas mines corporation, which has its headquarters at Santa Rosalia, is arranging to establish a large electric power plant at Santa Rosalia.

The Bermejillo syndicate, which owns the street railway system in Guadalajara, has begun work on the extensions and improvements of its lines, which will give Guadalajara one of the most complete electric street-railway systems of any city in Mexico. The work is being done under the direction of A. T. Coiffier of the City of Mexico.

Enrique Aguado is installing an electric-light and power plant at Progreso. It will be of capacity sufficiently large to supply other towns of that section with lights and power.

Henry Gray Harvey has taken steps toward establishing a large electric power plant on the Aros River near Temosachic, in the Guerrero district, state of Chihuahua.

It is authoritatively announced that the work of constructing the large electric power plant at La Joya in the state of Chihuahua will be started in a few weeks. B. J. Mahoney of Chicago will direct the work. A company has been organized to establish the enterprise. The concession is held by R. M. Burke of Chicago, former United States Consul at Chihuahua. It is planned to construct a dam across the Concho River at La Joya, and electrical energy will be transmitted to the cities of Chihuahua, Parral, Santa Rosalia and various mining camps of that region.

The Toluca Electric Light and Power Company will establish an electric power plant at Temascaltepec. R. J. M. Danley is general manager and chief engineer, with headquarters at Toluca.

The government of the state of Hidalgo is making satisfactory progress with the construction of a system of street railways in the town of Huichapam. When finished the system will be transferred to the city and operated as a municipal property.

An electric-light and power plant is being installed at the large factory of the Mexican Car and Foundry Company in the City of Mexico.

Jose Maria Ruhin of Puebla will install an electric power plant on the Cantarranas River in the state of Puebla.

A new electric-light and power plant is being installed at Urnapam.

The Mexican government will construct a federal telegraph line between Ascension and Frontera. The distance is about 150 miles.

It is announced that the firm of Fedrico Zorilla & Co. of Oaxaca has closed the contract with the municipal authorities for the public lighting of the city of Oaxaca. For this purpose there will be required 200 arc lamps. The capacity of the present plant of the company is to be greatly enlarged.

The Mexican Electric Tramways Company, which owns the extensive street-railway system in the City of Mexico, has in contemplation the investment of a large additional sum of money in the improvement of the property. It is stated that plans are now being made for the converting of several of the horse-car lines into electric traction and to make important extensions of the existing electric lines. W. W. Wheatley is general manager of the company.

Steps have been taken toward the immediate construction of an electric street-railway system in Santa Rosalia. A large dam will be built across the Conchos River to generate electricity. Paul Gintleir is interested in the enterprise.

The Mexican government has granted a concession to Francisco Orrantia y Sarmiento to install an electric-light and power plant at El Fuerte. He will operate other industries in connection with the electric plant.

After many delays the deal for the sale of the two street-railway systems of Monterey to a syndicate of Canadian capitalists is authoritatively announced to have been consummated. The work of converting the consolidated system into electric lines will be begun soon. J. A. Robertson of Monterey is the local representative of the new owners.

The concession which the Mexican government granted to M. C. Miller of Guadalajara for the construction of an electric railway from Guadalajara to the port of Chamela, on the Pacific coast, has been transferred to the Jalisco Rapid Transit Company, which has been organized with a capital stock of $15,000,000 for the purpose of building the road. It is stated that prominent capitalists and practical railroad men of the United States are interested in the project. It will be more than 200 miles long and will traverse a rough region of Western Mexico, crossing the Sierra Madres. H.

Ohio.

Cleveland, June 24.—The plant of the Willard Storage Battery Company, near the foot of St. Clair Street, Cleveland, was destroyed by fire early Monday morning. The loss is probably total to the company, although covered by insurance. The salesroom of Fairbanks, Morse & Co. was also badly damaged. The entire fire damage is placed at between $150,000 and $200,000 by the local press.

The American Society of Civil Engineers was in session at Cleveland this week. The first meeting of the convention was held on Tuesday, being called to order by August Mordecai of Cleveland. He introduced Director Harris R. Cooley of the Board of Public Service, who delivered the address of welcome. This was responded to by President C. C. Schneider. In the afternoon the members took a carriage ride about the city, and in the evening President Schneider delivered the annual address on "The Evolution of Practice of American Bridge Building." Wednesday morning Col. D. C. Kingman, City Engineer Carter, Alexander E. Brown, President Charles S. Howe of Case School of Applied Science and Harry Fuller made addresses on subjects of local interest, largely along lines of the varied industries and improvements. Afterward the members visited the Brown Hoist Works, Case School, the King Bridge Works and other places. They were entertained at the County Club by the Patterson-Sargent Company. On Thursday the discussion of the topics pertaining to the society was taken up. About 500 members attended the meeting. While a number of addresses were made and papers read, little technical matter entered into the work.

The City Council of Cleveland has passed an ordinance granting the Cleveland Electric Railway Company a nine-year franchise for a crosstown line on Doan Street and Woodland Hills Avenue. Mayor Johnson threatens to veto it.

William Aikins has resigned as general manager of the Ohio Central Traction Company at Galion and will be succeeded by T. C. Cherry of Cleveland.

Regular service has been installed on the extension of the Toledo and Indiana electric line, from Bryan to Wauseon. Through service from Toledo to Wauseon will be inaugurated at once.

Attorney Harry Probasco has requested the attorney-general to bring proceedings to oust the Miami and Erie Canal Transportation Company from its charter. Mr. Ellis has replied that if it is shown that the interests of the state demand such action, he will take it.

The statement of the Toledo Railways and Light Company shows an increase in surplus for the first five months of the year of $49,140 over the same period of 1904.

The Steubenville and Wheeling Traction Company of Steubenville has increased its capital stock from $400,000 to $650,000.

Receivers of the Central Market Street Railway Company at Columbus have applied to the courts to be allowed to issue certificates of indebtedness to the amount of $15,000, to secure money with which to make improvements required by the city.

The American Fender and Manufacturing Company has been incorporated with a capital stock of $50,000. Thomas E. Greene, Albert H. Miller and others are interested in the company.

It is said that the municipal light plant at Columbus may furnish commercial light in the near future. It is now ready to take care of the street lighting over the greater part of the city.

S. B. Rankin, as receiver of the Springfield, South Charleston and Washington Court House Traction company, has been operating it at a profit for the last two months. O. M. C.

Northwestern States.

Minneapolis, June 24.—A well-founded rumor is prevalent that the Northern Pacific railroad officials are contemplating the electrification of about 100 miles of the western end of that road as an experiment. Electricity can be generated very cheaply in Washington and the plan is looked upon as entirely feasible by Twin City officers of the road.

The Fort Dodge (Iowa) council is considering the advisability of establishing a municipal lighting plant and of taking over the present gas and electric-light franchise.

J. Holler and C. H. Hartung have decided to establish an electric-light plant at Van Horne, Iowa.

Business men at Oskaloosa, Iowa, have subscribed for $130,000 worth of stock, and the construction of a trolley line from that city to Buxton is now assured.

J. G. Robertson of St. Paul has the contract for installing a new engine and boiler in the electric-light plant at Warren, Minn., and the Fort Wayne Electric Works has the contract for a new dynamo. The lighting capacity of the plant will be doubled.

A company incorporated with $10,000 has been formed at Dayton, Iowa, for the purpose of establishing an electric-light system. C. D. Waterbury was elected president and H. E. Nelson secretary.

The Walther Lighting and Heating Manufacturing Company of Davenport, Iowa, has increased its capital stock from $25,000 to $35,000.

The South St. Paul (Minn.) Electric Light, Heat and Power Company has been incorporated by John Coats and others with a capitalization of $50,000.

The Iowa Gas and Electric Company of Washington, Iowa, has been incorporated with $100,000 capital.

The Fox River Valley Railway Company, which projects a trolley line from Sheboygan, Wis., to Kaukauna, has been granted a 35-year franchise at Manitowoc, Wis. R.

Indiana.

Indianapolis, June 24.—The North Central Railway Company has filed articles of incorporation for the purpose of building and operating street and interurban lines in and connecting the towns of Wanatah, Valparaiso, Wheeler, Hobart, Toleston and Whiting in Laporte, Porter and Lake counties. It is understood from outside sources that it is the intention of the promoters to secure a right-of-way and construct a traction line into Chicago that may be used by all traction lines entering that city from Northern Indiana. The directors are John Conkey of Valparaiso, Clarence H. Jones, B. F. Watson, E. L. Gower and E. N. Canis of Indianapolis.

The Town Council of North Manchester has granted a franchise to the Indiana Northern Traction Company, the choice of three routes being given. The company proposes to build a line from Wabash to North Manchester as an extension of its line now in operation between Marion and Wabash.

A franchise for a traction line in Greensburg has been granted to Charles L. Henry, president of the Indianapolis and Cincinnati Traction Company, by the Greensburg council with a view to the extension of the Shelbyville line to that city.

The Indianapolis and Eastern Railway Company and the Richmond Street and Interurban Company have entered into a close harmonious working relation, and all of the business of the two companies will hereafter be handled from the office of the Indianapolis and Eastern, the two companies coming under one management. This arrangement is accepted in all quarters as being the Widener-Elkins syndicate arrangement through Hugh J. McGowan and Randall Morgan, who have obtained actual control of the Indianapolis and Eastern.

Interurban service from Indianapolis to Toledo is promised by the Fort Wayne and Wabash Traction Company. As soon as the Toledo and Chicago Traction Company has completed a proposed line

for a short distance out of Fort Wayne an agreement will be entered into with the Fort Wayne and Wabash Traction Company whereby through connection may be made with cars running to Toledo. The Toledo and Chicago Traction Company has taken steps toward the construction of the short line between Butler and Fort Wayne, where connections will be made with the line running to Logansport and to Indianapolis over the Indianapolis Northern.

Work on the Dayton and Muncie Traction Company's line from Dayton, Ohio, to Muncie, which had been stopped for several months, was resumed on the 19th.

Suits aggregating $90,000 against the Indianapolis Northern Traction Company are now being tried in the Circuit Court at Kokomo. Brennen & Nelson are suing for $75,000 for the installation of the overhead work on the line from Indianapolis to Logansport and Peru, and J. N. Bick of Toledo, the grade contractor for the road, is suing for $15,000. The controversy arose over the inability to effect a satisfactory settlement.

Mail service has been established on the Indianapolis-Columbus traction line by the United States government. For the present pouch mail alone will be handled.

The city councils of both Crawfordsville and Logansport have passed ordinances governing and regulating the stringing of electric wires in those cities. The ordinances provide that the city electrician shall have general supervision over the placing, stringing and attaching of all telegraph, telephone, electric-light and power or other wires, so as to prevent fire, accident or injury to person or property, and prescribes rules and regulations. It provides for inspection and the licensing of electrical workers. S. S.

Michigan.

Detroit, June 24.—The street-railway strike still continues at Saginaw and Bay City. An injunction has been issued by the Circuit Court restraining employes, President Mahon of the street-railway employes, the trades council, unions and a number of citizens from interfering in any way with the operation of cars in the Saginaw Valley. This action, however, does not stop the rioting and a number of arrests are being made. The police of Bay City are said to be in sympathy with the strikers, as are also a number of citizens. The cars are running but are poorly patronized. The interurban cars have been fitted with wire netting instead of the glass windows, and it is said that the crews are armed. The trades council will fight the injunction.

Bids have been received by the Detroit municipal lighting commission for a new unit to generate 2,000 kilowatts. The lowest bid was that of the Great Lakes Engineering Company of Detroit, which provided for a triple-expansion engine of 2,800 horsepower and 150 revolutions per minute for $39,200.

The Trenton electric-lighting plant, recently destroyed by fire, is being rebuilt and will soon be in service again.

Springwells township (near Detroit) has been paid over $5,000 as a part of a judgment against the Detroit, Plymouth and Northville electric railway for failure to build a track within a specified time.

At a meeting of the directors of the Detroit United railway this week, at which H. A. Everett and W. E. Moore were present, it was decided to place the property on a five-per cent. basis.

Considerable feeling is being aroused in St. Joseph against the council granting the street-car system the right to use Forest Avenue, a beautiful residence street. A number of society women attended the council meeting and registered a protest.

The Saginaw and Southwestern Railway Company has been incorporated and capitalized at $50,000. It will build an electric railway from Saginaw to St. Johns, a distance of 50 miles. It will pass through the towns of St. Charles, Chesening and Elsie. It will connect at St Johns with the Lansing Suburban company's line for Lansing. The offices of the company will be at Saginaw. W. G. Emerick and W. S. Linton of Saginaw are directors. C. G. W.

Rocky Mountain States.

Salt Lake City, June 20.—A franchise has been asked for by George W. Dougherty of Missoula, Mont., the local representative of eastern interests, for a franchise for an electric railway to be operated in Salt Lake City and through the Bitter Root Valley. Already the syndicate has a franchise of the same nature in Ravalli County.

The Salt Lake and Ogden Electric Railway Company, of which Simon Bamberger of Salt Lake City is president, has been granted a 50-year franchise by the City Council of Ogden, Utah, and it is stated by the management that construction work will be commenced within a few weeks.

A petition for a franchise for the operation of an extensive electric-railway system will shortly be submitted by Yegen Bros. to the City Council at Billings, Mont., this firm now having in course of construction a large power plant on the Yellowstone.

The Electric Power Company of Boise, Ida., has recently added to the equipment of its plant an electric generator of 200 horsepower.

An electric power plant is shortly to be installed at Livingston, Mont., the promoters of the project being capitalists of Lewiston, represented in Livingston by John L. Bright. The estimated cost of the plant is $60,000.

The plant of the Missoula Light and Water Company of Missoula, Mont., according to a statement by the management, is to be considerably enlarged in the near future at a cost of about $30,000. G.

Reno, Nev., June 24.—The board of commissioners of Reno, Nev., has advertised for proposals for furnishing and installing in the Court House at Reno a complete and modern burglar-alarm system.

J. W. Seely and C. L. Allen of Castledale, Utah, are preparing to construct an electric-light plant at that place.

W. G. Mickle has retired from the Boise Electrical Supply Company of Boise, Idaho.

On July 11th the citizens of Provo, Utah, will vote at a special election on a proposition to issue bonds to the amount of $56,000 for electric-lighting purposes.

The electors of Coalville, Utah, have voted favorably on the proposition of establishing a municipal light plant. The estimated cost of the plant is $10,730.

The Pittsburg Lead Mining Company of Wallace, Idaho, which recently purchased extensive property on Nine Mile Creek, is planning to equip its mill with electric power.

All the franchises and equipment of the Tucson Street Railway Company of Tucson, Ariz., have been sold by the sheriff under a judgment for $22,000, which was held by the bondholders. The property was bought in by a representative of the bondholders. A.

Pacific Slope.

San Francisco, June 23.—The Portland Consolidated Street Railway Company of Portland, Ore., has been sold to Seligman Bros. of New York and E. W. Clark & Co. of Philadelphia, Pa., for approximately $6,000,000. Advices from Portland state that about $4,000,000 will be spent by the new owners in enlarging and perfecting the system.

The Union Oil Company has let a contract for the construction of an electric-light plant at Port Harford to S. B. Selkirk of San Luis Obispo, Cal.

W. W. Whipple of Seattle, Wash., is promoting a company which has for its object the installation of an electric-light plant, gas plant and telephone system at Astoria, Oregon.

The Seaside Electric Company has been incorporated with headquarters at Seaside, Ore., by D. J. Moore, A. S. Froslid and E. J. Judd. The company will put in a telephone and electric-light plant at Seaside.

The Big Bend Traction Company of Spokane, Wash., has begun work on an electric railway which will eventually be built between Spokane and Ritzville, Wash.

The Thomas-Day Company of San Francisco has secured a contract from the Starr Estate Company for the installation of gas and electric fixtures in a seven-story and basement building on Taylor Street, San Francisco, at a cost of $2,965.

Superintendent Jackson of the North Mountain Power Company, Eureka, Cal., has secured a franchise to run power lines through the streets and alleys of Eureka. The Ferndale Electric Light Company has applied for other franchises which will enable it to use the streets and alleys of Eureka for power-line purposes.

The San Luis Obispo Gas and Electric Company, through W. F. Boardman & Co., San Francisco, Cal., is receiving bids for the equipment of the new electric-light plant to be erected in San Luis Obispo. The specifications call for three 125-horsepower boilers, two compound automatic engines and one 100-kilowatt single-phase 60-cycle generator.

Electrical engineers report that there has recently been something of an easing off in electrical structure work. At the present time very few actual inquiries for prices are being received, although a good deal of work is projected for the near future. At the present time electric-railway projects seem to be more abundant than others. The supply houses report business good. There is an active demand for electrical supplies from all parts of the Pacific Coast.

The San Francisco Gas and Electric Company is thoroughly reorganizing its meter department with the intention of putting it upon a modern basis. The laboratory has been rewired and enlarged to twice its former capacity. Several new inspectors have been added and a more thorough system of tests is being inaugurated. The department is now under the supervision of C. W. Woodward, who was formerly connected with the Edison company of New York, and was selected for his present position by Superintendent Samuel Mapthaly while the latter was in the East.

F. M. Fairchild, superintendent of construction of the Petaluma and Santa Rosa Railway, has resigned his position with that company and will accept a similar office with the Ocean Shore Railway Company, which purposes constructing an electric railway south from San Francisco.

The Merced River Railroad Company has been incorporated for the purpose of constructing an electric railway 35 miles long from a point in Mariposa County to the west boundary of the Yosemite National Park in Mariposa County. The company has an authorized capital stock of $1,000,000. The incorporators are F. H. Ellis, Miltan Ellis, Henry Dennery, Louis H. Weigel and Arthur Baker. The headquarters of the company will be in San Francisco.

The Southern Pacific Railway Company is preparing to use electricity for power purposes in its new shops to be erected at Bakersfield, Cal. The new works will include a 100-ton traveling electric crane.

The Superior Court of Santa Ana, Cal., has decided the suit of W. S. Whitney to invalidate a $60,000 issue of bonds for the purpose of erecting a municipal electric plant in favor of the city. It is understood that the bonds will be sold and that work will begin on the lighting plant at once.

The Board of Supervisors of San Mateo, Cal., have granted the United Railroads of San Francisco a franchise to use the old Mission Road for an electric railway. The construction of a railway along this road will materially shorten the distance between San Mateo and San Francisco.

Jesse H. Rose of Minneapolis has asked for a franchise for an electric railway along certain of the streets of North Yakima, Washington. The road is to be completed and in operation by January 1, 1907.

S. B. Thompson & Sons of Portland, Ore., have secured control of the electric-light plant at Dallas, Ore., and will enlarge the plant at once. Orders have already been placed for a new engine and boiler.

L. A. Campbell, general manager of the West Kootinay Power Company, Rossland, British Columbia, states that the carrying out of the company's present plans for increasing its power will necessitate expending $1,000,000, one-half of which will be spent in the purchasing of the plant. A 21,000-horsepower hydraulic plant will be put in at Upper Bonnitin Falls. The new extensions to the company's lines will require 500 miles of copper wire.

The Loyalton Electrical Company of Loyalton, Cal., is extending its service to Beckwith, a distance of 17 miles.

The Portland Mine Company, Aspin Grove, B. C., is putting in an electric power plant on the Quilchena River. A.

PERSONAL.

J. P. Jones, superintendent of the Cedar Falls (Iowa) division of the Waterloo and Cedar Falls Gas and Electric Light Company, is enjoying a few days' rest in and around Chicago.

E. W. Burdette, counsel for the Edison Electric Illuminating Company of Boston, sailed for Europe June 22d. He will be joined later by Charles L. Edgar, president of the company, and together they will make a study of electrical plants and problems relative thereto in some of the larger cities abroad.

Frank J. Sprague has an interesting article in the July Century on "The Electric Railway." It gives a history, with many illustrations, of the development of the art in which Lieutenant Sprague has played such a conspicuous part. In the August number the same author will describe the latest apparatus used in electric railroading.

R. F. Geeska, who was until recently an engineer for the Western Electric Company in the power-apparatus department, has accepted a responsible position with the Rateau Turbine Company in Chicago. Mr. Geeska is a graduate of Lewis Institute of Technology and has had a number of years' experience in the design of electrical apparatus.

Thomas J. Gore of Seymour, Ind., who has been connected with the Pennsylvania lines for 14 years, will be the joint ticket agent for the electric traction lines entering the terminal station in Indianapolis, and will enter upon his new work July 1st. At this time all the interurban lines will be ready with their tickets and the sale and use of them will begin.

John Fitzpatrick, who assisted in installing the fire-alarm service of Chicago in 1877 and who had been since connected with the department as an operator in the old Rookery Building and City Hall and lately at the Englewood station, dropped dead a few days ago as he was entering his home at 6957 Parnell Avenue. Prior to joining the city service he was a telegraph operator for the Chicago and Alton railway.

Col. Robert C. Clowry, who went from Chicag some time ago to take the presidency and gener management of the Western Union Telegraph Company in New York, is making a notable administration. Being a thoroughly practical telegrapher himself, having a complete knowledge of the apparatus in all the complex telegraph system and

being endowed with an engaging personality, Colonel Clowry has proved, by his efficient handling of the company's interests, that he is the man for the place.

James Gamble, who is said to have built the first telegraph line in California in 1852, died at Santa Barbara, Cal., on June 19th. In 1856 he was made superintendent of the Alta Telegraph Company and was later with the California State Company and with the United States Telegraph Company as general manager. He was afterward made superintendent of the Western Union Telegraph Company, which position he held until 1881. He retired some years ago.

Apropos of the recent appointment of Grover Cleveland, Morgan J. O'Brien and George Westinghouse as trustees of the stock of the Equitable Life Assurance Society, the New York Times says: "Mr. George Westinghouse not only enjoys that independence which pertains to the quality of a great captain of industry, but he has in broad-minded and generous philanthropies given evidence of disinterested solicitude for the welfare of his fellow men."

C. Arthur Spaulding, traffic manager of the Bell Telephone Company of Buffalo, and O. R. McKenzie, traffic manager of the Central New York Telephone and Telegraph Company of Syracuse, N. Y., called on some of their friends in Chicago on Monday on their way East from the Bell contract agents' convention in Denver. They report that the gathering was a valuable one from a business point of view and that the host, the Colorado Telephone Company, was most hospitable.

W. C. Greene of New York, president of the Greene Consolidated Copper Company, who recently obtained a concession from the Mexican government for the establishment of a large electric power and transmission plant in the western part of Chihuahua, is now in Mexico for the purpose of directing the inauguration of the work on the enterprise. The power plant will be located on the Aros River near Guaynopa. The electric power will be transmitted to a number of mining camps of that part of Mexico.

H. R. King of the Western Electric Company of Chicago was recently made chief engineer of the power-apparatus department, with headquarters at the new Hawthorne plant. He succeeds H. H. Wait, who has become interested in the new Rateau Turbine Company, which was formed some months ago to introduce the Rateau steam turbine in this country. Mr. King received his technical schooling in the University of Michigan, and then accepted the position of electrical and mechanical engineer for the Fischer Electric Company of Detroit, where he was engaged in the design of direct-current generators and motors and steam engines. This position he held for nearly three years. He resigned there to take up consulting engineering work in mechanical and electrical lines, first entering the employment of Gilbert Wilkes, and afterward having an office of his own. During this period the installation of several important electrical and steam plants was under his supervision. The position of city electrical inspector of Detroit was offered him, which he accepted. A year and a half later he resigned this position and made a business trip in Venezuela, South America. After spending nearly a year in South America he returned to this country and accepted a position with the Western Electric Company, which he held for seven years before his recent promotion. H. H. Wait, after graduating from the Massachusetts Institute of Technology in 1892, accepted a position with the Western Electric Company, where he remained until he resigned to take up his new work. During the period that Mr. Wait was with the Western Electric Company the company he advanced from a position of comparatively minor importance in electric-light and power-apparatus work to the prominent one which he held before his resignation.

ELECTRIC LIGHTING.

The Eastern United Gas and Electric Company has been incorporated to operate in Aurora, Mo.

The Dayton Heating and Lighting Company of Dayton, Iowa, has been incorporated with a capital of $10,000.

The Climax Light and Power Company of Burlington, Kan., has been incorporated with a capital of $12,000.

The Ætna Electric Stage Lighting Company has been incorporated and proposes to manufacture electric stage lamps. The headquarters are in Chicago and the incorporators are J. A. Jacine, H. M. Pletz and G. H. Graeser.

F. H. Standard, consulting engineer, will install an electric-light and power plant at Cody, Wyo., for George T. Beck. The plant will consist of a Westinghouse 140-kilowatt alternator run by water-power. It will develop 2,200 volts and be located one mile from the city.

ELECTRIC RAILWAYS.

It is reported from South McAlester, I. T., that W. Busby has been appointed receiver for the Indian Territory Traction Company.

The Webb City (Mo.) Northern Electric Railway Company has been incorporated with a stock of $200,000. E. Z. Wallower of Pittsburg, Pa., is one of the incorporators.

The Kansas City, Stranger Valley and Western Railway Company has been incorporated to build an electric railway from Kansas City to Topeka, Kan. The incorporators are W. Laming and S. J. M. Naughton of Tonganoxie, Kan., and others.

The property and franchises of the Lehigh Valley Traction Company were sold at Allentown, Pa., recently under a court order for $2,000,000. The purchasers are William F. Harrity, George H. Frazier and Harry C. Trexler, who comprise the reorganization committee of the company. The Slatington line was also sold under similar conditions for $275,000.

The earnings statement of the Aurora, Elgin and Chicago Railway Company for the month of May indicates a large increase in the company's business. The gross receipts for the month are given as $52,070, as against $41,778 for May, 1904. The operating expenses were $28,474 and $25,032 for May, 1905, and 1904, respectively. For the three months ended May 31st the net earnings increased from $30,120 in 1904 to $52,440 this year. The operating expenses for 1905 include track rental for the use of the Metropolitan elevated tracks and an accident appropriation of two per cent. of gross receipts.

PUBLICATIONS.

Electric signs of all kinds are shown in some display sheets being distributed by the American Electric Sign Company of Chicago. Outdoor and interior signs are described.

The Aiton Machine Company has just issued its Bulletin No. 7, showing a seven-wire stranding machine; also Bulletin No. 18, showing cable-reel-winding gear, and will be pleased to furnish anyone interested in this type of machinery with copies of bulletins which it has on file at its offices, at 126 Liberty Street, New York City.

The Crocker-Wheeler Company of Ampere, N. J., has issued a new bulletin, entitled "An Electrified Railway Shop Described by Its Mechanical Engineer." It contains a series of articles by Roy J. Wright, written when he was mechanical engineer of the Pittsburg and Lake Erie railroad and reprinted in the bulletin in abridged form.

The Fiber Conduit Company of Orangeburg, N. Y., gets out a lot of attractive and useful and interesting mailing cards which it distributes to the trade. On the back of one of these cards, for instance, is shown standard manhole heads, with dimensions and weights, on another fiber bends, etc.

The American Electric Fuse Company of Chicago has issued a very attractive little booklet containing a report by James C. Kelsey, professor of telephony at Purdue University, upon tests which he performed for the company upon a bank of Kaisling protectors taken from the company's regular factory stock. The conclusion reached from these tests was in every way favorable to the Kaisling protector.

A tasteful booklet to be distributed by the Westinghouse Electric and Manufacturing Company at the Lewis and Clark Exposition has just been issued. The booklet illustrates and describes briefly the lines of apparatus manufactured by the Westinghouse Electric and Manufacturing Company and refers to apparatus on exhibition at Portland. Those obtaining one of these booklets will find therein a very good birdseye view of the exposition, which appears as the frontispiece.

The Sunbeam Incandescent Lamp Company has just issued a new bulletin describing and exploiting its complete line of Sunbeam reflector lamps. These lamps are furnished in six, 28 and 36 candlepower in all voltages. This bulletin is ready for distribution and a copy will be sent to anyone interested upon request either to the above company or to the Western Electric Company. The latter company and its branch houses carry a large stock of Sunbeam lamps, embracing the entire line.

MISCELLANEOUS.

Rush Street Bridge in Chicago, at which point two automobiles have gone into the river with fatal results, will be provided with an automatic electric bell which will ring while the bridge is in motion and illuminated danger signs will be placed at each approach to the structure in order that the public may be better warned when the bridge is open.

An electric storm in Eastern New York a few days ago killed a number of people and did other damage. Telephone and electric-light wires were badly disabled. On Broadway in New York city the electric conduits of the surface railways were flooded and at Snake Hill, N. J., lightning struck the Hudson County electric-light plant, and damaged the machinery so seriously that the arc lights which illuminate the boulevard, running the entire length of the county (14 miles), were put out of commission.

A new commutator brush has recently been patented by Charles W. Speirs of Battersea, England. The brush is formed of plumbago of a nature which, when ground, is in the condition of small flakes. The ground plumbago is treated with a glutinous substance and subjected to great pressure in a mold, in a direction at right angles to that in which the current is to flow in the brush. The flakes will then arrange themselves with their planes parallel with the pressing surface, so that a relatively large number contacts between flakes will occur in the thickness of the brush.

TRADE NEWS.

The Interior Electric Construction Company of Chicago has been incorporated for the purpose of manufacturing electrical devices. The incorporators are Robert Gibson, Fred Grant and Henry McIver.

Francis Raymond III. of Chicago has resigned from the Stanley-G. I. Electric Manufacturing Company with the purpose of again engaging in the field as an independent manufacturers' agent. Mr. Raymond had built up quite a business as a manufacturer's agent before the consolidation of the Stanley and G. I. companies; hence he does not reenter the field without a thorough and comprehensive knowledge that should make him a valuable acquisition to any company desiring experienced commercial representation throughout the West.

BUSINESS.

The Bethlehem Steel Company is at work on three crank shafts which will weigh 86,600 pounds each when finished. They are turned out of solid steel ingots 25 by four by four feet and are intended for three Snow gas engines, which are to drive 4,000-kilowatt Crocker-Wheeler alternators. These are said to be the largest gas-engine-driven generators ever built and were ordered by the California Gas and Electric Corporation.

The Pusey Voltage Regulator Company of 618 Fidelity Building, Philadelphia, contends that its voltage regulator is a necessity to the central-station man. It says that the device saves money in coal, lamps and labor. The regulator is guaranteed a sensitiveness of one-fourth of one per cent., is adapted to either alternating or direct currents and can be attached to any rheostat. It is handsomely mounted on a marble slab and consists of three parts—a beam, controlled by the solenoid, for making electrical contact; a reversible motor, for working the gear, and a clutch to be attached to the rheostat and connected to the motor by a chain of gears. The company issues an illustrated booklet which gives further details of the apparatus.

Electric and gas-company publicity will be the specialty, and almost the exclusive business, of the John Craig Hammond Advertising Company, which has been incorporated in Denver by John Craig Hammond, who has become well known to these lines of business through his work as the head of the publicity department of the Denver Gas and Electric Company, recognized as in the front rank of new-business developers. The general field will be entered by the new concern, but only to a limited extent. Included in the new organization are the men who have been on the advertising staff maintained by Mr. Hammond for more than a year, whose work has been chiefly in the gas and electric field. Several other men who have been less directly connected with Mr. Hammond, but who have been closely associated and working along similar lines, are also in the new organization. A year has been spent by the members of the company in perfecting their plans, more especially in testing them and working them into a perfect system. As the methods employed were especially devised for the gas and electric field, and entirely new, a close record was kept. The results are referred to by the members of the company to justify their belief that they can accomplish a great deal. As outlined by Mr. Hammond, the company purposes to go deeper into the matter of getting new business than mere publicity. It will embody such features as suggestions for improving the relations of the companies with the public and new-business methods other than the publicity. The organizers of the company believe that there is a large field for business-getting by the effort put forward jointly for a number of companies in the same line of business, through the same organization. To some extent, therefore, this feature of the business-getting system as devised by the new company would be co-operative. Excellent results that have been shown by the Denver company are familiar to a great many identified with this line of business. The work of this company, and others that have been getting their publicity matter from Denver, will be continued by the new organization. A general business, chiefly local, has been obtained, and the company has placed itself on a firm basis,

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) June 20, 1905.

792,597. Electrolytic Cell. John F. Kelly, Pittsfield, Mass., assignor to the Southwestern Exploration Company, Alamogordo, N. M. Application filed September 9, 1904.

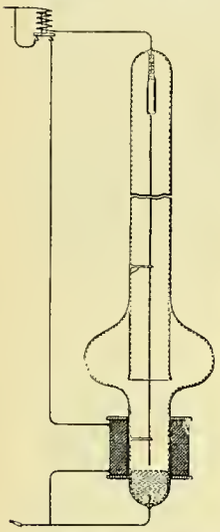
An electrolyte compartment contains an aqueous solution of an alkaline sulfate to be decomposed while anode and cathode compartments contain substantially only aqueous solutions of respectively sulfuric acid and an alkaline hydrate. Osmotic diaphragms are interposed between the anode and cathode compartments and the electrolyte compartment by which mass mingling of the liquids in adjoining compartments is prevented and through which the products of decomposition are in contact with the electrolyte.

792,607. Means for Attaching Pole Pieces. James F. McElroy, Albany, N. Y., assignor to the Consolidated Car Heating Company, Albany, N. Y. Application filed March 30, 1905.

A pole-piece made up of separate laminæ, possesses an attaching bolt having a key portion confined in the laminæ and a stem portion at an angle to and integral with the key portion.

792,611. Battery Grid. Henry C. Porter, Waukegan, Ill., assignor to the Evansville Battery and Electric Company, Evansville, Ind. Application filed August 19, 1904.

A battery plate or grid comprises integral bars having a series of openings therethrough, the openings being arranged to be filled with active material so that all the open spaces in the grid will be filled with a continuous body of active material.



NO. 792,639.—VAPOR ELECTRIC APPARATUS.

An exhausted envelop contains an electrode of fluid magnetic material and a co-operating electrode has a filament extending therefrom into proximity to the first electrode. A magnetizing coil causes the fluid electrode to move so as to make engagement with the filament. (See cut.)

792,658. Motor Starter. Albert J. Horton, Whiteplains, N. Y., assignor to the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. Application filed November 2, 1904.

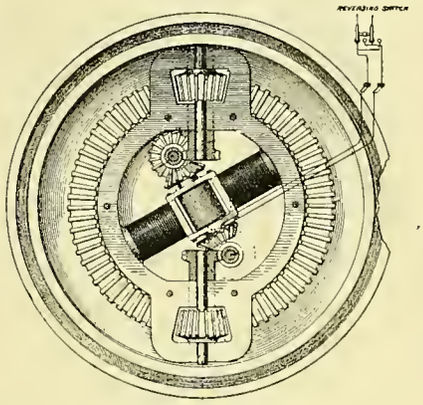
Combined with a movable member are a resistance controlled thereby, a second movable member, a resistance controlled by the latter member, means operatively connecting the former member to the latter member to move the latter member with the former in one direction while allowing the first member to move independently of the former member in the opposite direction.

792,689. Circuit Closer for Trolley Signals. Harold E. Bradley, Warwick, R. I. Application filed October 19, 1904.

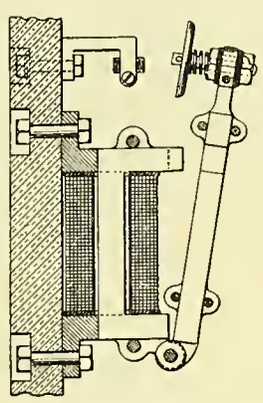
In a circuit-closer are a cylinder, a piston in the cylinder, a contact, a pair of contact arms, means for actuating one of the contact-arms by a passing car to engage its contact and means whereby the contact-arm will not be started to move from its contact until the piston has traveled a portion of its return stroke.

792,691. Telephony. Edward A. Buell, DeKalb, Ill., assignor to the Selective Signal and Telephone Manufacturing Company, Sycamore, Ill. Application filed May 9, 1904.

In a party telephone line is a selective switching mechanism at each of the subscribers' stations on the line. An electromagnetic appliance includes a single operating electromagnet exerting setting and locking action upon the switching mechanism, the windings of the electromagnetic appliances at the different stations being in parallel. A switching mechanism in association with the line operates the electromagnetic mechanism.



NO. 792,748.—POWER-TRANSMITTING MACHANISM.



NO. 792,859.—ELECTROMAGNET SWITCH.

Electric batteries and a conductor with contacts in fuel receptacle, and a torch with a cup adapted to receive fuel from the tank, the cup adapted in its withdrawal from the receptacle to complete an electric circuit, are the features of novelty.

792,739. Commutator Brush. Charles W. Speirs, Battersea, England, assignor to the Morgan Crucible Company, Limited, Battersea, London, England. Application filed November 7, 1904.

The commutator brush is formed of plumbago of a nature which when ground is in the condition of small flakes. The ground plumbago is treated with a glutinous substance and subjected to great pressure in a mold in a direction at right angles to that in which the current is to flow through the brush. The flakes thus arrange themselves with their planes parallel with the pressing-surface so that a relatively large number of contacts between the flakes will occur in the thickness of the brush compared with the number of contacts between the flakes in the length of the brush.

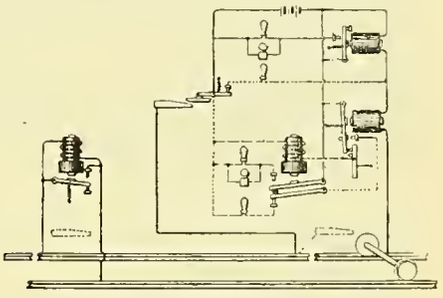
792,741. Electric-railway Switch. Thomas B. Stewart, William H. Turner and Rowland E. Dixon, Leeds, England. Application filed November 26, 1904.

The switch point is moved by a solenoid in a grounded electric circuit.

792,748. Power-transmitting Mechanism. Bion J. Arnold, Chicago, Ill. Application filed January 31, 1900.

In a power-transmitting mechanism are the driving and driven members of a clutch, a motor operatively associated with both clutch members and serving to couple or engage them, means for varying the speed of the motor, and supplemental clutching means to engage the clutch members when rotating at the same speed, independently of the motor, whereupon the supply of power to the motor may be cut off. (See cut.)

792,749. Power-transmission Mechanism. Bion J. Arnold, Chicago, Ill. Application filed February 19, 1900.



NO. 792,963.—RAILROAD SIGNAL.

792,612. Battery-plate Separator. Henry C. Porter, Waukegan, Ill., assignor to the Evansville Battery and Electric Company, Evansville, Ind. Application filed August 19, 1904.

A separator for battery plates consists of a self-supporting flexible sheet of insulating material and a number of bars arranged vertically and in staggered relation upon opposite sides of the sheet, whereby the sheet is kept bent into a series of reversed curves.

792,613. Battery Grid. Henry C. Porter, Waukegan, Ill., assignor to the Evansville Battery and Electric Company, Evansville, Ind. Application filed August 19, 1904.

A back plate of the grid is provided on one face with integral metallic bars arranged to form pockets for the retention of active material, the back plate being perforated at the back of the pockets.

792,634. Trolley Head for Electric Tram Cars. Samuel R. Thompson, Liverpool, England. Application filed January 17, 1905.

An automatic device for lubricating the trolley pulley is described.

792,637. Electromedical Appliance. Paul Wenigman, Chicago, Ill., assignor to Michael A. McLaughlin, San Francisco, Cal. Application filed November 2, 1904.

A supporting belt carrying electrodes is adapted to be applied to the body of the wearer. A connecting piece is secured to the belt to which the terminal of the negative element of a cell is removably secured. A metal envelop for the cell forms the positive element and a plug is soldered to the side of the metal envelop forming the terminal which is also in connection with the body.

792,638. Artificial Resistance. Willis R. Whitney, Boston, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 16, 1901. Renewed November 3, 1904.

A method of producing artificial resistances consists in combining a conducting substance such as carborundum with a binding material such as clay then baking the resistance device and subsequently burning away the outer surface of conducting material.

792,639. Vapor Electric Apparatus. Willis R. Whitney, Boston, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 19, 1903.

792,692. Electromagnetic Switching Mechanism. Edward A. Buell, DeKalb, Ill., assignor to the Selective Signal and Telephone Manufacturing Company, Sycamore, Ill. Original application filed May 2, 1904. Divided and this application filed August 9, 1904.

An electromagnet comprises two helices. An armature is pivoted between the helices and a bodily movable mounting for the armature is supplied. Spring mechanism acts upon the mounting normally maintaining the armature away from the helices.

792,693. Telephony. Edward A. Buell, DeKalb, Ill., assignor to the Selective Signal and Telephone Manufacturing Company, Sycamore, Ill. Application filed October 25, 1904.

In a switching device for connecting a source of current with a circuit are a self-restoring device serving intermittently to operate the switching device, a master-key for governing the association of the switching device with the circuit upon which it is designed to impress current, a detent normally adapted to hold the self-restoring device in its set position, and an electromagnet included in a circuit controlled by the master-key and governing the operation of the detent.

792,695. Sparking Plug. Edwin E. Clark, Canton, Ohio, assignor of three-fourths to Edmund A. Balm, Chicago, Ill. Application filed November 10, 1902. Renewed February 21, 1905.

A sparking plug comprises a conducting wire, a shell having an inner tapered chamber, an insulating-thimble secured to the shell and provided with a tapered end and a current-conducting bar carrying sparking points.

792,734. Automatic Electric Switch. Herman A. Schultz, Berkeley, Cal. Application filed January 3, 1905.

An electrical switch comprises a fixed and a movable member, a carriage for the movable member, a fulcrumed lever, a slotted bar connected with one end of the lever and with the carriage of the movable member, a float, a rod connecting the float with the lever, an antifrictional device carried by the end of the lever upon the opposite side of its fulcrum, and a wedge-shaped spring-pressed back against which the end of the lever is movable.

792,738. Electric Cigar or Lamp Lighter. Frank W. Smith and William H. Smith, New York, N. Y. Application filed August 1, 1902. Renewed January 9, 1905.

Combined with the driving and driven members of a clutch are a driving clutch motor mechanism in operative association with both clutch members and serving to couple them and means for receiving energy adapted to be accumulated by the motor mechanism.

792,751. Electrostatic Apparatus. Lucien L. Blake, Lawrence, Kan. Application filed June 9, 1904.

Electrostatic apparatus comprises an influence machine to generate static electricity, a ring nozzle co-operating with a plate of the machine, a shield mounted on an insulating support of the machine and provided with a nozzle, a pump, a drier and air-pipes connected with the nozzle, to supply jets of dry air in substantial impingement upon the plate and the support.

792,756. Illuminated Sign. Hjalmar Christensen, Seattle, Wash., assignor of one-half to Aral Gustavus Walin, Seattle, Wash. Application filed November 28, 1904.

In a sign board are a letter frame projecting beyond the opposite side faces of the board, a removable base forming a background for the letter frame, and electric lamps carried by the base board and projecting into the letter frame, the latter extending throughout the length of the lamp bulbs.

792,762. Dynamo-electric Machine. Gano S. Dunn, East Orange, N. J., assignor to the Crocker-Wheeler Company, Ampere, N. J. Application filed October 24, 1904.

A dynamo provided with an enclosing frame for the field and armature, and also an end shield is described.

792,776. Magnetic Separator. Edwin C. Kavanaugh, Holyoke, Mass. Application filed April 15, 1904.

In a magnetic separator are an enclosed magnetic cylinder rotatably mounted in a pulp receptacle, having pole pieces, magnet coils and a hollow endwise-extending journal combined with a receptacle located higher than the top of the cylinder chamber and pipe-connected with the hollow journal and a quantity of oil contained in the receptacle and filling the space within the cylinder.

792,787. Electric Unloader for Air Compressors. William Prellwitz, Easton, Pa., assignor to the Ingersoll-Sergeant Drill Company, New York, N. Y. Application filed November 20, 1903.

An air-compressor with its discharge valve has a main regulator valve for controlling the pressure behind the discharge valve, an auxiliary valve for controlling the movements of the main regulator valve and electrical means for controlling the movements of the auxiliary valve.

792,794. Electric Laundry Iron. Earl H. Richardson, Ontario, Cal., assignor to the Pacific Electric Heating Company, Ontario, Cal. Application filed January 25, 1904.

In an electric laundry iron are a body containing electric heating means, a handle secured to the body, a stand fastened to the body, an extension on the handle forming with the stand a support to hold the body in upright position and an electric terminal adjustably supported on the stand and adapted to have connection with the heating means in the body.

792,818. Railway Signaling System. Ezra R. Fern, Scranton, Pa., assignor of one-third to John W. Barnes, Scranton, Pa. Application filed September 6, 1904.

Signaling devices are arranged in a normally open circuit, the current conductor is in the form of a trolley wire or third rail. Electromagnets, circuit closers controlled by the electromagnets, and a spring-pressed contact arranged in the circuit of the electromagnets and disposed to one side of the conductor in position to be engaged by the current-collecting means of the car or train are the other essential parts.

792,843. Galvanometer. Edwin F. Northrup, Philadelphia, Pa., assignor to the Leeds and Northrup Company, Philadelphia, Pa. Application filed April 1, 1905.

Combined with a consequent-pole field magnet having two substantially parallel flat faces is a moving system suspended between the poles of and surrounded by the magnet which forms the sides of an inclosing case for the system. A covering extends over one of the faces of the magnet and forms the back of the case. A removable plate is secured to and extends over the other face of the magnet and forms the front of the case.

792,845. Electrical Switch. Hubert Pfirmann, Frankfort-on-the-Main, Germany. Application filed August 20, 1902.

Mechanism for driving a rocking switch comprises a device for temporarily detaining the switch, an elastic device arranged to be put under tension by the driving mechanism while the switch is detained and means operatively connected with the driving mechanism for throwing the detaining device out of action and allowing the elastic device to throw the switch beyond the inactive position.

792,855. Electric System. Axel L. Sjoberg, Union Hill, N. J. Application filed September 23, 1904.

An electric system comprising means for conducting electricity, a series of local stations each having a power-transmitting device, a series of movable bars set in different relations to each other at each of the several local stations, and adapted when in certain positions to operatively connect the device with a source of power and means for simultaneously operating one of the bars at each of the stations.

792,859. Electromagnet Switch. August Sundh and David L. Lindquist, Yonkers, N. Y. Application filed October 27, 1904.

An electro-magnet coil energized by a source of alternating current has a support and an armature pivoted at one end to the support and extending in front of a pole of the magnet and movable on its pivot to a position of magnetic equilibrium. A resilient body is placed so that the armature establishes contact when moved to the position. A circuit closer is controlled by the armature. The resilient body is constructed to take up the vibrations of the armature due to current alternations in the coil. (See cut on preceding page.)

792,860. Electromagnet Switch. August Sundh and David L. Linquist, Yonkers, N. Y. Application filed October 27, 1904.

An electro-magnet coil energized by a source of alternating current has an armature movable by the coil into a position of magnetic equilibrium, a circuit-closer carried by the armature, two circuit terminals disposed in the path of the circuit-closer and receiving it between them to close circuit, and resilient bodies combined with the terminals and constructed to hold them in contact with the circuit closer and to take up the vibrations of the armature due to current alternations in the coil.

792,875. Block-signaling Mechanism. Charles P. Bass, Portland, Ore. Application filed March 7, 1904.

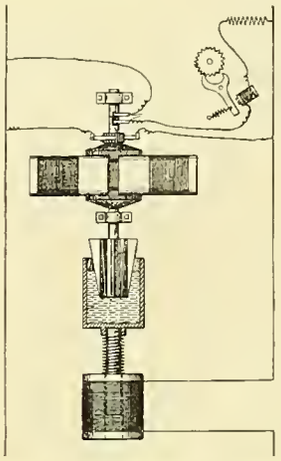
Signal mechanism comprises a semaphore automatically movable to its safety position, means for elevating the semaphore, including a rotable member having step-by-step movement, a signal light and bell, means co-operating with the rotable member for bringing the signal light and bell into electrical circuit with the trolley wire.

792,892. System and means for Laying Electrical Wires in Conduits. Guy M. Gest, Cincinnati, Ohio. Application filed February 14, 1903.

A continuous imperforate conduit completely incloses the naked electrical conductors against the outer atmosphere and moisture, and has one or more interior ducts. A series of solid one-piece insulators or blocks formed wholly of insulating material are arranged at determined intervals within one or more of the ducts, the insulating blocks extending across the interior area of the duct and having openings or perforations extending through their body and spaced apart. The one-piece insulating blocks are at perimetral points of less transverse area than the interior transverse area of the duct so that a continuous air space in the duct surrounding the entire line of naked conductor wires is provided.

792,900. Railway Signaling. Ernest C. Irving, Westminster, England, assignor of one-half to John Patrick O'Donnell, Westminster, England. Application filed March 14, 1903.

Combined with a signal are manually controlled mechanism for setting and resetting the signal, an electric circuit including an electromagnet for automatically setting and resetting the signal and means for setting the signal apparatus for the automatic operation.



NO. 793,035.—ELECTRIC METER.

792,903. Trolley Stand. Frank N. Kelsey, New Haven, Conn., assignor of one-half to Cornelius Conway, Jr., New Haven, Conn. Application filed April 14, 1905.

The trolley stand comprises a base, a frame swiveled thereto, a trolley pole socket pivotally connected at the rear of the frame and horizontal spring rods mounted in the frame and carrying tension springs. A spring carrier is mounted in the frame and brought into connection between the carrier and pole, whereby the movement of the pole imparts movement to the carrier.

792,922. Apparatus for Controlling Traffic on Railways. Thomas H. Patenall, Wilkinsburg, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed October 27, 1904.

A staff system for controlling traffic on railroads embodies a staff instrument located at each end of the section of track to be protected. Circuits extend between the instruments and a controller or controllers are located at a siding or sidings in the section of track for the circuits and adapted to receive a staff removed from either one of the instruments whereby the instruments are synchronized to permit of another staff being removed.

792,927. Telephone Transmitter. De Elbert A. Reynolds, New York, N. Y. Application filed February 25, 1905.

In a telephone transmitter or the like are combined, with two sound chambers and two diaphragms therefor, an intermediate chamber and a transmitting tube located therein having a single inlet and two laterally extending branches, the branches arranged to connect respectively with the sound chambers.

792,959. Clamp for Trolley Wires. Chris C. Bakewell, Kaylor, Pa., assignor of one-half to T. W. Minford, Kaylor, Pa. Application filed March 31, 1905.

A clamping device for trolley-wires, comprises a shell having a cylindrical outlined chambered portion, one wall of which is projected to form an integral jaw. A cylindrical member is adapted to telescope within the chambered portion and has an integral jaw adapted to have a rocking movement within an opening leading into the chambered portion of the shell.

792,963. Railroad Signal. Albert M. Bullard, Somerville, Mass., assignor to the American Signal Company. Application filed May 8, 1903.

In a signaling apparatus are a direct continuous-current circuit, means for changing the direct continuous current to fluctuating current and signal devices distinct from the changing means operated by the changed current. (See cut on preceding page.)

793,004. Eye-massage Machine. Frank H. May, Birmingham, Ala. Application filed July 23, 1904. Renewed April 8, 1905.

An eye-massage machine consists of a hollow case having at one end a laterally extended neck with a marginal oval frame, a flexible diaphragm held on the frame and a vibrator arranged within the case and connected to the diaphragm. The vibrator is operated by the armature of two electro-magnets within the casing.

793,030. Adjustable Support for Incandescent Lamps. Peter Forg, Somerville, Mass. Application filed June 4, 1903.

The supporting arm is hinged to a base and the slack of the lamp cord is held up by a cord extending over a pulley midway of the arms, one end of the cord being attached to the lamp cord and the other to a weight sliding on the arm.

793,033. Electric Circuit. Isidor Kitsee, Philadelphia, Pa. Application filed August 16, 1901. Renewed October 16, 1903.

The method of transmitting direct and alternating or phase currents over a common line wire consists in connecting one source of current to the line wire and connecting the second source of current in shunt in relation to part of the line wire, in a manner so that the impulses generated at one and the same time oppose each other in the shunt.

793,035. Electric Meter. Isidor Kittsee, Philadelphia, Pa. Application filed November 17, 1902.

The meter embodies means to make and break an electric circuit, means to vary the speed of the first means in accordance with the variation of the current flow, two or more registering devices adapted to be actuated each through an electro-magnetic device placed in a circuit adapted to be made and broken through different positions of the first and second means. (See cut.)

793,036. Electric Clock. Isidor Kitsee, Philadelphia, Pa. Application filed November 17, 1902.

An electric clock embraces the following parts: Means dependent on the force of gravity to operate the clock, electromagnetic means adapted to remove the gravity means from one position to another, means to make inoperative the electromagnetic means and means to keep active the electromagnetic means independent of the gravity means.

793,037. Electric Telegraphy. Isidor Kittsee, Philadelphia, Pa. Application filed February 4, 1905.

A telegraphic alphabet comprises two different characters, one character symbolized by a dot of a positive or negative polarity in accordance with the polarity of the impulse preceding and one character symbolized by two dots in close proximity but of opposite polarity to each other.

EXPIRING PATENTS.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on June 26, 1905:

384,958. Galvanic Battery. C. A. Brown and M. M. Clark, Chicago, Ill.
384,962. Electric Railway Signal. S. C. C. Currie, London, England.
385,001. Rheostat. J. W. Parkard, New York, N. Y.
385,020. Electric-light System. B. E. Sunny, Chicago, Ill.
385,022. Apparatus for Electric Welding. E. Thomson, Lynn, Mass.
385,023. Electric Switch. P. J. Tracy, Racine, Wis.
385,028. Electrolyte for Galvanic Batteries. B. J. Wheelock, New York, N. Y.
385,034. Electromotive Railway. G. T. Woods, Cincinnati, Ohio.
385,041. Switch for Electrical Purposes. W. A. Carey, Malden, Mass.
385,042. Mariner's Recording Compass. H. A. Chase, Stoneham, Mass.
385,043. Electric Alarm Compass. H. A. Chase, Newton, Mass.
385,053. Electric Railway. R. M. Hunter, Philadelphia, Pa.
385,054. Electric Railway. R. M. Hunter, Philadelphia, Pa.
385,055. Electric Railway. R. M. Hunter, Philadelphia, Pa.
385,067. Electric Cut-out. C. G. Perkins, Hartford, Conn.
385,068. Dynamo-electric Machinery. A. Reckenzaun, London, England.
385,097. Electric Railway. G. H. Condict, Philadelphia, Pa.
385,145. Method of Generating Electricity and Purifying Water. J. E. Siebel, Chicago, Ill.
385,147. Galvanic Battery. E. E. Starr, Philadelphia, Pa.
385,173. System of Electrical Distribution. T. A. Edison, Llewellyn Park, N. J.
385,180. Electric Railway. R. M. Hunter, Philadelphia, Pa.
385,200. Secondary Battery. A. Reckenzaun, London, England.
385,205. Test System for Multiple Switchboards. C. E. Scribner, Chicago, Ill.
385,211. Electrical Pumping Apparatus. F. J. Sprague, New York, N. Y.
385,215. Electrical Connector. F. Stitzel and C. Weinedel, Louisville, Ky.
385,254. Battery Zinc. J. Doyle, Hoboken, N. J.
385,308. Electric Battery. E. M. Hewett, Newton, Mass.

SPECIAL MENTION.

The American Electric and Controller Company of New York emphasizes the fact that it is prepared to furnish anything in the way of alternating-current or direct-current motor starters, solenoid switches, solenoids, drum-type controllers and central-station protective devices. Its solenoid switch is said to be the only one on the market that both opens and closes automatically. All the apparatus is equipped with overload and no-voltage release.

The Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y., reports having closed contracts for switchboards for the following places: Ardmore, I. T.; Minneapolis, Minn.; Cleveland, Ohio; Marion, Ohio; Delaware, Ohio; Furley, Kan.; McLain, Kan.; Idana, Kan.; Corson, S. D.; Brandon, S. D.; Star, Idaho; Ridgeway, Iowa; Lodiburg, Ky.; Bristol, Tenn.; Franklin, Pa.; Granville, N. D.; Bowbells, N. D.; Folsondale, Ky.; East Smithfield, Pa.; Elizabeth, N. C.; Washington, N. C.; Mountain Branch, Tenn.; Berwick, Pa.; Fulton, Kan.; Fenton, Iowa; Pontiac, Ill.; Macon, Ill.; Chicago, Ill., and Fulton, Iowa.

"America's Summer Resorts" is the title of the New York Central's "Four-track Series No. 3," just out. It contains, in addition to a great amount of information, a large and comprehensive map covering the country from Denver on the west, to New York, Boston, Montreal and Bar Harbor on the east. The folder is intended to touch briefly upon the many health and pleasure resorts lying within the territory described. If it is desired, therefore, to visit any of these famous resorts, the map points the way, while, by referring to a certain page of the reading matter, a person will be able to answer for himself almost any question he wants to ask in regard to rates, routes and the time required for the journey.

On and after Wednesday, June 21st, the Stanley Instrument Company of Great Barrington, Mass., says that it will be prepared to and will fulfill all orders in hand or received thereafter with its model H-6 rotated jewel-bearing wattmeters, which eminent counsel declare are not only outside of any valid claim of infringement of the Tesla patents Nos. 511,559 and 511,560, but are in exact conformity with the suggestion contained in the opinion of the United States Circuit Court of Appeals for the First Circuit, filed September 9, 1904. This opinion states in brief that if the device stopped with a "metallic rotating body" and some method other than a counting machine operated by it was used for determining the number of its revolutions, infringement might not be charged. The company is now conforming to that suggestion of the court and has designed and will manufacture and fulfill all orders with rotated jewel-bearing wattmeters in which the train mechanism or "counting machine" will not be operated by the disk or "metallic rotating body," but by a totally independent mechanism.

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LIBRARY OF ELECTRICAL ENGINEERING

Electricity in Heliographic and Lithographic Processes.

There are many commercial processes of printing, engraving and illustrating, and in nearly all of these electricity is or may be employed to advantage—in some cases in unusual and ingenious ways. The art of electrotyping, indeed, furnishes one of the oldest of the practical adaptations of electrical phenomena by the utilization of the electrolytic deposition of metals. But in modern printing, engraving, lithographic and heliographic establishments many uses of electric light and power are made which were not dreamed of when the first tank for electrotyping was set up. In fact, on inspecting any one of the leading works one is impressed by the extensive use made everywhere of electricity, which has really become almost indispensable to operations of this nature on a large scale. In order to illustrate this assertion some particulars will be given of the electric plant recently completed by a Berlin manufacturer in the establishment of one of the leading German lithographic and heliographic printing works, that of Stengel & Co. of Dresden.

The factory has a current-generating plant of its own, the direct-current shunt dynamo (Fig. 1) installed in the engine room yielding 175 amperes at 195 revolutions per minute, and a pressure of 220 volts. This is direct connected to a Diesel motor of 60 effective horsepower. To supplement the dynamo a storage battery of 120 cells has been supplied, having a capacity of 324 ampere hours with a three-hour discharge. This battery is charged by means of a booster dynamo.

Every one of the various machines used in the different departments—the heliographic presses, printing presses, paper-cutting machines, color grinders, glazers, card shears, etc.—are operated by electric motors of capacities varying according to the consumption of each machine. The elevator is also electrically operated.

All the motors driving the presses are belted to the flywheels of the presses. The paper cutters are fitted with friction clutches, designed as cone pulleys, and which are likewise driven by belt transmission. The color grinders as well as the glazing machines and card shears are provided with special pulley gearings.

Fig. 2 is a view of the heliographic presses. Ten of these presses are shown in the picture and each is belt-driven by a motor set down in an opening in the platform of the press.

An important adjunct to the plant is the apparatus for drying the heliographic plates. This work is done in a special hall containing 22 drying tanks. Fig. 3 is a view of a portion of this room showing two of these tanks and part of a third. The air in the tanks is heated by electrical radiators which are controlled by a governor located on the outside of each tank. The heaters consist of variable resistances controlled by the governors, which cut in or out the resistance according as the temperature is to be raised or lowered. This may be done by seven successive steps, giving seven different temperatures. As shown in the picture, the conductors are carried along the wall to groups of switches which control the current supply to the several groups of heaters.

The maximum temperature available with these radiators is about 40° C. above the room temperature. The temperature required for drying the plates need, however be only 20° to 30° above the room temperature. The current supplied to each radiator is 1.7 to 2.5 amperes at 220 volts. The radiators have operated satisfactorily, and, while requiring comparatively little superintendence, they allow the heliographic plates to be heated uniformly.

Another interesting feature of the plant is the room where the photographic printing processes are carried on by means of artificial light. The copying arc lamps, shown in Fig. 4, are provided with Hrabowsky reflectors. The lamps are hung by chains and pulleys, which allow of the adjustment of the lamps to any height, to a hook carried by a trolley wheel traveling on an overhead track, so that each lamp may be moved about easily from place to place over the work. The lamps are supplied with current by flexible pair conductors taking their supply from the terminals of the main circuit, as shown in the picture. This circuit is controlled by a switch located conveniently on the wall.

In addition to the copying arc lamps the plant includes 371 incandescent lamps, 16 Lilliput lamps,

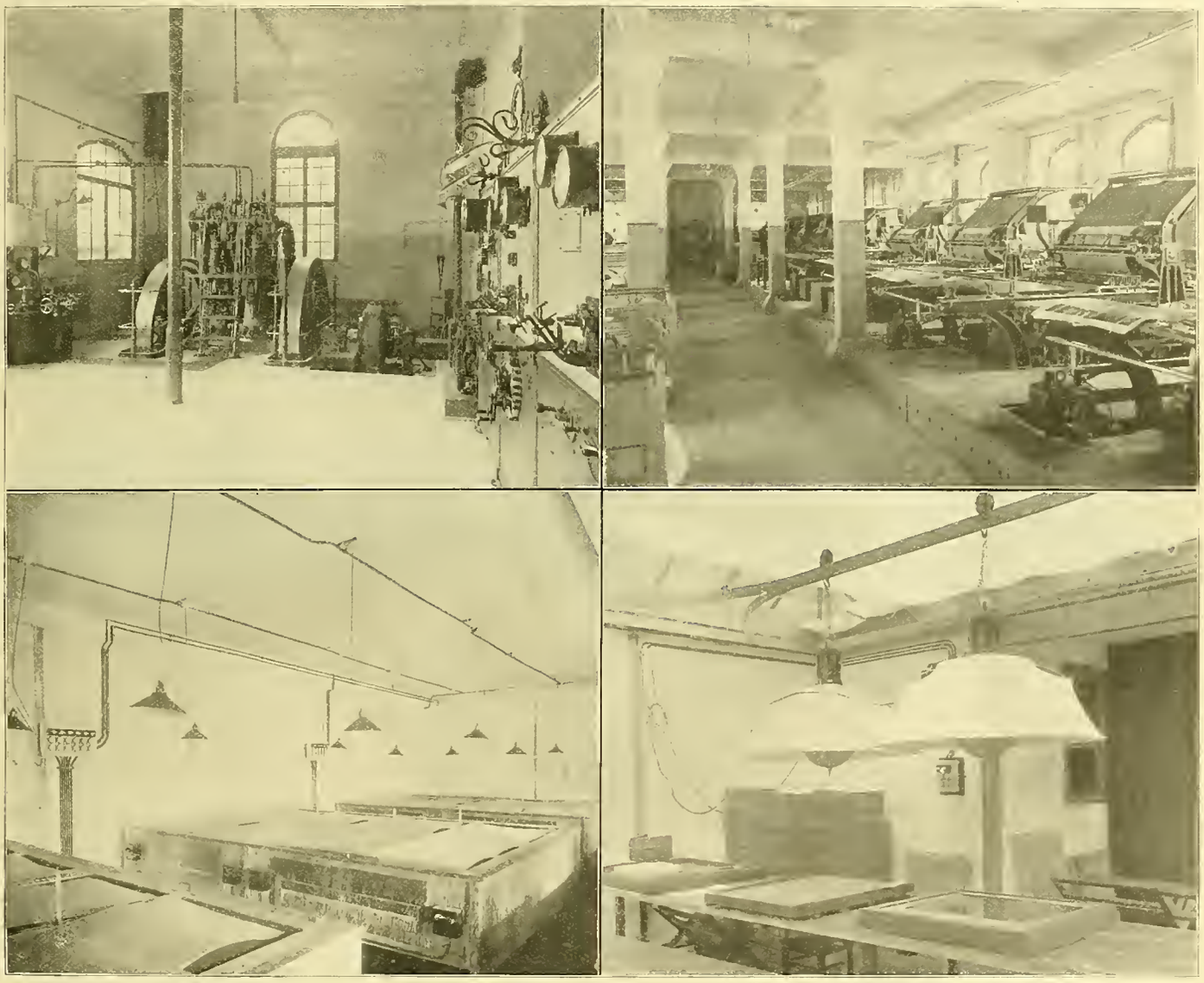

Fig. 1. Power Plant in German Lithographic and Heliographic Works.
Fig. 2. Electrically Driven Heliographic Presses.
Fig. 3. Electrically Heated Drying Tanks.
Fig. 4. Copying Lamps.

four arc lamps and two "permanent-burning" lamps. The Lilliput lamps and incandescent lamps are used to light the offices as well as the interior of the printing rooms and engine hall, while the arc lamps serve for the outside lighting. A. G.

Marconi and Fleming's Improvements in Space-telegraph Apparatus.

William Marconi and Prof. John A. Fleming, both of London, whose names are well known in connection with the development of space-telegraph apparatus, have recently taken out patents in the United States upon improvements to their respective systems. The following descriptions bring out the principle features of these improvements, which are interesting. Both of these patents are assigned to the Marconi Wireless Telegraph Company of America.

Mr. Marconi's invention consists of apparatus by means of which he says that tuned or syntonic effects may be obtained and the effects of thunder storms and other disturbing influences minimized.

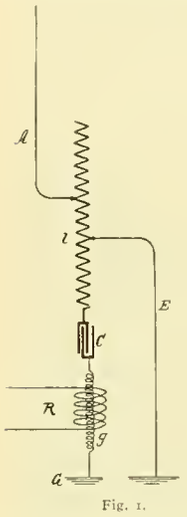

Fig. 1.

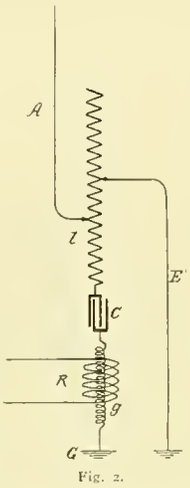

Fig. 2.

MARCONI'S IMPROVEMENTS IN TRANSMITTING APPARATUS.

The simplest form of this new Marconi apparatus is shown in Fig. 1, while Figs. 2 and 3 are modifications.

In Fig. 1 (A) represents the receiving aerial adjustably connected to the inductance coil (l), (C) a condenser connected to the inductance coil, and (R) a suitable receiver or detector connected to the condenser. One terminal (g) of the detector is grounded at (G) and another ground connection (E), which is preferably flexible or adjustable, is joined to the inductance (l) at a certain point, the position of which is dependent upon the period of the electric wave radiated from the distant transmitting station.

This receiving system is syntonized or attuned to one particular frequency of electrical waves radiated from any one of a number of differently attuned distant electric radiators, in the following manner: The size of the condenser (C) is fixed, and the inductance (l) is varied by adjusting its connection with the aerial until signals are received on the responder or detector (R). Then by sliding the flexible or adjustable ground connection (E) along the inductance (l) or otherwise, a point is found at which, if a new ground connection is established, waves of the particular frequency radiated from a given distant transmitting station from which it is desired to receive signals will be received and detected to the exclusion of signals transmitted from other stations radiating waves of different frequencies. This ground connection (E) may be made without weakening, but rather strengthening, the signals in the detector (R).

The position of the ground connection (E) in the inductance (l) is dependent upon the length of the wave to be detected. It should be connected at or near the node or point of no potential of the electric wave which it is desired to read or detect, and the detector (R) will then be unresponsive to electrical waves of frequencies other than that for which the system has been adjusted as described.

By means of this invention a very sharp selectivity of signals is obtained, and the troublesome effects of atmospheric electricity are largely or wholly eliminated.

In Fig. 2 is shown a modification of Fig. 1, the ground connection (E) of Fig. 1 being replaced by another at (E') of Fig. 2, the position of which on the inductance (l) being found similarly to the adjustment of (E) as already described.

By reference to Figs. 1 and 2, it will be seen that the receiving apparatus illustrated each comprises two associated circuits—one (an open circuit) including the aerial (A), the conductor (E), or (E') and that portion of the inductance coil (l) between the respective points of contact with the aerial and the conductor; and the second circuit (a closed circuit) including the responder or detector (R), condenser (C), conductor (E), or (E') and that portion of the inductance coil between the condenser and the conductor (E).

It is essential that a condenser shall be included in the so-called "closed circuit." Otherwise the apparatus will not properly operate, because if a condenser is omitted from the circuit, that circuit cannot be tuned to respond to the proper wave period.

As stated, the flexible or adjustable ground connection (E) may be variably connected with or arranged to simultaneously include more or less of the turns of the inductance coil in the two circuits referred to. Obviously, the adjustment of the conductor (E) with relation to the inductance (l) will result in altering the turns of the inductance included in each circuit, but without altering the sum of the inductances included in both circuits. When the conductor (E) is adjusted to a certain position (for instance, that shown in Fig. 1) and electromagnetic waves fall upon the aerial (A), such waves will excite oscillations in the aerial, and if the time period of the open-circuit aerial, plus the included turns of the inductance coil, is the same as that of the condenser (C), plus the turns of the inductance coil included in circuit with the condenser, and if this agrees with that of the waves incident, the responder will be affected If, however, waves of other period fall upon the aerial there will be little or no sympathetic vibration excited in the condenser circuit and the responder will not be affected.

Many extensions of the arrangements shown in Figs. 1 and 2 will readily suggest themselves. In Fig. 3 is shown one such extension, comprising a series of similar syntonic circuits, each in tune with the wave transmitted, the system being grounded at the nodal points (E), (E'), (E^2), (E^3) and (G), which are determined by the periodicity of the wave transmitted. This arrangement gives a particularly sharp attunement and is especially adapted to eliminate the stray or extra signals caused by atmospheric disturbances.

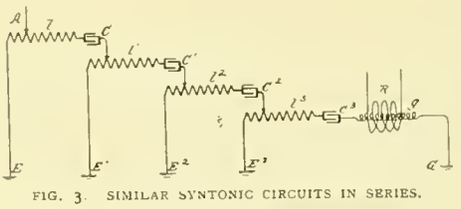

FIG. 3. SIMILAR SYNTONIC CIRCUITS IN SERIES.

The object of Professor Fleming's invention is to produce in connection with a transmitting apparatus, sparking terminals, one of which may be moved, relatively to the other, whereby successive portions of the terminal or terminals are presented to the sparking point and also to produce a practically noiseless discharger.

The improvements consist especially in combining the conducting bodies, between which the spark-gap is formed, with means whereby either or both of the conducting bodies will be moved, so as to continually present fresh discharge surfaces between the bodies. Any suitable connections may be employed for this purpose, and any desired form of sparking terminals may be used. In Fig. 4 are shown two spark balls. Obviously, however, any suitable forms of sparking terminals may be used, and either one or both may be moved relatively to the other. These balls or disks, which are made of iron or steel, are carried on shafts which in turn are borne on insulating surfaces or bearings, and they are placed at a proper distance apart for the discharge taking place, and arrangements are provided for regulating this distance. Preferably this is done by supporting each ball with its motor on a table pivoted about one edge, such tables being tilted more or less by means of screws.

It is advantageous to have the balls kept in rotation in a closed chamber in which air or other gases can be compressed, and in this manner if the walls of the inclosing chamber are sufficiently thick and rigid any external sound is excluded so that the discharge is practically noiseless. In this chamber there is a window of very thick glass which permits of the electric spark being inspected and the length of this spark ascertained by placing a lens in front of the window and throwing an image of the spark upon a screen. From the focal length of the lens and its distance from the spark it is easy to calculate the scale of magnification, and, therefore, from the length of the image, to ascertain the real length of the spark.

The balls between which the discharge takes place are driven round at a slow pace by means of gearing, which in turn is driven by a small electric motor or clockwork. When motors are employed each ball is preferably driven by its own motor and these motors are contained in the sound-proof chamber which also contains the discharger. As the contact surfaces are continually

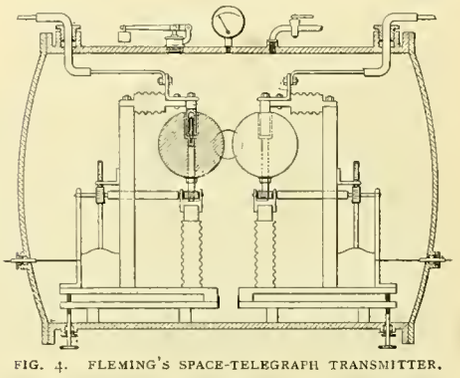
FIG. 4. FLEMING'S SPACE-TELEGRAPH TRANSMITTER.

being changed they wear more evenly and the kind of spark is better preserved.

If the balls are hollow, water may be caused to circulate through them and so keep them cool. It is found that a very great advantage is secured by using a short spark taken in compressed air inclosed in a strong iron reservoir, as the electric discharge can be made perfectly noiseless and the injurious effects arising from this sound are also obviated. In order to make the contact between the revolving ball or disk and the external electrical generator—whether it be by a transformer, induction coil or any other means—mercury cups are employed. The terminals of the electric supply circuit can be connected to two metal cups which are insulated and contain mercury. The shaft carrying the ball has also on it a thick copper disk partly immersed in the mercury in this cup so that the ball has to revolve, and yet a good connection is kept up with the external circuit. Otherwise mercury cups are attached to the shaft of the revolving balls and rods dip into these cups connected with the external circuit.

Street Railway Association of the State of New York.

The twenty-third annual meeting of the Street Railway Association of the state of New York was held at Lake George, N. Y., on June 27th and 28th, the headquarters being the New Fort William Henry Hotel, and the exhibits being in the Casino at New Fort William Henry Park. The meeting was a profitable one and an excellent programme was carried through.

The executive committee held a session at 9:30 on Tuesday morning, June 27th, after which a business session was held, at which the address of the president and the reports of the various committees were read, together with some of the papers. In the afternoon papers and discussions were first on the programme, followed by the "question box" and general business, including the nomination of officers. In the evening the delegates and guests examined the manufacturers' exhibits.

The entertainment features on Tuesday were numerous. In the afternoon the ladies boarded large, open cars, seating 90 persons, and took a trolley ride over the line of the Hudson Valley railway, six miles north from New Fort William Henry Hotel to Warrensburg. Returning, the cars proceeded to Glens Falls and Saratoga, through historic and picturesque country. That night there was dancing and a display of fireworks.

At Wednesday morning's session the time was taken up in the reading and discussion of papers and further discussion of the "question box." In the afternoon, besides the reading of papers, election of officers was held and the unfinished business of the meeting transacted.

For officers the association elected the following-named gentlemen: President, R. E. Danforth of Rochester; first vice-president, B. B. Nostrand, Jr., of Peekskill; second vice-president, J. H. Pardee of Canandaigua; secretary, C. B. Fairchild, Jr., of New York; treasurer, W. W. Cole of Elmira; executive committee, E. F. Peck of Schenectady,

T. W. Wilson of Buffalo, Oren Root, Jr., of New York, J. N. Shannahan of Gloversville. The time and place of the next meeting was left to the executive committee.

Five papers were read at the meeting, as follows: "Contrasts Between Company and Municipal Ownership and Management of Public Utilities," by H. W. Blake; "Types of Interurban Cars," by J. N. Shannahan, general superintendent of the electric division of the Fonda, Johnstown and Gloversville railroad; "Publicity," by J. Harvey White of the Boston Elevated Railway Company; "Uniform Standards of Examination of Railway Employes," by Dr. F. H. Peck, and "Suitable Cars for City and Suburban Service," by T. W. Wilson, general manager of the International Railway Company. The "question box" was edited by C. B. Fairchild, Jr.

The entertainment features on the last day included a steamer excursion for the ladies on Lake George and the annual banquet, which was held in the banquet hall of the new New Fort William Henry Hotel.

"Electrical Palisade" in Madison, Wis.

The accompanying picture illustrates the "Electrical Palisade," a decorative-lighting attraction which was installed and has been maintained for some time past by the Elks lodge in Madison, Wis. It is placed in Monona Avenue, near the Elks' Club House. The Madison Gas and Electric Company supplies the current for the decorations on the

THE "ELECTRICAL PALISADE," IN MADISON, WIS.

midnight schedule, which is very popular in that city for electric displays, signs and window lighting. There are in use in the city, which has a population of about 25,000, over 125 electric signs, all in use every night until midnight.

The Madison Gas and Electric Company is one of the progressive smaller central stations which recognizes the value of an energetic campaign to secure as much business as possible in the line of sign and decorative lighting. As was emphasized strongly at the recent convention of the National Electric Light Association in Denver and Colorado Springs, this part of the load of a central station is one of the most important of any connected, and its growth is to be fostered in every way, for current thus sold is not only a source of profit to the company, but the signs and decorations themselves are a valuable advertising medium for the central station.

St. Paul is another northwestern city in which an active campaign for the sign business is being made on the midnight schedule. There the charge is 25 cents for a four-candlepower lamp between 6:05 p. m. and midnight. The company now has over 400 electric signs installed, time switches being used.

Mexican Electric Light Company.

At a meeting of the Mexican Light and Power Company held in Montreal the shareholders authorized the board of directors to enter into all necessary arrangements to incorporate and organize a new Canadian company to be named the Mexican Electric Light Company, which shall acquire the shares and properties of two other companies now doing business in the City of Mexico, viz., La Compania Mexicana de Las Fuerzas Hidro-Electricas de San Ildefonso, S. A., a company organized under the laws of Mexico, having a capital of $3,500,000 Mexican and a bond issue of 5,000,000 francs; and also the shares of the capital stock of an English company, owned by Anthony Gibbs, Sons & Co., bankers of London, having a capital of £500,000 sterling. The present net earnings of these two companies are now over $450,000 per year, which will be very considerably increased when the hydraulic power from the Necaxa Falls is substituted for steam power, as coal in Mexico City costs from $10 to $12 per ton. The directors of the Mexican Light and Power Company have received a report from representatives in Mexico stating that a contract had just been made by which the company will supply 5,000 horsepower to the street-railway company of the City of Mexico, owned by Warner, Bite & Co. of London. The government of Mexico has also signed a contract for 2,000 horsepower for pumping purposes.

English 220-volt Lamps.[1]

By John W. Howell.

The following quotation is from the remarks made by Col. R. E. B. Crompton in his discussion of the papers read by Mr. Torchio and Mr. Dow at the International Electrical Congress at St. Louis last September:

"In England our variety of distribution systems is not so great as we find here. We started with three-wire 200 or 220-volt systems, distributing at 110 volts. We have everywhere practically doubled this voltage. All our largest cities in England, including London with its 6,000,000 inhabitants, after very careful consideration, practically adopted what you have called the double-voltage system. This doubling the voltage was not adopted without a struggle. For a long time the lamp manufacturers opposed it and told the consumers, probably with some reason, that they would be at a disadvantage, as lamps of the double voltage could not be made so efficient as lamps at the single voltage, but we showed that this could be remedied by refinements in lamp manufacture, so that now it would be very difficult for the consumer to find that he was at any practical disadvantage on account of inferior efficiency of the double-voltage lamps.

"The result is that the majority of our consumers take their supply at pressures varying from 200 volts in London up to 250 volts in Glasgow. We therefore consider this question settled and therefore completely disagree with all the arguments on this point in both Mr. Torchio's and Mr. Dow's paper."

These remarks indicate that either the English makes of 220-volt lamps are very much better than those made or known in this country, or that English makes of 110-volt lamps are very much inferior to those made here, or that the considerations and conditions, other than the difference in quality of the two types of lamps, which effect the choice of one system or the other are different in the two countries.

As a lamp engineer seeking all available information on lamps I recently secured samples of the best-known makes of 220-volt lamps on the English market, thinking that the very extensive use of such lamps there had led to the development of a better lamp than those produced in this country. I here present data on tests which I have made on these lamps, and also similar data on tests made on American-made lamps.

I obtained 25 of each of these five makes of lamps—Sunbeam, Stearn, Royal Ediswan, Robertson and Cryselco—my letter to our English representative asking for samples of the best-known lamps on the English market. All these lamps were labeled 220 volts, 16 candlepower. All of them were photometered at 220 volts. The results were shown in target diagrams. These diagrams show a very great lack of uniformity in the individual lamps of each make and a tendency to low candlepower and high watts per candle.

The averages are as follows:

	Candles.	Watts Per Candle.
Make C	15.5	4.00
Make D	13.5	4.65
Make B	14.3	4.33
Make A	14.5	4.37
Make E	11.4	5.2

These are supposed to be 16 candles, four watts per candle.

For comparison with these I used a similar diagram made on Edison lamps—220 volts, four watts per candle—which I took from a paper read by Mr. F. W. C. Bailey before the National Electric Light Association, May, 1902. Mr. Bailey obtained these lamps on the open market through a supply house. These lamps average 16.2 candles, 3.83 watts per candle, and show very much greater uniformity of candlepower than the English lamps.

To determine the quality of these lamps 15 of each lot were set up for life-test. In order to make this comparison fair all were set up at the same watts per candle, all were set up at 3.1 watts per candle as the lamps were received in May, and it was necessary to set them up above their rated efficiency in order to finish the test in time for this meeting.

For comparison with these I set up at the same time and under the same conditions lamps of our own make and rated the same as the English lamps. These lamps were taken at random from our own stock, no selection being made.

The results of these tests were shown in the diagrams, showing loss of candlepower and time of burning. The lamps in each lot were quite uniform. The average results are as follows:

Make C	104 hours to 80 per cent.
Make B	88 hours to 80 per cent.
Make E	65 hours to 80 per cent.
Make D	82 hours to 80 per cent.
Make A	72 hours to 80 per cent.
Make Edison	156 hours to 80 per cent.

These results indicate that the Edison lamps made in this country are 50 per cent. better than the best make of English lamps of this type, and nearly twice as good as the average of the other makes tested.

These samples may not fairly represent the average quality of the different makes of lamps but the uniformity of the lamps in each lot indicates regularity in manufacture. The total result certainly indicates that the American-made 220-volt lamps are not inferior to those on the English market.

Regarding 110-volt lamps, which are the standard for central stations in this country, the Association of Edison Illuminating Companies purchases several millions of these lamps each year: all of these are inspected and samples are regularly tested for life.

These inspections and tests are made by the Electrical Testing Laboratories in New York. I have obtained from them the target diagram of Edison 3.1-watt 110-volt lamps. They give it as a fair sample of these lamps at the present time.

The curve showing loss of candlepower with time for this class of lamps represents the average result obtained on 5,488 lamps tested for life during the year ending May 1, 1904. This shows 512 hours life to 80 per cent. The average efficiency of these lamps was 3.14 watts per candle, correcting this to 3.10 watts per candle gives the useful life to 80 per cent. to be 480 hours, which is over three times the useful life of the American 220-volt lamps and over five times the useful life of the average of the English 220-volt lamps tested.

At any efficiency other than 3.1 watts per candle, the relative values of these various lamps would be

1. A paper (with diagrams omitted) presented to the American Institute of Electrical Engineers at Asheville, N. C., June 19, 1905. The paper consists of comments on remarks made by Col. R. E. B. Compton at the International St. Louis Electrical Congress. Mr. Howell is an engineer of the General Electric Company.

the same, so it may be said that at any efficiency 110-volt lamps are at least three times as long-lived to 80 per cent. as 220-volt lamps.

It is our experience, based on many tests, that 110-volt lamps of 3.1 watts per candle and 220-volt lamps at 3.8 watts per candle have equally useful lives.

It is the custom in England for the consumer to purchase his lamps where he pleases, the electricity supply companies furnishing current only. Under these conditions using lamps of the same efficiency and considering them dead when they have fallen to 80-per cent. candlepower, the customer using 220-volt lamps would have to buy three times as many lamps as one using 110-volt lamps and each lamp would cost more money.

Or if lamps of equal life were used each 220-volt 16-candle lamp would consume 11 watts more than a 110-volt 16-candle lamp. Assuming that both lamps last 500 hours, each 220-volt 16-candle lamp would consume 5,500 watt-hours, or 5.5 kilowatt-hours more than each 110-volt lamp; and with current costing 10 cents per kilowatt-hour, each 220-volt lamp of 16-candlepower would during its life consume 55 cents' worth of current more than each 110-volt lamp.

Colonel Crompton says: "It would be very difficult for the consumer to find that he was at any practical disadvantage on acount of inferior efficiency of the double-voltage lamps."

This may be true under English conditions, but in this country most large lamp consumers buy lamps on close specifications and make tests to see that the specifications are fulfilled. It is also a common custom in this country for consumers to buy samples of different lamps on the market and determine by test which makes are best. This forces lamp makers to mark their lamps very accurately for volts and candlepower, for any package may be tested in competition with lamps of other makers.

If these customs prevailed in England it would be impossible to sell such badly rated lamps as those which are the subject of the tests given in this paper.

These tests indicate a general lack of information on the part of the English consumers on the subject of quality and performance of lamps, and it is not surprising that people who will continue to use lamps so poorly rated for volts and candlepower as these are would not appreciate the difference between 220-volt and 110-volt lamps, but the English engineers should know the difference between good and bad lamps and between 220 and 110-volt lamps.

Progress in Electric Heating.

Electric heating as a profitable load of central-station companies is receiving increased attention. This is shown by the report of James I. Ayer to the National Electric Light Association at the Denver-Colorado Springs convention. Mr. Ayer sent out a set of questions relating to the various phases of the subject to the central-station members of the association. The total number of inquiries sent out was 480 and the number of answers received was 235. As indicated by the answers to these questions about one-third of the 235 have no heating apparatus on their lines, mostly those who have no day service. With those who have, there is a growing interest. They generally sell apparatus at or about cost, and about one-half keep such a record as they may from sales, inspection permits, meter records, etc. A comparatively small percentage make special rates.

With a few there is a strong impression that the cost for service is high and a serious handicap. With others, that this does not apply to many useful devices, that the introduction of heating goods is important as broadening the field of usefulness of electric service among existing customers, and where rates can be made sufficiently low, material additions in day loads develop. That the best methods of extending their use are by office exhibits and demonstrations, loaning articles for trial and personal solicitations seem to be the prevailing opinion.

There are some material loads of a desirable character added from the service to laundries, clothing factories and other industrial establishments in 52 cases; and those customers found the service more satisfactory, though in some cases at a higher cost for heat, than by other methods.

The cost of apparatus is a factor in limiting the sale and should receive attention. The average critic does not always appreciate that an electrically heated tool or device is materially different in its make-up from its fellow of older acquaintance. Aside from producing a device as like as possible to the one it displaces, it must contain a heat generator made to withstand use and abuse in unskilled hands while operating at high temperature, thus calling for great care in design, construction and selection of material. Of the number made, compared with articles of like character in common use, they are as one to many thousands. The cost of selling is also quite high as compared with articles better known and of wider application, because the field, generally, is restricted to those using electricity who may be persuaded to discard some familiar well-known method and device and buy the new.

These are the principal reasons for what is considered high cost of electric heaters. Some few stations reported failures in efforts to successfully introduce apparatus under conditions where others succeed. This is generally due to the lack of a proper understanding of requirements, methods and apparatus.

While it seems a simple matter to substitute an electric iron for a gas iron with equal or better results, and it can generally be done, yet there are kinds of work, kinds of operators and kinds of irons differing in their individual characteristics which must harmonize when properly combined; all of which means that a thorough acquaintance with the devices you are introducing is essential.

There are favorable conditions where electric lighting is cheaper than gas, unit for unit, where it may not be necessary to include compensating advantages to equal an unfavorable difference in first cost, but the extension of business is not found possible under such conditions only. On the contrary, the public should be taught that a better thing is worth more.

The electric heater in many of its forms meets many household demands better, and usually more cheaply than they can be met by any other means. With the many household, shop and office conveniences available, the electric heater is, except for long-continued service, a medium more attractive, convenient, safe and sanitary than any other, and can be operated cheaply enough to furnish an additional reason for taking on or maintaining electric service from a central station.

Electrical Features of the "White City," Chicago.

The White City amusement park in Chicago, which was opened to the public on May 27th, is especially interesting to electrical men because it requires more electrical energy for lighting than any other single installation in Chicago. The general amusement features of the place and the arrangement of the grounds have been described in former numbers of the Western Electrician, and only the lighting features will here be considered.

The park is located at the corner of Sixty-third Street and South Park Avenue, where it occupies a space of about one by two city blocks. Besides the outdoor attractions, such as the chutes, outdoor circus, etc., there are about 25 buildings on the grounds, accommodating various "shows" or provided for the comfort and enjoyment of patrons. Each of these buildings is lighted by electricity within and the outside of each is outlined with eight-candlepower electric lamps. Besides, the chutes and other structures are outlined with electric light, and the lagoon and flower garden in the center are bordered with large posts, surmounted by incandescent lights in frosted globes, some of which are shown in the pictures. The name of the especial attraction within is designated by an elaborate electric sign on each building.

The scheme for decorative lighting forms a most brilliant night picture; although the principal illuminating feature at the park has not yet been completed and the accompanying illustrations hardly do justice to the real picture. In the center of the park is being finished an electric tower, which rises to a height of over 200 feet and on which are being placed, according to the management, about 70,000

ENTRANCE TO FIRE SHOW IN "WHITE CITY."

small incandescent lamps. The base of the tower is shown in one of the accompanying pictures.

The records kept on the grounds show that there are at present in service at the White City 124,575 incandescent lights. When the tower is completed, which is to be in a few days, and a few other smaller installations are made, there will be over 200,000 incandescent lamps on the ground, according to the same authority.

A contract was made with the Commonwealth Electric Company to supply the current for the park, and in view of the large amount of energy required it was decided to build a sub-station on the grounds. A building was erected at the center of the east side of the park, where three 1,000-kilowatt rotary converters have been installed and are now in operation. The building is large enough to house four 1,000-kilowatt units. A view of the interior of the sub-station is shown herewith. A 9,000-volt, three-phase, 25-cycle transmission line brings the power by way of the Fifty-sixth Street station from the Fisk Street power house of the

View Looking South Toward Electric Tower.

"Board Walk," West Side.

ELECTRICAL FEATURES OF THE "WHITE CITY," CHICAGO.

Commonwealth company. There are two sets of incoming feeders, one held in reserve, each consisting of three heavy lead-covered cables. These are placed underground nearly the entire distance. Provision is made for tying in the transmission system at the Harrison Street station, feeding from the latter through the Fifty-sixth Street plant in case of a breakdown.

Three three-phase, 1,100-kilowatt, air-cooled transformers supply the rotary converters at 180 volts per phase, which latter give 230-volt direct current for supplying a 115-230-volt three-wire direct-current system. Any slight unbalancing of the three-wire system is taken care of by an arrangement which is usual in the Commonwealth company's sub-stations, by which the alternating-current ends of the rotary converters are star-connected with grounded neutral, and this neutral is connected to the neutral of the three-wire direct-current system. Any unbalanced current in the direct-current system is thus fed back into the neutral of the alternating-current side. A motor-generator set having a 125-horsepower induction motor and a nine-kilowatt generator is used for starting the rotary converters. The rotaries, which are driven by induction motors, if thrown on the system suddenly, would take sufficient current seriously to disturb the voltage. Therefore, the small motor-generator set is used, the direct-current side of this set feeding into the direct-current side of each rotary and driving it as a motor. When the rotary is up to speed it may then be thrown onto the line and not seriously disturb the voltage.

The distributing system for lighting embodies several distributing centers in various parts of the grounds which derive their supply from 14 main feeders. These main feeders are carried under the "Board Walk" to the distribution centers. They are all heavy lead-covered cable ranging from 500,000 to 2,000,000 circular mils.

The main switchboard in the sub-station is shown in the picture; it has 15 panels. The first panel is blank, and then follow in order four feeder panels, three meter panels, two rotary-converter panels, one blank, one station panel, another rotary-converter panel, a blank and a motor-generator panel.

One set of feeders goes to each of the distributing centers, being connected with three large copper bus bars mounted on slate with eight sub-feeder Noark fuse blocks. From each of the fuse blocks feeders are carried to the different buildings, each of which has a center of distribution both for interior and exterior lighting. At this point a main service switch is installed for each building, through which current is fed to the center of lighting where a cut-out cabinet is installed. The lighting is symmetrically divided and pole boxes are installed, to which all the branch circuits feed. There are from 20 to 35 circuits in each pole box. From each pole box two two-inch pipes are connected with the main cut-out cabinet, into which the circuits are connected with the cut-outs.

ROTARY-CONVERTER SUB-STATION AT "WHITE CITY."

For the outside lighting a three-quarter-inch conduit is run from the pole box, ending at the face of the building with a bushing. Two circuits of 14 or 12 duplex wire are pulled through the pipe. The outside decorative lighting ranges from 18 to 24 eight-candlepower lamps to each circuit. By running a three-quarter-inch pipe to a center and feeding one circuit each way a large amount of piping is saved.

The exterior lighting of the entire grounds can be thrown on at once or at each building separately. At the center of distribution in each building there is a throw-over switch which may be brought into service at a moment's notice. In case the main fuse blows in any building the lighting can be thrown over on extra set of feeders and thus avert any panic in case of emergency. In every building throughout the entire grounds, over every door, either entrance or exit, there is a red light which is connected separately from every other light in the building and used as an exit light. In wiring the White City 3,575,400 feet of wire has been used. It is all encased in iron pipe, which required a very large amount of piping.

SPIRAL ELECTRIC TOWER. THE "WHITE CITY."

The electrical construction and wiring at the White City, which was done under the supervision of Mr. H. B. Wild, assisted by his brother, Mr. J. M. Wild, was accompanied by many inconveniences. There were no plans for the electrical end of the work at all, and the work had to be laid out and roughed in as the work on the buildings progressed. On November 1, 1904, Mr. Wild was given the plans showing the architectural designs and front elevation of a number of the buildings, and the specifications for the first material were written, the order going to the Chicago Edison Company. This company later furnished all the material used in the electrical construction. On November 9th, 10 wiremen were started to work, the number being increased to 25 and later 50 men during the winter. As the construction of the buildings progressed the centers of distribution and branch circuits were laid out, and when the heavy lead and rubber-covered cables arrived a force of 40 men was put to work getting them in place. As the day for opening the park drew near it was necessary to increase the force of men in each building to complete the distributing system on time. This, however, was done under the able supervision of these two young men, and a lighting system which has met the approval of the city inspection department and the Chicago underwriters has been the result. Mr. G. H. French was the electrical engineer for the White City Construction Company.

The park is very popular with the public and the grounds are well filled every pleasant afternoon and evening.

Besides the lighting, current is required to operate 31 direct-current motors, ranging from three to 50 horsepower, which are used for many purposes about the grounds. All the attractions requiring power are operated by electric motors. The motors are supplied from the interior lighting mains.

Electricity is put to many novel uses at some of the concessions, the electric theater and the mechanical exhibition being the principal ones in this respect. At "Hereafter" and "Under and Over the Sea," striking illusions are produced by the aid of electric light. At the fire show there is a real street railway, but the power for the one car on this line is furnished from a street-railway power house outside the grounds.

Electrical Exports for May.

Electrical exports from the United States for the month of May, 1905, amounted to a total value of $1,237,394. The value of similar exports for the corresponding month last year was $810,958. A good increase is shown in the export both of electrical appliances and electrical machinery, the former including telegraph and telephone instruments. A comparison of the figures gives the following results: Electrical appliances—May, 1904, $292,997; May, 1905, $430,692. Electrical machinery—May, 1904, $517,961; May, 1905, $806,702. For the 11 months ended with May, 1905, both electrical appliances and electrical machinery show a gain over a similar period ending with May, 1904, the former class of goods increasing from $4,486,647 to $4,490,818, and the latter from $5,047,268 to $6,661,676.

Considering electrical machinery only, the following list shows the principal buyers from the United States in the month of May and the value of the machinery they imported: Japan, $267,834; Mexico, $182,464; British North America, $148,841; Brazil, $62,897; United Kingdom, $33,815; France, $17,711; British Australasia, $15,620; British East Indies, $12,414; Germany, $11,880; Cuba, $7,153;

ILLUMINATION IN LAGOON AT "WHITE CITY."

Argentina, $5,813; Philippine Islands, $3,499; British Africa, $2,773; Central American States and British Honduras, $2,464.

A Tribute to the Firefly.

Theoretically considered, the various devices for producing artificial light are woefully inefficient. The fact has often been commented on by scientific men. In a recent series of lectures on "Flame" at the Royal Institution in London Sir James Dewar gave some figures to show the energy expended in the production of light. These figures are not particularly new and are perhaps to be regarded as approximate rather than exact, but they are of much interest. They are as follows:

	Percentage of Light.	Non-luminous Energy.
Candle	2	98
Oil	2	98
Coal gas	2	98
Incandescent lamp	3	97
Arc lamp	10	90
Magnesium lamp	15	85
Cuban firefly	99	1

Progress of the Technolexicon.

The compilation by the German Society of Engineers of the Technolexicon, or universal technical dictionary for translation purposes, in the English, German and French languages, is steadily progressing under the able guidance of Dr. Hubert Jansen, editor-in-chief. This work was begun in 1901, and there are now about 2,000 firms and individual collaborators at home and abroad assisting in the task. Up to the present time 2,700,000 word-cards have been collected. To these will be added the hundreds of thousands of cards that will result from the working-out of the original contributions not yet taken in hand. Dr. Jansen may be addressed at Berlin (N. W. 7), Dorotheenstrasse, 49.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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DATES AHEAD.

National Electrical Contractors' Association (fifth annual convention), Mechanics Hall, Boston, Mass., July 19th, 20th and 21st; electrical exhibition, July 15th to 22d.

Ohio Electric Light Association (annual convention), Hotel Victory, Put-in-Bay, August 16th to 18th.

International Association of Municipal Electricians (annual convention), Erie, Pa., August 23d, 24th and 25th.

Old Time Telegraphers' and Historical Association (annual meeting), New York city, August 29th to September 1st.

American Electrotherapeutic Association (annual meeting), Academy of Medicine, New York city, September 19th, 20th and 21st.

American Street Railway Association (annual convention), Bellevue-Stratford Hotel, Philadelphia, September 25th to 29th.

INCANDESCENT filament lamps of any sort have not been regarded as well adapted for street lighting in this country, but apparently the new tantalum lamp has been considered for this purpose in England. The London correspondent of the Western Electrician writes that the electrical engineer to the Sheffield corporation, in laying a scheme before his council for an extensive system of public street lighting, says that for side-street lighting his tests on tantalum lamps bear out the claims of the inventors to a remarkable degree. The principal claim made for the new lamp is economy in current consumption, but the first cost is high—a fact that must be taken into consideration where large numbers are needed for outside areas. For effective lighting—side-street or otherwise—it is difficult to see how the tantalum lamp can replace the arc light to advantage.

WHILE it is well to have the electric motor large enough to pull easily the load which it is expected to carry, Mr. E. P. Dillon of Colorado Springs emphasizes in his Denver convention paper on "Induction Losses" that, in alternating-current work, it is unwise to have them too large. The user may be persuaded by a salesman to buy a motor sufficiently large to handle his work for several years to come. The result, as the author points out, is that the customer has a motor that will never be loaded more than 50 or 75 per cent., and he suffers a loss of efficiency in his motor, besides loading up the transformers and other apparatus with wattless current. Mr. Dillon thinks that in some cases the companies might find it advantageous to offer some premium to their consumers for the maintenance of a high power factor, or embody a clause in contracts specifying that motors be installed whose rated capacities shall be within a certain percentage of their individual loads.

SPEED, regularity, convenience and other advantages are desirable in railroad travel, but the one thing that is of paramount importance is safety—safety for human life. It may be, as the railroad people say, that the recent terrible wreck on the Lake Shore near Cleveland would have occurred just the same if the train had been running on a comparatively slow schedule instead of a very fast one. But the accident did happen, and it ought never to have happened, either to a slow train or to a fast one. And if the train had been going at a more moderate rate of speed, perhaps the accident would not have been such a bad one. At any rate, if it prove necessary to patrol the track with watchers stationed half a mile apart, the railroad companies should take suitable precautions to prevent accidents. The men who have in charge the lives of the traveling public should be clear-headed, trustworthy men of good judgment, in good health, fairly paid and given sufficient resting time so that they will be keenly alert while on duty. The human element is most important, and weaknesses in it are probably responsible for most of the railroad accidents. The equipment, too, it goes without saying, should be the best obtainable. Railroad managers must not permit commercial rivalry to make them forget for a moment that their very highest duty is to insure by every means in their power the safety of the men, women and children who ride on their trains.

THE DIFFERENCE between American and British practice in incandescent lighting is well brought out in the paper recently read by John W. Howell at the convention of the American Institute of Electrical Engineers in Asheville, N. C., last month, and entitled "Comments on Remarks Made by Col. R. E. B. Crompton before the International Electrical Congress at St. Louis." An abstract of this interesting paper appears elsewhere in this issue. The largest cities in England have now practically all adopted the 220-volt system, which was not done without a struggle. Colonel Crompton remarked that with present development of the 220-volt lamp very little disadvantage from inferior efficiency can be discerned. This remark Mr. Howell construes as indicating one of three things—either that English 220-volt lamps are much better than our own; that English 110-volt lamps are inferior to those in this country, or else that there are conditions governing the choice of lamps in England other than the difference in quality of the two types. Seeking information on these points, Mr. Howell made a series of comparative tests of English and American lamps, and these tests were made the basis of his paper. The result of these tests led him to believe that English engineers generally have a lack of information on the subject of performance and quality of lamps, and that the people continue to use lamps of poorly rated voltage and candlepower. In this country lamp consumers buy their lamps on close specifications, and make tests to see that these specifications are fulfilled. Also, manufacturers here must mark on each lamp plainly its volts and candlepower. If these customs prevailed in England, it would be impossible there for manufacturers to sell such poorly rated lamps as were found in some of the tests.

PROF. JOHN PERRY of the Royal College of Science in London, much like his sprightly compatriot, Bernard Shaw, has no overweening respect for tradition or any rooted belief that a seeming preponderance of popular opinion must necessarily be right. This independence of thought he has recently demonstrated anew in an account of last year's "circular tour" of foreign electrical engineers in the United States, in which he participated. Unlike many other British observers, he is not unreserved in his praise of American industrial processes. Speaking in general terms, he considers that the American engineer has better opportunities than his English contemporary, but is not so well educated. Here are some extracts from his recent article which will give an idea of his views:

"In America there is more chance for an inventor, for a clever workman; everybody welcomes a new thing, more systematic ways of doing old things. This atmosphere of discontent and of irreverence ought to produce far greater effects than it has done, but what can the most exhilarating atmosphere do upon badly educated men? It seemed to me that the best work in America was being done by men born and educated in England."

"America has gone ahead too fast; with her, electricity had very little competition with gas and other older systems, and as a result she has been much less cautious and economical than we in all sorts of ways. I think that we have been too cautious; we are too much afraid to try new ways of working. When a system is working well, we discourage the man who wants to upset it, even if we see that he might improve it."

"On the whole, however, things have been made too easy for the American man. Agricultural and mining wealth of incalculable value have made it easy for any poor boy of energy to become rich. Consequently, boys and men are not educated so well as European boys. There are good school buildings, but poor teachers. In both primary and secondary schools small salaries are given, which command in most cases the services of women only. Millions are spent in bricks and mortar and apparatus in colleges, but the standard salary seems to be that of a tram-car conductor. The doctrine, 'One man is as good as another,' may be right enough from some points of view, but it has led to the most slipshod superficial kind of education that the world has ever seen. An electrician's scientific knowledge is just enough for his needs, and he is provided with this by a system of what is called technical or engineering education, altogether different from anything seen in England. In England we have the notion that if a man wishes to hit a target he must aim higher than the target. But the American has shown in the past such a power of quickly correcting widespread abuses that this need not be regarded as more than a temporary phenomenon."

Criticism is more helpful than indiscriminate praise, and in this light we have to thank Professor Perry for pointing out some of our faults. There is undoubtedly an element of truth in his observations about our "slipshod, superficial kind of education," but it is to be remembered that in this country the number of material problems pressing for immediate solution in the rapid development of the country has been large. There has seemed to be little time to devote to abstract reasoning if the railroads were to be built, the agricultural resources were to be utilized, the minerals taken from the ground and prepared for use, various new kinds of machinery designed, and many industries, including that utilizing electricity, established. But we believe that in no other nation is elementary education so widely diffused; that nowhere else is education more highly prized, and that our specialists' education is not so superficial as Professor Perry, in his flying trips, has been led to believe.

The Application of Electricity as a Motive Power Under Steam-railroad Conditions.

By Arthur Jobson.

A large amount of attention, either directly or indirectly, is at present being given to the question of the application of electricity as a motive power under the existing steam-railroad conditions. There is probably no single question before the electrical engineer of today which is of more importance, and which presents more interesting features for discussion. Its successful development means a vastly wider field of work for the electrical engineer, with scarcely any corresponding decrease in the field of the mechanical engineer. For should the electric locomotive supersede the steam locomotive, as is now safely predicted, the change would result in a combination of a number of individual power units into large units supplying an equal amount of power under different conditions. These larger power units would necessarily be equipped with prime movers, boilers, etc., all of which comes directly within the field of the mechanical engineer.

When one attempts to consider the question in all its phases, either with regard to the present railroad conditions or with regard to those conditions which it is naturally assumed would be brought about as a result of the change, it becomes extremely complicated. Yet it is possible to arrive at some definite general conclusions, which is all that will be attempted in this paper.

With but few exceptions, it is the tendency of every industry which develops along commercial lines to produce a maximum output with a minimum input, or, as it might be better expressed, to increase in utility as the development proceeds. This utility is always increased, in productive capacity at least, by a combination of small units into large ones. After the combination has taken place it becomes a question of making the new conditions, which are chiefly secondary in their nature, conform with the old ones in such a way that the productive capacity of the new system as a whole is equal to or greater than that of the old one. Otherwise the change would not be made, or if it were made and a loss resulted due directly to the adoption of the new system, the old one would prevail.

The production and transformation of energy is no exception to this general rule. It is well known that steam boilers combined in large units are more efficient than the single units themselves if the combination is kept within certain limits. The same is true with steam engines, as it is with any piece of apparatus or mechanism used primarily for developing energy and converting it into a form which may be utilized. It is evident, then, that in the production of power, and during the process of its conversion into mechanical power by a prime mover, a saving would result should the electric system for railways supersede the one now in use. For, as already mentioned, the steam locomotive, with its comparatively inefficient boiler and engine, would be replaced by large power stations containing highly efficient steam boilers and prime movers as a direct result of the adoption of the electric system.

But the increased efficiency of the electric system, however, cannot, from the nature of the conditions themselves, be considered to extend farther than from the energy developed in the coal consumed to that given off by the prime mover. For this increase in efficiency has resulted wholly in a direct change from individual units to a combination of units, which is not affected by the electric part of the system. It now becomes necessary to consider the transmission of the power developed by the prime mover to the point where it is to be utilized in running the locomotive. This transmission requires a transformation of the mechanical energy given off by the prime mover into electrical energy, and then, after it is transmitted it must be retransformed into mechanical energy before it can be used. It will be seen that this requirement is the fundamental principle underlying the opposition to the change, for it is evident that each of these transformations which are not required by the steam locomotive will result in a loss of energy. This loss must be partly, if not wholly, offset by the gain in energy due to the combination of power units already mentioned.

The steam locomotive utilizes its power directly at the place where it is developed, without the extra transformations and transmission required by the electric locomotive. This is a principle underlying the nature of the conditions themselves which cannot be overcome, and which is evidently a strong point in favor of the steam locomotive. In the steam locomotive only two primary losses need be considered; namely, those of the boiler and those of the engine. But with the electric locomotive these losses must not only also be considered, but others in conjunction with them, brought about by changing the mechanical energy of the prime mover at the power station into electrical energy, transmitting it, and then going through a similar change in the reverse order, as already pointed out.

A clearer idea of the relations between the two systems may be obtained by expressing them as follows:

Let A = efficiency of the engine of one of the best types of steam locomotives.

Let B = efficiency of the boiler of the same locomotive. The first is to include all the losses from the power given off at the drivers of the locomotive to the indicated horsepower of the engine. The second is to include all the losses from the indicated horsepower of the engine to the power developed from the coal consumed on the boiler grates. It is evident that the product of these two ratios will represent the efficiency of the locomotive as a unit.

A like relation may be obtained for the electric locomotive by taking into account the source of its power and considering the whole system as a unit. First, let it is be assumed that a single prime mover at the power station develops enough power to operate 10 electric locomotives, the rated horsepower of each being the same as the steam locomotive just considered. Then:

Let C = the ratio of the power given off at the drivers of these locomotives to the indicated horsepower of the prime mover at the station..

Let D = the ratio of the indicated horsepower of the prime mover to the power developed on the grates of the boiler (or boilers) which supply the steam for the prime mover. As before, the first is to include all the losses from the power given off at the drivers of the electric locomotives to the indicated horsepower of the prime mover. This will include the losses in the motors, transmission line, sub-station apparatus, generator, prime mover, etc. The second will include the losses as indicated; namely, those from the indicated horsepower of the prime mover to the power developed on the boiler grates.

It is evident that the product of these two ratios will represent the efficiency of the electric system as a unit. Hence, with but few minor exceptions, if no power is to be lost by substituting the electric locomotive for the steam locomotive, the product of the first two ratios should be equal to the product of the last two. Or $AB = CD$.

From this we get $\frac{A}{C} = \frac{D}{B}$. Since D represents practically the boiler efficiency in the electric system, and B the efficiency of a single locomotive boiler, it is evident, for reasons already pointed out, that the first will always be greater than the second; hence the ratio $\frac{D}{B}$ will be greater than one.

Within practical limits it may be given the value 1.35. Giving it this value we have $\frac{A}{C} = 1.35$, or $C = \frac{A}{1.35}$. A is the efficiency of the locomotive engine under consideration. Giving this quantity a value of 75 per cent., we have for C a value of approximately 55½ per cent., which is the combined efficiency of the electrical equipment and prime mover included. Assuming the efficiency of the prime mover to be 90 per cent., and taking this out of the 55½ per cent., the result is about 60 per cent., which represents the combined efficiency of the electrical equipment alone. Hence, with the assumed values for A, $\frac{D}{B}$, and the efficiency of the prime mover, 60 per cent. represents the efficiency below which the combined efficiencies of the motors, transmission line, generator and sub-station apparatus must not fall if no loss of power is to result in adopting electricity as a motive power for railroads.

No attempt has been made so far to discuss the practical side of the question, which is really the difficult one. But the general theoretical conclusions arrived at will form an interesting basis upon which to work. They show approximately the limits between which the electrical engineer must confine himself. The efficiency of the electrical equipment as a unit may drop quite a good deal below the derived value of 60 per cent., and yet a saving in power result over the steam system.

A case in point is represented by the fact that the steam locomotive, in its runs, must carry a supply of fuel and water about with it, which is not necessary in the case of the electric locomotive. The tractive effort required to draw this fuel and water supply amounts to an average of from three to five per cent. of the total tractive effort put forth by the locomotive in hauling its train. It is evident that this is a complete loss, and would have a direct bearing upon reducing the efficiency of the locomotive as a unit. Furthermore, no fireman would be required on the electric locomotive, which is another feature that would allow its power efficiency to drop slightly below the limit in value derived, and make the electric system operate economically as compared with the steam system, since the efficiency from an economic point of view has been slightly raised.

These are practical points, which, when considered, modify to a certain extent the general conclusions already reached. Yet they are chiefly secondary in their nature, being brought about by the primary changes which have taken place. There are three phases of the question which it has been intended to make especially clear: (a) The advantage which the steam locomotive has over the electric locomotive because of the fact that the former utilizes its power at the place where it is developed without the extra transformations required by the electric locomotive. (b) The advantage in the electric system of combining the comparatively low-efficient locomotive boiler and engine in large units. (c) That the comparative high efficiency of these large units is largely offset by the loss in the electric equipment required to transfer the power from the prime mover to the locomotive. The 60 per cent. efficiency derived for the electrical equipment would be represented by 100 per cent. in the steam system. On the other hand, when the two systems are compared with regard to their respective mechanical efficiencies, an advantage would be shown in favor of the electric system.

Exhibits for Street-railway Convention.

A feature which will receive much attention at the meeting of the American Street Railway Association to be held in Philadelphia, September 25th to 30th inclusive, will be the exhibits of the manufacturers. The South Pavilion of the Philadelphia Museums and an adjoining building of larger area have been selected as exhibition halls, and they are admirably suited for that purpose. They have about 75,000 square feet of floor space, are well lighted and ventilated, and, being located on Thirty-fourth Street, near South Street, within 15 minutes of the City Hall, are easily accessible. They afford excellent facilities for shipping, having a switch track (Pennsylvania Railroad) which enters the buildings and 500 feet of track under cover. There is also ample room outside the buildings for outdoor exhibits, with two railroad tracks, one 600 feet long and the other 400 feet long, and arrangements can easily be made for purchase of such electric power as may be necessary for exhibits. The reservation of space for exhibition purposes is restricted to members of the American Street Railway Manufacturers' Association, the membership fee, which is $35 a year, including the privilege of floor space. The secretary of this association is George Keegan, 13-21 Park Row, New York city.

Pacific Coast Association in Session.

Under date of June 30th the San Francisco correspondent of the Western Electrician writes as follows: "The Pacific Coast Electrical Transmission Association and the Pacific Coast electrical engineers are now in convention at the Lewis and Clark Exposition grounds, Portland, Ore. On June 29th the following-named temporary officers were elected: President, George W. Dickie of San Francisco; secretary, Wilmar Roberts of Seattle, Wash; executive committee, Samuel Reid of Portland, Ore., George P. Low of San Francisco, Cal., and Milmore Roberts of Seattle, Wash."

Municipal Operation of Light Plant in Monroe, Mich., to Be Abandoned.

It was mentioned in the Western Electrician of June 17th that the city of Monroe, Mich., was thinking seriously of abandoning the operation of its municipal lighting plant, several propositions from private concerns having been received to buy or lease the plant. The city has now decided definitely to do this, and sealed proposals are now invited for the purchase of the plant or its lease for a term of years. Bids are to be filed with the city clerk on or before July 11th.

QUESTIONS AND ANSWERS.

Current Transformation for Bell Work.

In the Western Electrician of May 27th a subscriber desired to know how to make a transformer that will change alternating into direct current for the purpose of ringing a system of electric bells in his factory. This question was answered at the time, but Frank W. Cerny of Mesa, Ariz., now writes explaining a method whereby the ringing may be accomplished without transforming.

ANSWER.

If the alternating current referred to is 60-cycle or less, there is no need to change to direct current to ring the bells. If the contact make-and-break is cut out, and connection is made direct to the coil terminals, adjusting the striker close to the gong, the bells will ring very well. Of course, enough resistance must be inserted in series with the bell system to give the proper voltage at the bell terminals. The gentleman from Arizona says further: "I have a bell with seven-inch gong, coils wound with 10 ohms of No. 27 D. C. C. wire; in series with this I use one 16-candlepower 115-volt lamp on a 115-volt 60-cycle circuit. This bell is operated by a 1,000-ohm relay on a party-telephone line. It rings loud enough to be heard all over a noisy power house.

Copper Plating.

A subscriber from Boise, Idaho, wishes to know how copper plating is done.

ANSWER.

Before the plating operation is begun the work must be carefully prepared to take on the deposit. If the work is of a regular surface, permitting grinding and buffing, this method is the best. The work should be ground down to as near a smooth surface as possibile, by means of emery and pumice polishing wheels, and then finished upon a buffing machine at a high speed until a perfectly bright and smooth surface is procured. It should be remembered that the least scratch or irregularity upon the surface is magnified by the plating process. When the polishing is finished every particle of grease must be removed from the surface, and this is preferably done by boiling in a hot solution of potash in water. It is then thoroughly brushed with powdered pumice stone and water until clean water will run off and show no traces of grease. Care should be taken not to touch the surface to be plated with the fingers, as the grease thus left upon the surface will be very apt to cause a poor deposit at that point. After all this has been done a fine wire is twisted about some portion of the object which is not to be plated, and it is dipped in a pickling solution made in the proportion of one gallon of muriatic acid, one gallon of nitric acid, one quart of water and a handful of salt.

Many articles are, however, of a shape that does not allow of the grinding process, and therefore must be chemically cleaned. This is done by the use of various dips and pickling solutions. Such a dip, for iron or steel, and called the "black pickle," is made by mixing in a stone jar one part of sulphuric acid and 15 parts of water. Hydrochloric acid may be substituted for the sulphuric if desired. The work should first be dipped in boiling lye and then rinsed in boiling water.

Having prepared the work for plating, it is hung as the cathode in a tank containing the plating solution, and one of the best solutions for this purpose is the cyanide-copper solution. This is made by mixing together five ounces of carbonate of copper, two ounces of carbonate of potash and 10 ounces of cyanide of potassium and one gallon of water. The anode used should be of electrolytic or deposited copper, as it gives off copper more freely than the rolled plates. If too much cyanide is in the bath hydrogen will be given off from the objects to be coated, but no copper will be deposited. The remedy is to add carbonate of copper, dissolved in water with a little cyanide, until the difficulty is overcome.

For coppering before nickling, the bath described will not give the best results, the deposits not being thick enough to buff down. To make a solution for this purpose fill the tank two-thirds full of water; then dissolve in a separate vessel 10 ounces of chemically pure cyanide to each gallon of solution, and when dissolved add to the water in the tank. In another vessel dissolve thoroughly five ounces per gallon of solution of carbonate of copper; then add the carbonate to the solution in the tank. Finally, add two ounces of carbonate of potash for each gallon of solution, dissolved separately or not. Then make the dynamo or battery connections, put in the anodes and try a piece of work, hanging it as the cathode in the solution. If gas is emitted add more carbonate of copper. Should the deposit blister, the current is too strong. The solution should stand at 12° to 15° Baumé. When conditions are right the work may be left in the tank several hours without showing signs of blistering.

The current density is an important factor in electrodeposition, and it varies with the nature of the deposit required. For ordinary purposes a current density of nine amperes per square foot of positive surface is most satisfactory. For an ordinary vat, the resistance of the electrolyte will be such that a pressure of four to six volts will be required; but a dynamo or battery giving 10 volts will cover all cases.

Transformer Operation.

The same correspondent wishes to know if it is necessary to raise the regulating weight of a General Electric constant-current transformer in throwing the load on. The transformer is carrying full load and is of 45-kilowatt capacity.

ANSWER.

It is best in throwing the load on, especially where the transformer is operated at full capacity, to raise the weight a slight amount, so that the load will come on gradually and smoothly, without the sudden surge that might occur if the weight were not raised.

Transformers in Direct-current Plant.

A reader of the Western Electrician in California writes for information in relation to a description of the plant of the Museum of Natural History in New York, which appeared in the issue of June 10th. The plant is a direct-current one and the statement was made that the transformerers connected with the 250-kilowatt generators have an overload capacity of 25 per cent. He wishes to know how it is that transformers are used in a direct-current plant.

ANSWER.

While it is not incorrect to describe the devices mentioned as "transformers," it would be better, perhaps, to call them by the usual name, "compensators." Their object is to keep the neutral wire at constant potential. There are four of these compensators, and they differ from transformers in having only one winding. They will balance any inequality of load on the neutral wire to the extent of 25 per cent., and the generators themselves will take care of an overload of 25 per cent.

Operating Troubles in Small Stations.

A reader of the Western Electrician in Montana writes that his company was obliged to install temporarily some water rheostats to control series alternating-current lamps in advance of the receipt of regulators ordered for this purpose. The rheostats, which permanently grounded one side of the alternator, were in service a little over a month. Shortly after they were installed one side of a competing company's line became grounded during a heavy rain and wind storm by a tree, which itself was badly burned. This ground did not blow any fuses, but the alternators in the two competing companies' plants immediately commenced to "buck" and every lamp in town to go out and relight about 80 times a minute. The correspondent, being with a new company, and wishing to make as good a showing as possible, tried to make the competing company's plant shut down, but was obliged finally to shut down his own plant. Since then the two companies have consolidated, and the two particular machines which "bucked" are run in synchronism. He is now of the opinion that on the particular occasion above referred to, it might have been possible when the ground was on to have brought the two plants into synchronism and kept them in service, and asks how a similar difficulty might be overcome under the same conditions when no synchronizing instruments or lamps were wired up.

ANSWER.

From the correspondent's letter, one or two conditions must have existed. First, the competing company was also running with one side permanently grounded, which grounded sides might be designated A.

Second, a cross (good contact) may have existed between two wires, one of which came from each plant, which resulted in one side being common to the two plants which might be called B.

In the second case the correspondent's company already having one side permanently grounded, it only remained for the competing company to have an accidental ground on side B in order to put the machines in parallel, which machines, if not in synchronism, would blow the fuses or "buck." In the first case the two plants may have been put in parallel by the wet tree under conditions where the resistance between the competing and his own company's wire was very much less than the resistance to ground.

Under existing conditions, it might have been possible to have kept the plant running by slowing down or speeding up the machines, as might have been necessary to bring the correspondent's plant in synchronism with that of the competing company, providing that the speed and voltage of the two machines was properly maintained. In the absence of synchronizing instruments or lamps and potential transformers, as was the case, the only alternative would have been to "cut and try," raising and lowering the speed and voltage until the blinking of lamps became less frequent and, possibly, with some good luck, cease altogether in the end.

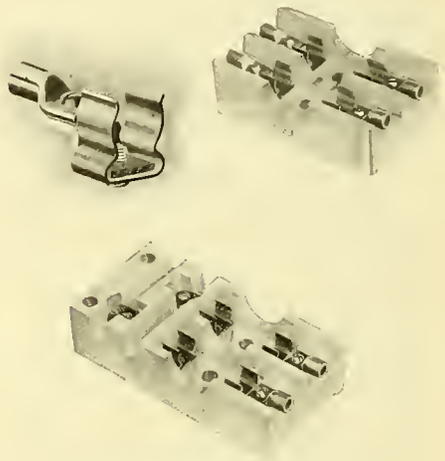
New Porcelain Specialties.

For over a year and a half the Peru Electric Manufacturing Company of Peru, Ind., has been busily engaged in developing a line of porcelain that shall not only meet the National Code standard but also possess a number of novel and improved features that would win it a place in the first rank with the contractors and jobbers, and in fact all those desirous of installing the most improved porcelain fixtures.

One of the specialties on which the company has spent considerable time and trouble is the Peru National Code Standard cartridge fuse block.

The fuse block is a very simple one, but is at the same time substantial and convenient. Fig. 1 shows the terminal, which is the metallic portion of the block. Attached to this is the tubular lug into which

Fig. 1. Fig. 2.



NEW PORCELAIN SPECIALTIES.

the wire or cable is soldered. A special feature of the block lies in the fact that these terminals are in effect practically countersunk in the porcelain; that is, the block is so designed that the terminals set back from the edge and the porcelain walls extend above them. Thus the possibility of short-circuit is reduced to a minimum. The clips are of the best quality of spring bronze and are so formed as to make the best contact with the fuse.

Fig. 2 is a two-wire main fuse block, while Fig. 3 is a two-wire single-branch for 30 to 60 amperes. Other styles include a block for a two-wire double branch and a block used where a crossover is required, the latter coming in sizes up to 30 amperes. Peru blocks will take any National Code standard fuses of corresponding capacity.

National Association of Electrical Contractors.

The fifth annual convention of the National Association of Electrical Contractors will be held in Boston, as already stated, on July 19th, 20th and 21st. In connetcion with it there will be an electrical exhibition in Mechanics' Building, beginning Saturday evening, July 15th, and ending a week later. There will be an open session of the convention on Wednesday, July 19th, with addresses by Mayor Collins, E. McCleary of Detroit, Charles L. Eidlitz of New York, A. L. Gorman of New York, F. E. Cabot of Boston, P. J. Kennedy of Boston, and others. There will be executive sessions on succeeding days and several entertainment features. A number of manufacturers and dealers have secured space for the exhibition. One feature of the latter will be a demonstration of the harmlessness of high-frequency currents by Earle L. Ovington.

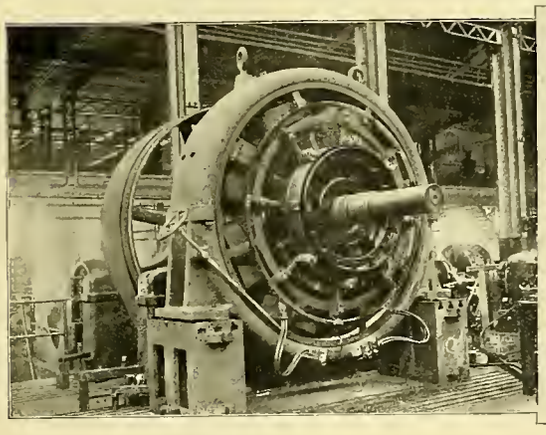
The Missouri River Power Company of Helena, Mont., is about to begin the construction of another dam across the river to develop electrical power for Helena and Butte. It will cost $1,000,000, it is said.

Direct-current Engine-type Generators.

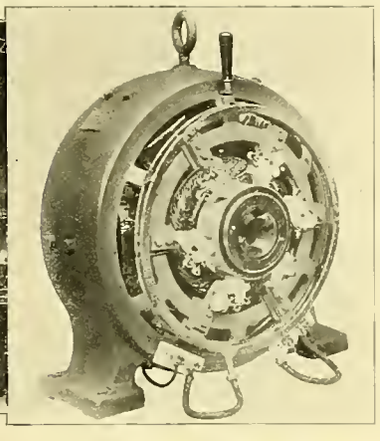
An engine-type generator differs from a self-contained or belted-type machine in that its armature is carried by the shaft of the engine or an extension of the shaft instead of having its own shaft. But one bearing is thus required in addition to those on the engine, and the space occupied by such a unit is less than that for any other installation of equal output.

Such a line of machines embodying the latest improvements and designed with especial attention to accessibility, performance and low-running temperature is manufactured by the Westinghouse Electric and Manufacturing Company. The arrangement of brush-holder rings and commutator, the position of the equalizer rings, the use of coils, or they may be designed for a higher percentage as may be required for special cases.

The armature core consists of sheet-steel stampings, built up on a spider, which also carries the commutator. The armature may be drawn from the shaft if necessary without disturbing the commutator or windings. Liberal provisions for ventilation are provided, as air spaces are placed at short intervals and extra spaces are provided between the outer laminations and the end plates. The coils are machine-formed and are interchangeable. By placing fiber wedges in V-shaped grooves near the top of the slots the coils are held in place without the use of band wires. The commutators are constructed of hard-drawn copper of the highest conductivity and carefully insulated, so that a smooth



350-Kilowatt Machine.

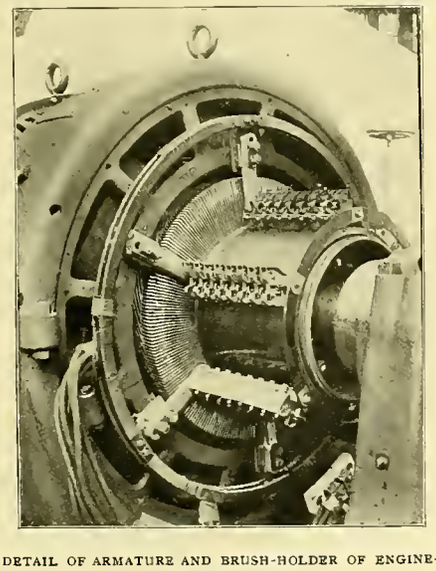


Six-kilowatt Machine, 26⅞ Inches High.

DIRECT-CURRENT ENGINE-TYPE GENERATORS.

retaining wedges in the armature slots, the arrangement of series field-coil connections, removable pole-pieces and brush-holder shifting device contribute to the best performance and the utmost simplicity in operation.

The stationary part of these generators is a circular yoke of cast-iron carrying inwardly projecting poles, on which are placed the field windings. For capacities from 25 kilowatts up to and including 125 kilowatts the standard construction is a vertically split frame, while for larger sizes the horizontal division is regularly built. Machines below 25 kilowatts have solid frames. Generators of any size can be built with either the vertical or horizontal division if circumstances require it. The pole-pieces are built up of laminations of soft steel, carefully annealed by a special process and riveted



DETAIL OF ARMATURE AND BRUSH-HOLDER OF ENGINE-TYPE GENERATOR.

together under pressure, and held in place by bolts which pass through the yoke and are fastened by lock washers on the outside. The bolted-in construction allows the removal of any one of the field coils with its pole without disturbing any other part of the machine. Spreading pole tips serve the double purpose of giving an excellent commutating field under the pole tips and of furnishing a support for the field coils.

The shunt and series coils are separately wound, with an air space provided between them. The series coils are made of forged copper conductors of rectangular section, and the shunt coils are machine wound. These generators are usually over-compounded for an increase in potential of about 10 per cent. at the terminals from no load to full load, but may be adjusted for lower percentage of compounding by means of a shunt to the series wearing surface is secured with an entire absence of sparking.

The brush-holder mechanism is carried by brackets mounted on a rocker-ring concentric with and carried on a machine seat on the front end of the field frame. No part of the supporting ring projects over the commutator face, thus leaving the brush-holders and commutator entirely clear of obstructions and readily accessible at any point. Every machine is so arranged that the rocker-ring shifting device may be placed on either side. The transmission of current through the springs and the consequent heating and variation in pressure are eliminated by copper shunts connected directly from a clamp on each brush to the solid part of the holder. Ample means are provided for adjustment as the commutator wears, and for changing the spring tension on the brushes

An important feature in connection with these generators is that all brushes of the same polarity are maintained at the same potential. Much trouble has frequently been experienced in the operation of large multipolar direct-current machines with parallel-wound armatures, owing to the difficulty of securing the same magnetic strength in all the poles. Sometimes the potential generated in the conductors under one pole exceeds or is less than that generated in conductors similarly situated under another pole of the same polarity, the result being a difference of potential between brushes of similar polarity. Troubles caused by currents flowing from one brush to another or from one section of the armature winding to another, attended by annoying and wasteful heating of the conductors and sparking at the brushes, are eliminated by the following method of balancing:

In the larger machines with parallel armature windings the points in the armature winding which are normally of equal potential are connected by leads through which currents may pass from one section to others with which it is connected in parallel. These currents are alternating in character and lead or lag with reference to their respective electromotive forces, and thus magnetize or demagnetize the field magnets so as to produce automatically the necessary balance between them. The same troubles would result from the decentralization of the armature in a multiple winding, but are avoided by the system of balancing.

With the balanced magnetic circuits any heavy magnetic pull on one side of the armature, due to wear of the bearings, is prevented. The pull which may be exerted by one side of the field on a large armature, even if out of center by a small fraction of an inch, may become as high as several tons if this method of balancing is not used. Such an increased pull on the armature would result in the heating and rapid wearing of the bearings. By the above method of balancing the induction under all poles is maintained practically the same, causing the magnetic pull to be equal at all poles and preventing an unbalanced pull. This method of automatically balancing the magnetic circuits of parallel-wound direct-current machines is fully covered by patents owned by the Westinghouse company.

G. W. Smith & Co. of Bolivar, Mo., have sold out their stock of electrical goods.

Heavy Traction Problems in Electrical Engineering.

An instructive paper was read at the convention of the American Institute of Electrical Engineers in Asheville, N. C., on June 20th, by Mr. Carl L. de Muralt upon the subject of "Heavy Traction Problems in Electrical Engineering." In this paper the author considered the relative advantages presented by the various electric systems available, with a view to determine which, at the present state of the art, is best adapted to handle heavy traction on through lines. To do this he considered it essential to take an actual case, on which a detailed report was worked out some time ago, and to present the data obtained from the investigation in such form that conclusions may be drawn which will apply to similar cases.

The case taken considered a terminal point from which two lines run out: one division 175 miles long was a regular trunk-line system and the other branch an ore road 49 miles long. On the first division there were 16 stations and on the second, four. The traffic on the first division consisted of freight and passenger trains, and on the second of ore trains.

Four systems were seriously considered:

1. Continuous-current series motors on the locomotives, fed from synchronous-converter sub-stations along the line, which sub-stations receive three-phase alternating current from the power station.

2. Three-phase alternating-current induction motors on the locomotives, fed from three-phase transformer substations along the line, which receive three-phase alternating current from the power station.

3. Single-phase alternating-current motors on the locomotives, fed from single-phase transformer substations along the line, which receive either single-phase or polyphase alternating current from the power station.

4. Continuous-current driving motors, fed from motor-generators on the locomotives, the latter receiving single-phase alternating current from the power station, either direct or through transformer sub-stations along the line.

Numerical data were worked out for the first two of these schemes. The actual energy consumed by the trains was shown in a number of tables which were given in the paper. It was found there was not much difference between the two systems, as far as actual energy consumed was concerned. There was an appreciable difference in cost of delivering the energy to the trains, however. First of all, the contact line from which the current is collected by the moving trains cannot be of the same type for the two systems. The reason for this is mainly the limit in pressure imposed on the continuous-current system by the properties of continuous-current machinery. While it is possible to build alternating-current motors for practically and reasonable pressure, continuous-current motors have thus far been limited in most cases to a pressure in the neighborhood of 650 to 700 volts. This is not an absolute limit, however, and in the present instance a pressure of 1,000 volts was chosen, which would probably be found feasible for motors of the size under consideration.

Even at this pressure the current to be collected is very heavy. The express locomotives will require inputs of 1,450 kilowatts, the freight and ore locomotives, inputs of 1,600 kilowatts. At 1,000 volts this represents currents of 1,450 and 1,600 amperes, respectively, which would be still further increased by the inevitable drop in pressure. Such currents cannot be collected with safety from an overhead-trolley line, and recourse must be had to some heavier construction, either in the shape of a third rail at practically track level, or a similar rail suspended overhead over the center or the side of the track. With an alternating-current pressure of 5,000 volts in a three-phase system, the maximum current in one phase will be 185 amperes, which could readily be taken from a copper overhead line of the familiar construction.

The total cost of equipping the 233.5 miles of track with third rail was found to be $835,692, whereas, an overhead-trolley line would cost $559,556. The cost of sub-stations for the direct-current and alternating-current systems worked out to be $552,000 and $48,800, respectively.

The high-pressure transmission line may be the same in both cases. The greater amount of energy which has to be transmitted in the direct-current system, due to the greater losses in this system, will, of course, increase the drop in the transmission line to a certain extent. But a somewhat greater maximum drop is permissible in the direct-current system. The high-pressure line proposed for the railroad under consideration was estimated to cost a total of $679,860, which amount would allow for entirely separate poles for this line. Some might suggest using the poles of the contact line in the alternating-current system. But this seems open to objections, and it would appear to be advisable to make the transmission line entirely independent in either case, in order to secure the greatest possible safety against breakdown. The above amount therefore holds good for the continuous-current and the three-phase alternating-current system.

The cost of power stations for the two systems

was $725,000 for the continuous-current system and $580,000 for the three-phase system. The cost of operation in the case of the three-phase system is also much less.

Discussing the single-phase alternating-current system, the author pointed out that this system has an advantage over the three-phase system, in that it requires one single overhead conductor only, as compared with the two conductors necessary in a three-phase system. But, in the opinion of the writer, the single-phase alternating-current commutator motor, be it of the series, the repulsion or a compromise type, is not at all suitable for heavy traction work.

The torque of a single-phase motor is 30 per cent. smaller than that of a corresponding continuous-current motor, and it is not constant, but varies between a maximum and zero, with double the periodicity of the line current. The mean value of the torque is only half of the maximum torque when slipping wheels, which means that in cases like the above, where the tractive efforts required necessitate going to the limit of adhesion between wheels and track, a single-phase locomotive must have almost twice as much weight on drivers as either a continuous-current or a three-phase locomotive. It is true that this difference holds good only for motors mounted directly on the car axle, and it will be somewhat less if geared and spring-suspended motors are used.

The single-phase motor is restricted to a pressure at the commutator of hardly more than 200 volts. It has a lower inherent efficiency than either the continuous-current or the three-phase motor. Due to the low average flux density used, it will for the same output weigh probably 50 per cent. more than a corresponding direct-current motor.

Motor-generator locomotives using a combination of a high-speed single-phase alternating-current motor and a high-speed continuous-current generator, furnishing energy to continuous-current driving motors, with pressure control according to the Ward-Leonard system, Mr. de Muralt thinks are really more useful than is generally admitted. The question of weight, which is often urged against this system, is only relatively important and, while it would probably be out of the question to use this system for the propulsion of single cars at high speeds, yet it deserves careful attention whenever heavy trains have to be considered. As a matter of fact, it will be found that it is principally the speed desired, which decides the question whether motor-generator locomotives can be used to advantage or not.

Coming back again to the comparison of the three-phase and continuous-current motors, the weight is affected to a certain extent by design, the cost by some other considerations. Taking identical conditions and modern, careful design for both motors, then the three-phase motor will weigh only about 0.75 times as much as the continuous-current motor. This is partly due to the smaller losses in the three-phase motor, and partly to the fact that the distributed winding and the general construction of the three-phase motor allow it to to radiate heat with greater ease than is the case in the continuous-current motor where practically all the losses have their origin far from the radiating surface. In general, both iron and copper are distributed to better advantage in the three-phase motor. And, if the selling price of both motors is taken proportional to the cost of production, then the three-phase motor will certainly be cheaper than the continuous-current motor.

A continuous-current system will always have a higher power factor than an alternating-current system. But the power factor in no way influences the actual energy consumed. A low power factor simply increases the current flowing at any time by the addition of the so-called wattless current, and the current-carrying capacity of transformers, transmission line and generators will therefore have to be somewhat larger if the power factor is poor.

It will be difficult to reach general conclusions applicable to all possible cases. Yet it is safe to say the advantages of the three-phase alternating-current system may become somewhat less if the distances between stations are reduced and if trains are made lighter, while, on the other hand, heavier trains and longer runs between stations make the advantages of the three-phase system even more pronounced. And wherever there are any long grades, the three-phase system presents the special advantage of relieving the power station by the energy returned from the descending trains.

As regards traffic density, it may be said that the three-phase system is preferable for light traffic, on account of the smaller first cost of installation, and for congested traffic, because the constant speed of the induction motor will permit maintenance of a high-speed schedule, even under abnormal conditions.

The greatest advantage which can be secured in trunk-line operation by the use of electricity in place of steam, lies in the practically unlimited power which can be poured into an electric locomotive. This increased power can be used to haul far heavier trains than are now customary, up steeper grades and at higher speeds if desired. The technical characteristics of the three-phase alternating-current system are such as to make it preeminently suited for taking advantage of this situation, and its smaller cost of installation, with corresponding lower charges for interest, amortisation, etc., allow the railway company to reap the full benefit of the resulting greater economy of operation.

A 2.5-watt Incandescent Lamp.

A new line of high-candlepower incandescent lighting units just announced by the General Electric Company, signalizes an important development in incandescent lamps. This is nothing less than the production of the long-wished-for 2.5-watts-per-candle lamp, measured by present standards of horizontal candlepower reading, and with a life equal to the present standard 3.1-watts-per-candle lamp. This improvement in the art of incandescent-lamp manufacture, perhaps unequaled since the carbon-filament lamp became a commercial success, may mark a new era in the growth of incandescent lighting.

The actual gain, says the company, is 20 per cent. greater efficiency than is at present obtained from the highest efficiency incandescent lamps, on a basis of equal life. This improvement should materially assist central-station companies in competing with Welsbachs and other similar illuminants, as an advantage equivalent to 20 per cent. reduction in rates is thus gained.

The General Electric Company is developing these lamps first in the high-candlepower sizes, in units of 50 candlepower (horizontal candlepower rating) and higher, to meet the demand for large lighting units, supplementing its Meridian lamps in the field of general illumination between the arc and the ordinary incandescent lamp. Appreciating the large gain in lighting efficiency that may be secured by the use of properly designed reflectors, the company has designed a special line of Holophane Pagoda reflectors for use with the new high-candlepower units. These reflectors are of the well-known Holophane design, of prismatic glass, and when used with the lamps form a brilliant and highly efficient lighting combination of attractive appearance.

Two forms of reflectors are provided, the distributing, or "D" form, shown in Fig. 1, giving a lighting distribution similar to that from the Meridian lamp, as may be seen in the diagram, Fig. 2. This is the form of reflector for general use.

The other form of reflector is known as the concentrated, or "C" form, shown in Fig. 3, giving a concentrated distribution beneath the lamp, as outlined in diagram, Fig. 4. This form of reflector is suitable for use in long, narrow rooms with high ceilings, such as hallways, in window lighting, or wherever a concentration of light is desirable.

The lamps are at present supplied in three sizes, as described in the following table:

Type No.	Total Watts per Lamp.	Distributed Candlepower in Downward Direction with "D" Form of Reflector.	Concentrated Candlepower in Dowoward Direction with "C" Form of Reflector.
5.....	125	70 (See Curve D-1 Fig. 2)	120 (See Curve C-1 Fig. 4)
3.....	187½	105 (See Curve D-2 Fig. 2)	180 (See Curve C-2 Fig. 4)
4.....	250	140 (See Curve D-3 Fig. 2)	240 (See Curve C-3 Fig. 4)

The appearance of the lamp is enhanced by having the bulb frosted to within a short distance of the base. The lamps have larger bulbs than are at present used with standard lamps of similar candle power, and the life of the lamps is equal to that of the present standard 3.1-watts-per-candle lamps;

Fig. 1.

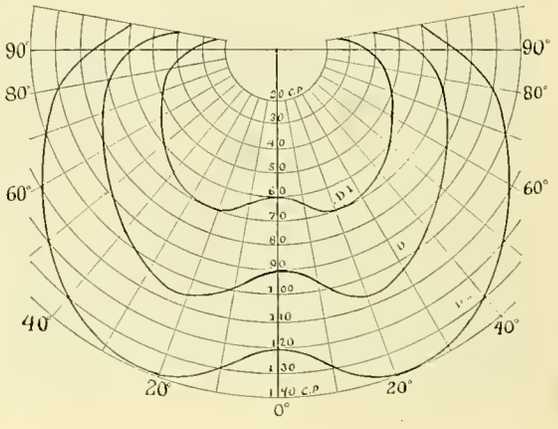


Fig. 2.

Fig. 3.

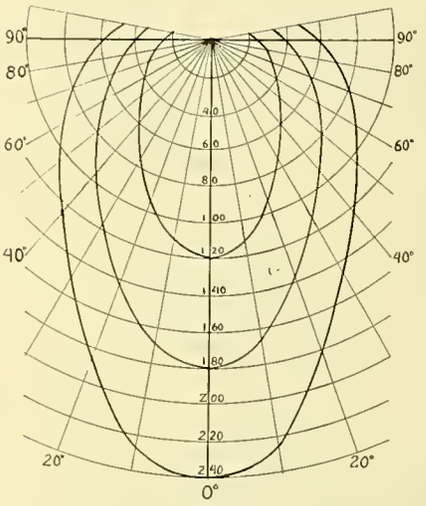


Fig. 4.

A 2.5-WATT INCANDESCENT LAMP.

As the investment cost is small, the company points out that these lamps can be used to marked advantage for general illumination in place of more expensive types of apparatus. A new form of shade holder has been devised by which the shades can be readily attached to, or detached from, the sockets.

New Works of the Allis-Chalmers Company.

Active preparations for the extension of the works of the Allis-Chalmers Company at West Allis, a suburb of Milwaukee, are being made. James Stewart & Co. of Pittsburg have been awarded the contract for acting as supervising engineers and managers of construction for the entire undertaking. The American Bridge Company of New York has secured the contract for the structural steel, erected in place, for three of the new buildings, a contract which calls for approximately 6,800 tons of steel. The Riter-Conley Manufacturing Company of Pittsburg has been awarded the contract for the structural steel, erected in place, for the foundry and pattern-storage buildings and erecting shops, comprising approximately 4,000 tons of steel. All the structural steel is to be delivered and erected within 23 weeks from the date of the signing of the contract, as the company expects to occupy its new works by or before next March.

Some idea of the size of the works when extended will be afforded by the fact that the company's present floor space at West Allis has a total area of 652,000 square feet, and the new extensions upon which work is now in progress, will add 861,000 square feet, or the present capacity will be more than doubled, making the total floor area at the West Allis works 1,513,000 square feet. The

plant will be capable of affording employment for 11,000 persons, thus bringing up the total number employed by the company, including those at Milwaukee, Chicago, Cincinnati and Scranton, to the aggregate of 18,000 persons.

Commercial Power.[1]

By P. E. Bellamy.

In preparing this report the committee addressed several members of the association who operate power plants, requesting them to furnish it a list of questions upon which it would be glad to receive information. These questions, with a few additional, were sent to the various members of the association, and the subject matter of this report is based upon the answers returned. It was the first intention of the committee to compile these replies in tabulated form, but their nature made this impossible. Owing to the fact that the questions covered both direct and alternating current in all three phases, few of the plants were able to answer all questions. The committee found that there were 18 plants in our association operating power service, of which 10 reported answers to the question.

A question of primary importance to us all is that of cost, and one which is at the same time the most difficult to answer. It is very easy for a merchant, and almost as easy for a manufacturer, to estimate the cost of placing his wares before the public, but with the central-station man it is entirely different. We could estimate the cost of producing current on the peak of our load, or at any other point, if one operates at that point alone, by adding our operating expenses to all of our fixed charges, but when we attempt to say just how much of these fixed charges shall be charged to our peak, and how much to our night load, and how much to the power load, we come to something that seems to be purely a matter of opinion, and something which in many plants is entirely disregarded. In order to learn what proportion of interest, depreciation and other fixed charges were charged by the various central stations to the power load, one question was asked with that end in view. Only three of the plants replied to this, one stating that they did not figure it so close, while the other two agreed in charging to the power load the proportion of fixed charges which the power load bears to the maximum station load. We quote from the answer received from Mr. Greene of Cedar Rapids as being the most complete. "We keep accounts so as to show investment in power house, boiler plant, engine plant and electric plant, thus giving the total investment in power house, real estate, buildings and equipment. We estimate what we think depreciation should be. Interest is calculated on the investment. Other fixed charges are proportioned to cost of generation on the basis that investment in power plant bears to total investment. The amount chargeable to the power circuit is that proportion above that its maximum load bears to maximum station load."

This question of cost is one of vital importance, and one to which we cannot give too much attention. It would seem from the answers returned that very few of the plants in the state know what their actual cost of power production is, and I have no doubt that many of us are furnishing some customers at an actual loss on the account of this ignorance.

One question was asked with a view of comparing the amount of work that could be done by machinery driven by an electric motor, with that done by small private gasoline or steam plants. Only a few answers were returned, but these would indicate that machinery driven by an electric motor was from 20 to 30 per cent. better than steam, and about 50 per cent. better than the better grades of gasoline engines.

With reference to the cheapest type of motor for the consumer to operate, interest, maintenance, depreciation and cost of current being considered, three plants answered, all of whom were in unison in specifying alternating-current motors. The Cedar Rapids plant recommended two or three phase, because the expense and first cost are about the same. Depreciation and maintenance are very much less. Iowa City reports two-phase, because more efficient and less cost of maintenance. Dubuque reports induction motor, because no brushes, no commutator, no burnouts, will stand more overload and are more efficient and economical than direct current.

The most desirous class of service was universally reported to be small units operating for long hours. Small units, because you are thereby enabled to get a much better price per kilowatt, with small proportional increase in service cost, and long hours, because fixed charges are no greater for long hours than for short-hour service.

No plant answered as to the ratio of profit between the lighting and power service, but all were united that the lighting service was the most profitable, the power service generally being furnished to assist in the all-day lighting service, and to utilize the idle machinery.

The average earnings per horsepower, with motor installed, ranged from $16 to $38.40 per horsepower per annum. The actual figures were $30, $16, $38.50, $38.74, $19.80, $24.

No one of the operators who answered considered it a good policy to make a flat rate on motors, to run a stated number of hours per day, unless a maximum meter was installed and service was for stated number of hours per day, under the control of the company. We all have had experiences and know how inconsiderate the average customer is, frequently allowing the motors or lights to operate when the same is not needed. A meter is the only just and equitable rate for all classes.

Considering motors of 25 horsepower and over, the rate for the same, with the minimum rate and average bill per month, was reported as follows:

Red Oak—A minimum rate of $3 a month for three horsepower and smaller; $1 per horsepower per month for all motors over three horsepower.

Cedar Rapids—We disregard the size of motors and go on maximum demand. The rate on 25-horsepower maximum demand would be 10 cents per kilowatt for first 880 kilowatts used in any month, and 3 cents per kilowatt for all additional current used in same month.

Waterloo—One dollar and fifty cents per horsepower minimum. Ten cents up to 30 kilowatts per horsepower. Two and one-half cents for all additional.

Dubuque—Five cents per kilowatt. Minimum, $1 per horsepower per month. Average bill, $1.65 per horsepower per month.

Mason City—Five cents per kilowatt up to $50 per month. Three cents for everything in excess of $50. Minimum rate, $1 per horsepower.

In reference to the most satisfactory direct-current meter, four stations reported that they had had no experience with anything but the Thomson or General Electric. Two others reported experience with both Thomson and Duncan, with a decided preference for the Duncan.

With reference to the most satisfactory alternating-current meter three report using the Westinghouse, two the General Electric and one the Fort Wayne exclusively, all giving satisfactory results.

With reference to meters for multiphase service, two stations report the best plan is to use two to three-phase meters, while two others report a better plan to use one single-phase and multiply the reading.

Multiphase motors do not seem to have been generally used in elevator service, but in the economy and general results are as satisfactory as direct current in general service. Davenport reports them very satisfactory, but hesitates to recommend them for elevator service. Waterloo reports them generally satisfactory, both for elevator and general service. They at present operate one 20-horsepower passenger elevator in an office building. Dubuque reports a preference for direct current for elevator service. The main objection to multiphase motors for elevator service seems to be in the starting torque. In reference to the economy and satisfaction of single-phase motors, as compared with direct-current, Davenport reports that where a special transformer is unnecessary they are equal to direct-current. Mason City reported them equal to direct-current in small units.

Comparing single-phase motors to polyphase, Davenport reports the polyphase preferable on account of the heavy starting current.

Waterloo uses the three-phase. Dubuque reports the multiphase preferable to the single-phase, while Mason City answers that the single-phase are equal to the multiphase.

Dubuque was the only plant having experience with induction motors operating them with variable speed, and reports them satisfactory on crane work.

No experience was reported with packing-house work, but compound-wound direct-current motors were recommended in preference to alternating-current. If necessary to use the latter, it was thought desirable to use some pulleys.

Discussion.

Austin Burt of Waterloo, Iowa, firmly believed in low rates for power business. Within reasonable limits the station can take on power customers at very low rates, provided it does not come on the peak.

George S. Carson, Iowa City: How can you get a power load without getting on the peak? Customers want the power at any time they wish. Unless there is a reasonable minimum charge you will have some customers who will use your power only as a convenience, bringing in no adequate income. I am strongly in favor of a reasonable, minimum charge to protect the stations.

Mr. Burt said that a day load was necessary, and it must be developed. He didn't believe in giving away current, but the power business should be encouraged by low rates—say, less than five cents a kilowatt-hour.

The discussion drifted into one of rates and systems of charging. W. J. Greene of Cedar Rapids, Rufus Lee of Clarinda, D. F. McGee of Red Oak, and others took part. Mr. Carson said that there should be no discrimination; all customers should be treated alike, with the two-rate system or turning-point system of charging perhaps.

L. D. Mathes, Dubuque: Make the same rate to everybody. If anybody wants a better rate, let him use the current and have it show on the meter. Special rates are an absolute evil; they are boomerangs.

Electric-railway Freight Service.[1]

By H. H. Polk.

It seems to me that steam railways, with few exceptions, are very short-sighted in refusing to recognize electric railways in the interchange of freight. They cannot, by this policy, stop the building of electric railways. They are here to stay, and each year sees more of them in operation. They make good feeders for the steam railroads, bringing to them much freight. The steam railroads that publish joint rates with electric railways and are willing to grant a division of the rate, will get all of the foreign shipments which originate on the line of the electric road, and there are many instances where the electric railway taps a new territory, one to which the steam railroad has heretofore never had access.

The electric railway should have a traffic arrangement with some connecting steam railroad in order to do a successful carload business, for if it does not have this, the rate from a point on its line to a point on the steam railroad would be the sum of the two locals, and therefore prohibitive. Mr. A. B. Stickney, president of the Chicago Great Western Railway Company, says that he does not care how freight is brought to his road, whether in a wheelbarrow, stage-coach, horse car or by an electric car, he will take it and be willing to pay a little something to get it. This is the broad-minded view to be taken of this question. It is generally conceded that the electric road is more popular with the farmer. It is more profitable to him to ship over the electric railway than over steam railroad, as the electric railway gives him more rapid, frequent and fully as reliable service, enabling him to receive and ship freight, mail and express at almost any hour of the day. The farm takes on a new aspect and becomes capable of being used in many ways otherwise impossible, part of the benefit of which will, of course, accrue to the railroad.

Much the same thing is true of the small cities and towns through which these interurban lines run. The merchant can easily order by telephone from the wholesale houses, and within an hour or two the goods so ordered are in his store. He is not required to have so great an investment in his stock, and is able to cut down his insurance, so that he, too, is glad to make use of the electric freight service.

Some comparison of statistics of the freight traffic on steam and electric railways may be interesting here. On steam railroads the income from passenger service is about 30 per cent. of the total earnings, while the receipts from the freight service amount to about 70 per cent.

During the year ended June 30, 1901, the steam railroads in the United States reported a freight traffic of 1,089,226,440 tons. Of course, this is a greater tonnage than shippers actually turned over to the railroads because of the handling of the same freight by more than one road, duplications resulting from taking the total of all traffic on all roads. However, after making the deductions necessary to eliminate the duplications, it is found that traffic received from the shippers amounted to 583,692,427 tons. To handle that vast tonnage required 29,400 freight and switching locomotives and 1,600,000 freight cars. The mines from which coal, iron ore and other minerals are taken furnish more than one-half the tonnage handled by the railroads, but as this traffic is carried at a low rate per ton the receipts from this amounts to much less than one-half of the total freight revenue. Manufacturing industries supply nearly one-seventh of the tonnage; the products of the forest nearly one-eighth; the products of agriculture, one-ninth; the remainder, which is less than one-seventh of the total, consists of live stock, general merchandise and unclassified commodities. The articles above referred to include many thousands of kinds of commodities.

The reports on street and electric railways compiled by the Department of Commerce and Labor, Bureau of the Census, for the year ended June 30, 1902, of all street and electric railways in operation during that time show that there is much room for the development of this department of electric railways.

Until 1887 nearly every large railroad had a classification of its own, but now most business is handled by one of three classifications. In several states—Illinois, Iowa, Georgia and some others—there are classifications prescribed by the state boards of railroad commissioners applying to freight carried entirely within the state.

The electric railways should use the classifications which are used by the steam roads in their territory. In this state the roads should govern business within the state according to the Iowa classification. On interstate business the western classification should apply. It is my opinion that the electric railways should adopt a rate which is possibly five per cent. lower than the Iowa classification. The rapidity and frequency of the service do a great deal toward getting business for the electric road, but if we can say to a shipper that

1. A report, somewhat condensed, made to the Iowa Electrical Association on April 19, 1905. Mr. Bellamy is manager of the Knoxville (Iowa) Electric Company.

1. Abstract of a paper read before the Iowa Street and Interurban Railway Association in Dubuque on April 20, 1905. Mr. Polk is president and general manager of the Interurban Railway Company of Des Moines.

our rates are less than the Iowa classification, it is just that much more attractive to him.

A well-organized freight department is, of course, of primary importance, and I will attempt to outline the methods used by our company in this department.

We have a general freight agent and two clerks in the general office. We also have a local agent at our freight house in Des Moines, and an agent at each of our stations on the line. The great volume of freight business done by steam railways is conducted by the use of a few business papers, and the records kept are complete and very simple. In the electric-railway freight business still fewer papers are required. We use the regular shipping ticket that is used by all steam railroads. This is filled out by the shipper in duplicate, the agent receipting the original and retaining the duplicate, from which he makes up his way bills. The way bills show the station from, the destination, the date, car number, car initials, consignor and consignee, number and description of articles, weight, rate and charges. They are sent to the freight auditor each day by the agent, and he enters them in his "freight-forwarded" book.

The agent also makes out an expense bill in duplicate for each consignment on the way bills for all freight billed from his station. The expense bill gives the names of the consignor and consignee, station from, destination, car number, car initials, number and description of articles, weight, rate and charges. The conductor takes the expense bill instead of the way bill, as is customary on steam railroads, and delivers it to the agent at destination, who in turn checks the freight delivered from them. The expense bills are then entered in a book called the "freight-delivery" book, in which the consignee receipts for the shipment delivered to him. When the charges are paid the agent signs the original and gives it to the consignee for his receipt, and the consignee signs the duplicate, which is retained by the agent. The agent is required to remit to the treasurer daily all money, together with all duplicate expense bills, whether deadhead, prepaid or with charges, for freight which has been delivered. A duplicate of these remittance sheets is retained by the agent. The original remittance sheet, with all original expense bills and money, are placed in a heavy manila envelope, which is sealed with wax, and sent by "railway mail" to the treasurer, so as to reach the general office before five o'clock p. m. In this manner we can tell at the end of each day how each agent stands in his accounts.

This system was adopted for two reasons—first, that we wanted all accounts kept in the general office, and, second, that we could handle the freight and accounts at each station much cheaper than we could by any other system, and we have found this to be very satisfactory.

The greatest difficulty we experienced in developing our freight department was in convincing the public that we could handle any kind of freight, from a small package to a carload of live stock, grain, lumber, or any other commodity. However, this did not take very long, and today they know that we can handle anything a steam railroad can.

In order to do a successful freight business, it is necessary to "get out" after the business, or someone else will get it. Solicit your business, not only from the farms through which your road runs, but also from as far away as it is possible to draw it. The amount of business obtained by a good solicitor five or six miles away will astonish you. Do not be content to work up business in the country alone. Do so in your cities and towns. See that your freight solicitor makes regular calls upon the merchants of the smaller towns, the dairy concerns, wholesale houses, etc., in the cities. Find a market for the products of the farm, such as dairy products, poultry, fruit, vegetables, etc. Encourage all of these lines and the freight business will rapidly grow.

A report of the Department of Commerce and Labor for the year 1902, in a general discussion of the characteristics and significance of interurban service, says: "It is difficult to avoid entrance into the domain of prophecy. Some of the electric railways have already made such progress in methods that certain prophets look forward to the complete superseding of steam traction by electric traction. However this may be, it is evident that even if the electric railways confine themselves to the methods already widely prevalent, they are bound to become a social and economic factor of enormous importance. Remarkable benefits have already been realized from the existing interurban lines, and the extension of such railways to a large proportion of our more prosperous communities seems but a matter of a short time."

Discussion.

James F. Lardner of Davenport asked Mr. Polk whether he had a freight house in Des Moines, to which the latter answered that their freight house is a small room in the car barn in the heart of the city. It is getting too small and the company intends to occupy new quarters; it expects to build a small freight house and take care of its growing business. Occasionally they get a car load of merchandise. Daily cars of cattle and grain are handled.

When asked whether his company had through traffic rates, Mr. Polk replied: "We have joint rates and bill from any station on our line to point of destination. To a certain extent the steam roads after they think it to their benefit will come more than half way; occasionally will give a division of the rate on certain shipments."

F. McDonald of Waterloo asked if Mr. Polk's company made prepayments on all shipments, to which he answered: "Yes; most of our business is prepaid, though shipments may go collect and carried at tariff rates." Mr. McDonald also stated that stock shipments were hard to handle by electricity on account of the fact that the stock in nearly all shipped on certain days to reach the market, and often 20 cars are handled daily. "Sunday is a good day," he said, "and we have as high as 15 to 20 cars of stock alone, making a train of 20 to 22 cars, and in order to handle by electricity it means that you must have a great deal of surplus at the power house and only use it on one or two days in the week.

Mr. Lardner wanted to know of Mr. Polk how his operating expenses compared with the handling of through freight. Mr. Polk said that it used to cost $1.50 to haul $1 worth of freight. It now costs 36 cents to haul $1 worth of freight. "We have doubled our earnings from freight without increasing our operating expenses."

Securities of Independent Telephone Companies.[1]

By A. B. Greenshields.

Right at the start I will say that if you gentlemen present who are interested in the building and development of the vast Independent telephone properties of this country have given as much care and conservative business judgment to the issuing of the capital obligations of your various companies as you have given to the rapid extension of the telephone business, it will require no advance agents or "Bostonian authors" to prove to the people that one of the safest and most remunerative places for their savings is in the first-mortgage bonds of a conservative and well-managed telephone company.

I do not propose to go into the progress and development of the Independent telephone business, as that will be more than fully discussed among you at this time. What I wish to do is to take a calm, conservative, and common-sense view of Independent telephone bonds as an investment security. During my banking experience of over 26 years I have taken great interest in the different grades of securities which have been offered to the public, and the stability of these different securities during times of severe business depression and financial disturbances, and in my own mind have graded the best class of investment securities in somewhat of the following manner:

First—The interest-bearing indebtedness of the national government, which is secured, not only by the entire wealth of the country, but also by direct taxation of the whole people.

Second—The interest-bearing indebtedness of the different states and municipalities, which is secured by direct taxation of the people in these states and municipalities.

Third—The first-mortgage securities issued by public-service corporations, which usually take the form of a lien covering all of the property owned or acquired by the corporation.

Taking up the first, or government indebtedness, the amount is so small that it is nearly, if not all, absorbed by the national banks of the country to be used as a basis of currency circulation, which is profitable to them, although the actual interest return on the bonds is probably less than two per cent.

Taking the next, or state and municipal bonds; the demand for these bonds so far exceeds the supply that the yearly interest return to the investor is, say, from 2½ to 3½ per cent.; and the average American, unless he be a multi-millionaire, usually looks around him for a larger interest return for his surplus funds, which leads him into the third grade, or the interest-bearing indebtedness of public-service corporations.

The principal public-service corporations may be divided into four classes, supplying the following utilities: Water, light, communication and transportation.

In looking over these four classes of public utilities and analyzing the operations of the companies supplying them, we find a great difference, not only in the stability of their income and the mechanical wear and tear, or depreciation of their property, but also in the possibility of accidents in operating, incurring damage and consequent loss to the companies. In water and telephone companies we find the annual rental system, which, for stability of income, could not be improved upon. The mechanical wear and the possibility of accidents in operation are not of sufficient importance to be considered, while the yearly depreciation, in comparison with the original cost, is very small. The same may be said of gas companies, except that their income, which is on a measured basis, is more or less affected by conditions prevailing at different periods. In the electric-light and railway companies we find a fluctuating and uncertain income, together with a very heavy mechanical wear and depreciation, which, I fear, have not been given sufficient consideration, in many companies that are today dividing their surplus earnings among their stockholders. The possibility of damage and consequent loss to these companies through accidents in operating is an important item that should be fully considered. In steam-railroad companies the income depends entirely upon the conditions prevailing during the different periods, increasing enormously in good times, and, in many cases, causing extravagant expenditures; decreasing proportionately in periods of depression, without their being able to correspondingly decrease expenses below a certain point. With heavy demands upon its transportation facilities, the mechanical wear and tear is very great, and at such times the depreciation of its property is very heavy. Then, again, when its equipment is idle, the percentage of depreciation to earnings is even heavier. Accidents in operating frequently incur heavy damages, and the consequent loss to the companies cannot be estimated in advance.

I am frequently asked the question, What tangible assets has a telephone company to show for its capital obligations? Like any other public-service corporation, it is fully equipped to continually supply a practically perpetual and ever-increasing demand for a necessary public utility; and while the real assets of the company are not so much in evidence, as in the case of a manufacturing or an industrial company, they are, nevertheless, of much greater value, being guaranteed a continual and never-ceasing usefulness, if properly maintained. Such questions, coming from men of mature deliberation, are sometimes very amusing. A few days ago, a gentleman who is heavily interested in a prominent steam-railroad company's securities, laughingly remarked that a telephone company had practically no tangible assets to show for its bonded indebtedness; and when I called to his attention the fact that the same railroad, in building a new low-grade division, was spending in some cases $240,000 per mile, and asked him what the assets of a 40-foot cut in grading the road would be worth to the holder of that company's securities, he began to think, and is thinking yet.

The real value of the assets of any public-service corporation is the company's ability to supply the people continually with a public convenience or service which is always in demand; not what you can get for these assets as so much merchandise. In my opinion the safest and most stable of these public-service corporations to invest in are the companies supplying such utilities as water and telephone service. Their earnings are on a fixed annual-income basis, and, unlike other public-service companies, their earnings are not subject to changing conditions prevailing at different periods. Both of these utilities are absolutely necessary to our business and social life, and for neither of them can we find a substitute.

Securties issued by steam-railroad companies are today much in favor with the investing public, and at present the interest return is in many cases as low as 3¼ per cent. per annum; yet there are few of these companies that have not been in the hands of receivers at some period during their lifetime. Like the telephone companies, they are public-service corporations, depending upon the people for the revenue necessary to pay, not only the operating and maintenance charges, but also the interest on the money spent in their construction. A thoughtful investor cannot but realize the difference between investing in the securities of a new railroad company and a new telephone company. Railroads have always, of necessity, been pioneers in a new country, the populating and building-up process following them; the long period of waiting for sufficient business to pay their naturally heavy operating expenses, leaving them for years without money enough to pay their fixed charges, resulting in foreclosures and subsequent loss in the scaling-down process that followed reorganization. On the other hand, the new telephone company commences business under entirely different circumstances, starting in cities and towns where an actual demand for its service is anxiously awaiting the completion of its property; so that, from the very start, revenue sufficient to pay its operating and maintenance and leave a handsome interest return on the cost of its construction is not only assured, but the service rendered its subscribers is also actually paid for quarterly in advance. Cities, towns and boroughs continually growing, the demand for local and long-distance voice communication must grow proportionately, and so long as a telephone company can supply the people with a prompt and efficient service, the man who invested in that company need have no fear for the safety of his capital or the annual-interest return on his investment. When you consider that the ultimate profit on capital invested in an Independent telephone company is as great in proportion as that made on an investment in a steam-railroad company, without the corresponding delay in, or risk of the telephone company's earnings proving insufficient to pay fixed charges, and also to make an immediate return on the investment, is it any wonder that, as a safe

1. Paper read at the Chicago convention of the National-Interstate Telephone Association on June 21st. Mr. Greenshields is a well-known investment banker and broker of Philadelphia, Pa.

business proposition, it has attracted capital to the extent of between $200,000,000 and $300,000,000 in a few years, without having had to resort to the financial jugglery practiced by the great financiers of Wall Street when capital is required for the construction cost of new enterprises?

Until recently country bankers kept their eyes riveted on Wall Street, thinking that all securities worth investing in emanated from that source. The result of their united buying, together with that of their depositors acting upon their advice, has given undue popularity to an inferior class of securities called "collateral trust bonds," some of which are now selling on a basis of less than four per cent. Prominent New York bankers have gone out of their way to advise their country correspondents to purchase them, pointing out the fact that insurance companies had bought millions of them for permanent investment. The recent investigation of the Equitable Life company's affairs has made plain to all of us the reason for instilling confidence in the minds of purchasers of such securities. I think that from now on the investors throughout the country will give more attention to the first-mortgage bonds of companies operating in their own localities; to them I recommend the first-mortgage bonds of conservative and well-managed Independent telephone companies, which, at present prices, return from five to six per cent. on the investment.

Louis Hollweg Succeeds the Late S. P. Sheerin.

Changes made necessary by the death of S. P. Sheerin, president of the Indianapolis Telephone Company and the New Long-distance Telephone Company of Indianapolis were effected at meetings of the directors of both companies held last week. Lewis Hollweg, formerly vice-president of the Indianapolis Telephone Company and the New Long-distance Telephone Company, was elected president of both companies, and H. B. Sale, formerly secretary and treasurer of both companies, was elected vice-president and general manager of the Indianapolis Telephone Company. A. F. Ramsey of Crawfordsville was elected vice-president of the Long-distance company. Mr. Hollweg was closely associated with the management of both companies under Mr. Sheerin's administration, and Mr. Sale has looked after the details of the companies for several years, and is regarded one of the most competent telephone men in the state.

Plan Independent Extension About St. Louis.

A syndicate in which leading directors and stockholders of the Kinloch Telephone Company of St. Louis are largely interested has purchased a controlling interest in the Suburban Telephone Company, operating in St. Louis County, Mo. The deal was closed between the Mississippi Valley Trust Company, acting for the Kinloch interests, and James Houseman, representing the stockholders of the Suburban company. Some of the latter are in the syndicate. It is stated that the management of the company wanted to extend its field, and the deal was made to get in new capital on which to draw. The plans are to increase the capital stock from $100,000 to probably $500,000, and extend the lines all over St. Louis County. H. W. Karrenbrock of Clayton, Mo., will continue as president of the new company.

TELEPHONE MEN.

H. W. Ritterhoff, who has been with the Bell company, has been appointed contracting agent for the Home Telephone Company of Kansas City, Mo.

J. P. Walsh has been promoted to be manager of the Fargo (N. D.) office of the Northwestern Telephone Exchange Company, succeeding Mr. Edwards, who was made district superintendent.

A. Von Schlegell has been promoted from the position of local manager of the Northwestern Telephone Exchange Company in Minneapolis to have charge of the contract department. The contract department has been enlarged and its scope extended. T. J. Seymour succeeds Mr. Von Schlegell as local manager.

NEW COMPANIES.

The Fort Cobb Telephone Company of Oklahoma City, Okla., has been incorporated with a capital stock of $2,500.

The Bloomington Mutual Telephone Company of Osborne, Kan., has been incorporated with a capital stock of $3,000.

The Paducah (Ky.) Home Telephone Company has been organized by J. Wheeler Campbell of Paducah, J. C. Monteith of Bloomington, Ind., and J. E. Bergin of Nanticoke, Pa., to absorb the People's Independent Telephone Company.

Ohio Telephone Notes.

According to a syllabus issued by the Supreme Court a few days ago a municipality has no authority to demand free telephone service for its own use or fix rates in an ordinance, nor can it enforce an ordinance in which such an agreement has been incorporated. The case in question was that of Farmer & Getz and the village of Salem against the Columbiana County Telephone Company. The court holds that the state gives power to construct lines in streets and public ways, but not in municipalities. Municipalities have only power to agree as to the mode of use of the streets and the compensation for such use, which shall not be beyond the amount that will be required to restore them to their former usefulness. A court of equity will not require a company to adhere to an agreement on the rate that has been fixed by a village or city council.

On July 6th the Cuyahoga Telephone Company will pay a dividend of nine per cent. on its preferred stock, this figure representing an accumulation on the stock to that date. Then, on January 1st next, the regular semi-annual dividend of three per cent. will be declared. The company will then continue to pay this dividend regularly. The company owns the Electric Building, a good office structure and six branch exchanges. The gain in subscriptions since the first of the year has averaged about 600 a month. On July 7th three stockholders will be elected to the directorate to represent the interests acquired by the Toledo people some time ago. While it is not known absolutely who these will be, reports are to the effect that William F. Robinson, Jay K. Secor and James S. Brailey, Jr., will be the men named.

At the next meeting of the directors of the United States Telephone Company a quarterly dividend of 1½ per cent. will be declared, payable July 6th.

The Central Union Telephone Company is at work building 17 new circuits in Butler County. This will add 170 miles of galvanized wire to the 300 miles of country line and 200 miles of city and village line now in use.

The Bell interests have decided to construct a new cable in Columbus that will admit from 4,000 to 5,000 new subscribers, build a new line between Columbus and Dayton, make improvements and extensions in other places and erect a lot of new pole lines for farmers in the outlying districts.

The Rising Sun Telephone Company, incorporated a few days ago, will put in a small plant at Rising Sun and operate in connection with the Bell long-distance lines. T. P. Sylvan and others are interested.

An increase of capital stock from $3,000 to $6,000 has been made by the Farmers' Telephone Company of Perrysville.

Officers of the Citizens' Telephone Company of Waterville have been elected, with C. E. Schaffmaster president.

Federal Telephone stock has been taken off the stock exchange in Cleveland.

An increase in capital stock from $2,000 to $4,000 has been made by the Peoples' Telephone Company of Jacobsburg.

The Citizens' Telephone Company of Jackson has been incorporated with a capital stock of $4,000 by Chester A. Dyer, G. W. Brooks, Joseph Lewis, R. E. Swaney and C. C. McKinniss. C.

Indiana Telephone Items.

The Home Telephone Company of Richmond has just completed the installation of a new copper line between Richmond and Hallansburg, Ohio.

The Central Union Telephone Company announces that it is ready to begin the work of placing its wires underground in the city of Richmond, and is urging the City Council to permit it to construct an underground system. Considerable opposition to the proposition has developed among members of the council, who maintain that when the conduits are constructed all companies having poll lines should participate in the cost and have the use of them. The Central Union Company refuses to be a party to such an arrangement and insists that electric-light and telephone wires cannot be successfully operated in the same conduit, and also maintains that it is poor policy to have rival companies using the same conduit. The general manager says that if the permission for the exclusive underground system is not granted the company will proceed at once to expend about $7,000 in improving its pole-line system. The company complains of experiencing much trouble with its lines on account of the close proximity of its wires to the high-tension wires in the street and is anxious to remedy it.

The Syracuse Home Telephone Company has decided to sell its plant. Syracuse has nearly 2,000 inhabitants and the system has over 300 telephones connected. At Lake Wawasee, near by, there are many summer cottages which will be connected up at once, thereby extending the system.

A struggle is in progress between the New Long-distance Telephone Company and the Bell Telephone Company for the control of the plant of the Citizens' Telephone Company of Kokomo.

A. J. Heinz, manager of the Knox County Home Telephone Company of Vincennes, has resigned his position, taking effect July 1st. He began service with the company three years ago, when there were less than 400 subscribers; now there are 1,000, with no party lines in the city. S.

Telephone News from the Northwest.

The Tri-state Telephone and Telegraph Company will build a toll line west from Austin, Minn., through Albert Lea, and ultimately to Sioux City, Iowa.

At Oldham, S. D., a rural telephone company has been formed with $20,000 capital, and will build a network of lines covering the county.

The mayor of Rochester, Minn., has vetoed the resolution whereby the Tri-state Telephone Company is granted permission to make toll connections with that city. He intimates that it was not properly passed and suggests that he will not be averse to an ordinance properly passed. Business men have petitioned the council to grant the desired right-of-way.

The Browerville Telephone Company has been incorporated at Browerville, Minn., and will establish an exchange at once.

Reports filed with the state auditor of South Dakota show that 157 telephone companies have filed reports for this year. This is an increase of over 50 per cent. in the last year. This applies only to companies which were completed and operating prior to the first of May, there having been 54 companies placed on the list in addition to those numbered.

The Hamilton County Farmers' Telephone Association has purchased the Bell system at Aurora, Neb.

The Iowa Telephone Company will discontinue its exchange at Eldora, Iowa, an agreement having been effected whereby the Eldora Mutual Telephone Company gives the Iowa company local connection through its exchange.

The contract has been let for the erection of a telephone exchange building at Nevada, Iowa.

The Iowa Telephone Company is making extensive improvements on its lines centering at Fort Dodge. R.

Large Switchboard for Kinloch Telephone Company in St. Louis.

The Kinloch Telephone Company of St. Louis is to have a new 17,000-line central-energy lamp-line multiple switchboard for its main exchange. The contract calls for an "A" board consisting of 37 sections, a "B" board consisting of two sections, three monitor sections of two operators' positions each, one observation desk of four positions, one combination manager and assistant manager desk, one combination chief and assistant chief operator's desk, and one two-position wire chief's desk.

The main switchboard is to be equipped for the present with 12,500 lines, thus making what is said to be the largest original installation ever made in the Independent telephone field. The contract has been awarded to the Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y.

GENERAL TELEPHONE NEWS.

The Home Telephone Company of Joplin, Mo., has increased its capital stock from $200,000 to $750,000.

The Cumberland Telephone Company of Nashville, Tenn., will erect an $8,000 branch exchange in that city.

The People's Telephone Company has been organized at Twin Falls, Ida., and has made application for a franchise.

A telephone system is proposed for Lynn Grove, Ky., by the Lynn Grove Telephone Company, which has been incorporated with a capital of $2,000.

There are said to be nearly 50 different rural telephone lines in Crawford County, Kan., owned by farmers. Of these 28 center in McCune and six in Girard.

The director-general of telegraphs of Madrid, Spain, has called for bids for the construction of a telephone system at Mahon, Balearic Islands. The bids are to include the operation of the plant for a period of 20 years.

The Piedmont Telephone Company of Gastonia, N. C., will absorb several exchanges, including those at Yorkville, Tirzah, Blacksburg and other South Carolina points. Many improvements will also be made in the systems.

The American Telephone and Telegraph Company of Cumberland, Md., is reported to be arranging for the extension of its line from Cumberland, Md., to Columbus, Ohio, via Bloomington, Bond, Deer Park, Oakland, Md., and Parkersburg, W. Va., establishing a station at Oakland.

The Keysone Telephone Company of Philadelphia has closed a contract with New York bankers, who take over $4,000,000 in first-mortgage five-per cent. 30-year bonds of the Keystone company. Local institutions are interested in the allotment obtained by the New York bankers. The telephone company will now be able to pay its floating indebtedness. The banking interests will be represented on the board of directors.

CORRESPONDENCE.

Great Britain.

London, June 21.—After a period of relief in the matter of tramway accidents through the failure of brakes to act, two recent "runaways" have once more directed attention to this important matter. In these days of efficient brakes it is difficult to convince oneself that the brakes, per se, were the real cause of the accidents. The personal element enters so much into this matter that the need for an automatic brake, should the car exceed a specified speed, would appear to be a necessity. One of the accidents referred to above was on the Isle of Thanet Tramways, where, unfortunately, more than one catastrophe of this nature has taken place. The other instance was upon the Sunderland and District Tramways—a system owned by a new company and only sanctioned by the Board of Trade the day prior to the accident. Unfortunately this happened upon the opening day and the explanation of the motorman is that when he reached the hill upon which the "runaway" took place he regulated the brake to the regulation speed of four miles an hour, but that half way down the hill the electric brake failed to act. Finding this to be the case, he applied the hand brake, but the impetus which the car had received rendered this action futile, with the result that the car left the track and a boy of 14 years was killed. An unusual circumstance was that the electrical equipment of the car was undamaged, an important point in tending to elucidate the cause of the accident.

The London County Council is still endeavoring to solve the problem put before it by the House of Commons committee in connection with the proposal to construct electric tramways along the Thames Embankment. It may be remembered that this is the first time that the idea of carrying tramways over the Thames bridges from the south and along the embankment to form a connection with the lines in the north has ever reached even the committee stage of Parliament. By great efforts, however, this much has been accomplished this session; but the committee as a condition of its consent to the proposition laid it down as a sine qua non that Blackfriars Bridge should be widened. It so happened that the rights over the bridge are vested in the corporation of the city of London, which body hitherto has been antagonistic to the tramway. Therefore, something in the nature of a deadlock had arisen when the city corporation in deference to the wishes of the committee agreed to appoint a sub-committee to consider the point. It is now stated as probable that this committee will recommend that the city corporation agree to the tramways over the bridge, but that all the cost of widening shall be borne by the city corporation in order that its authority over the bridge may not be diminished, but that the County Council shall pay an annual rent for the use of the bridge. Whether the County Council will agree to this latter suggestion it is difficult to say. Probably in view of the obstruction it has met with in the past it will agree and consider itself fortunate.

The Metropolitan District Railway Company, Mr. Yerke's undertaking, has just added some six miles to the portion of its lines worked by electricity, making about 12 miles in all. These lines, however, are more or less isolated pieces and in a way have no connection with the Inner Circle (which was the main object of Mr. Yerkes), except that the circle can be reached by changing cars. It is the circle, however, that all Londoners are anxious to see worked electrically, but it is stated by the company that no definite date can be given when the electric trains will be running on that line. Nothing official has transpired as to the cause of the delay, but it has been stated, and not contradicted, in the daily papers that both the British and foreign contractors for the rolling stock are responsible.

An item of incidental interest in connection with the fight by the London local authorities against the various power bills is that some $75,000 has already been spent by the local authorities in opposition. It is not much consolation to the ratepayers to reflect that all the municipalities have seen for their money up to the present is defeat all along the line. A strenuous effort is, I hear, being made to overthrow the successful bills in the House of Lords before they reach the committee stage of the House of Commons.

The Eastbourne Town Council has for some time been running a service of petrol motor buses in preference to electric tramways. Upon the single-deck buses, a loss of $5,000 was incurred last year, and it has now been decided to abandon their use. The suggestion has been made quite seriously to convert the discarded single-deckers into motor dust carts.

Two proposals are now before the Folkestone corporation for the construction of tramways—one for a surface-contact system and one for a trolley system. Curiously enough, each of the promoting companies offers the same terms, so that the choice of systems will depend absolutely upon merit.

G.

New York.

New York, July 1.—Plans for the establishment of a municipal electric-light plant at a cost of $7,567,000, were made public today. The plans provide for the establishment of a central station, on ground already acquired, and with a capacity of 15,000 kilowatts, the distribution system being designed to supply 15,000 arc and 300,000 16-candlepower incandescent lamps. The annual operating expenses are estimated at $1,269,000, including all fixed charges, interest at 3½ per cent. and six per cent. for depreciation. This, on paper, will be equivalent to an annual saving of $434,000.

At the meeting of the Rapid Transit Commission on Thursday it was announced that the subway extensions will be open for passengers on July 15th, and it will then be possible to ride from the Battery to Bronx Park. A scheme for what promises to be the effective ventilation of the subway by means of large exhaust fans was approved. Meanwhile, small electric fans, which, however, can by no manner of means be described as "ventilating," have been put in at the principal subway stations this week, each fan being attached to one of the iron supports on the platforms, and deriving power from a lamp bracket, thereby reducing the general illumination at the stations. During the coming week a system of cooling the subway by spraying water on the tracks will be tried, at the suggestion of John B. McDonald.

The Brooklyn Heights Railroad Company, which is a corporation subsidiary to the Brooklyn Rapid Transit Company, has signed a contract with the Westinghouse company of Pittsburg for two steam-turbine generating units, each of a normal capacity of 10,500 horsepower, and a maximum capacity of 16,000 horsepower, working under dry steam at 175 pounds.

The War Department at Washington has approved the plans of the New York and Long Island Railroad Company for a tunnel under the East River, from Long Island City to East Forty-second street. The authorization permits either one tunnel with two tracks, or two tunnels with one track each.

The New York and Long Island Traction Company has been granted an extension of a franchise to build a trolley line on the Jerico Turnpike.

The first subway to be authorized under the new law is an extension of the Manhattan subway to the Fort Lee Ferry, in New Jersey.

Philip K. Stern, an electrical engineer, has laid out a "Leap Frog" railroad as one of the new side-shows at Dreamland, Coney Island. This attraction consists of moving passenger cars which pass each other on a single track.

The Yorkville Electrical Construction Company opened a new store and office at 1216 Lexington Avenue, this week.

The Metropolitan Switchboard Company has recently put in a new dimmer at the Harlem Auditorium, at One-hundred-and-twenty-fifth Street and Seventh Avenue.

The National Elevator and Construction Company of this city is putting in electric generators in a new apartment house on One-hundred-and-seventeenth Street and Lenox Avenue.

The New York Edison Company has received a contract to supply current for lighting, elevators and power purposes at the Broadway Arcade, a new combined business and apartment house, at Broadway and Sixty-sixth Street. The new reduced schedule of the company goes into effect today, the reduction to retail customers being from 15 to 10 cents a kilowatt-hour. The lighting service includes renewals of lamps and trimming.

The Department of Education is asking for sealed bids, on or before July 10th, for installing an electrical equipment in the additions to public school No. 110, on Driggs Avenue, Brooklyn. One hundred days will be allowed for the completion of the work, and the security required amounts to $5,000. Plans, etc., can be seen at the offices of the department.

D. W. W.

Dominion of Canada.

Ottawa, Ont., July 1.—Extensive power development at Fort William, Ont., is contemplated by a company having a capital of $2,000,000. The name assumed is the Kakabeka Power Company. The incorporators are: H. S. Holt, president of the Montreal Light, Heat and Power Company; Charles R. Hosmer, director of the Canadian Pacific railway; F. W. Thompson, manager of the Ogilvie Flour Mills Company; W. Norton and F. H. Phippen of Montreal.

The officials of the Temiskaming railway of Ontario are conferring with the Locomotive and Machine Company of Montreal with a view of having an electric locomotive constructed. It is intended that electric locomotives shall be used on some of the divisions of the railway.

The new taxation scheme of the Newfoundland government, by which it is proposed to tax the cable companies so much per live wire, is likely to result in having at least four of the transatlantic cables now landing on the island of Newfoundland go direct to North Sydney in Nova Scotia. Hon. A. M. McKay, manager for the island of the Anglo-American Cable Company, stated that such a move would mean a large saving to his company, probably $150,000 per year. The cables were landed in Newfoundland because at the inception of cable laying, distance meant much, whereas now it makes but little difference, as the size of the cable core has been very much enlarged.

The City Council of Brantford, Ont., has given its final assent to the Hamilton, Ancaster and Brantford Company to come into the city over the existing tracks of the Brantford Street Railway Company. Along Colborne Street a 47-year franchise has been granted the company. For the rights secured the city is to get $250 a year from the company and $100 a year from the Brantford street railway.

The Canadian government has appropriated $15,000 for the purpose of making experiments with the electric process of smelting ores and manufacturing steel. The experiments will take place at Sault Ste. Marie, and the Consolidated Lake Superior Company will furnish a building and a dynamo capable of supplying 400 electric horsepower for four months free of charge. M. Herault will personally conduct the experiments, and he is expected to arrive in Ottawa during the present month from France.

The Ontario government has considered the scope and composition of the proposed power commission. It was agreed that the commission should not exceed five in number, and it will investigate and report on existing waterpowers in the province capable of producing electrical energy. The commission will be empowered to find out the cost of such energy produced from waterpower and from steampower and report on the respective possibilities of each and make comparisons.

The motormen and conductors of the electric street railway of Cornwall, Ont., are out on strike. They demand an increase of four cents per hour, or from 13 to 17 cents. Manager Hodge submitted the matter to the directors in Montreal, who declared that it was impossible to comply with the demand of the men. The line is operated by the Sun Life Assurance Company of Montreal, having passed into the hands of that company as bondholder. This company has also purchased the electric-light service of the town, and by combining it with the street railway expects to make the investment profitable.

W.

Southeastern States.

Charlotte, N. C., July 1.—The capital of the Hickory (N. C.) Railroad and Power Company has been increased from $125,000 to $300,000.

The finance committee of the Board of Aldermen of Fayetteville, N. C., has been instructed to sell $30,000 of five-per cent. 30-year electric-light bonds.

Additional rumors regarding the development of more waterpowers on the Catawba River by the Catawba Power Company of Charlotte say that the Great Falls near Chester, S. C., will shortly be developed. Next it is said that the Wateree power will be utilized, some 25,000 horsepower being available. These with the three units at Catawba Falls will give a total of 110,000 horsepower, all under the same management and all within 40 miles of each other. All of the plants are to be capable of being run in co-operation with each other.

The Carolina Electric Company has moved its plant from Maxton to Alma, N. C., where fuel is cheaper.

The survey of two possible routes for the electric railway between Raleigh and Durham, N. C., has been completed, one being 21 miles and the other being 25 miles long.

Announcement is made that an early meeting of the water and light commission of Asheville, N. C., will be held to consider the issuing of water bonds and also $40,000 electric-light bonds for constructing a plant on Swannanoa River.

Six new cars 65 feet in length have been received for the new electric railway that will connect Atlanta and Marietta, Ga.

It is announced that the Cape Fear Power Company will have power in Fayetteville, N. C., by August 1st.

L.

Michigan.

Detroit, July 1.—The street-railway situation in Detroit as to municipal ownership, or the operation of the Detroit United railway system under a new arrangement, seems to be nearing a focus.

The Indiana and Michigan Electric Company of South Bend, which controls the power plants at the Hen Island and Buchanan dams on the St. Joseph River, has closed a contract to deliver 3,000 horsepower to the Benton Harbor and St. Joseph Electric Railway and Lighting Company, which operates the street-railway and lighting systems of these towns. The current will have to be transmitted about 25 miles by wire.

The building of an electric railway from Bay City to Caro, which has lain dormant for some time, is now about to be carried out. It will open up a new and fertile section to railway facilities.

The Traverse City Traction Company, which put on three automobile busses in that city to be operated on a regular street-car schedule about a month ago, has increased its capital stock to $30,000, and will purchase 16 more machines to cover resorts and a fruit section within a radius of 40 miles of Traverse City.

It is stated that the stock of the Washtenaw

Light and Power Company of Ann Arbor and Ypsilanti has been purchased by Alex Dow of the Detroit Edison Company for his eastern associates, and is now controlled by them. It is proposed to develop additional power from the Huron River between Dexter and Rawsonville. There is a 210-foot fall between these points. A part of the improvement consists in the creation of a large reservoir or lake near Ann Arbor.

The last franchise for the Grand Rapids and Kalamazoo electric railway has been secured and construction work will be commenced about July 15th. The line will connect these two cities and pass through Cooper, Plainwell, Otsego, Martin, Bradley, Shelbyville, Wayland and Moline.

The strike of the street-railway employes in the Saginaw Valley still continues without much prospect of settlement. The business men of Bay City and Saginaw are suffering and every effort is being made to bring the men and the company together.

The following companies have been incorporated: Menominee and Escanaba Railway Company, capital $300,000, to build an electric line between these cities; the Electric Advertising Company of Detroit, capital $5,000, to manufacture electric signs and novelties. C. G. W.

Ohio.

Cleveland, July 1.—Negotiations again seem to be under way between the Widener-Elkins-Dolan syndicate and the Toledo, Bowling Green and Southern Traction Company by which the former is to either lease or purchase the property of the latter. W. Kelsey Schoepf, J. B. Foraker, Jr., and George Warrington of Cincinnati were in Toledo the early part of the week in consultation with George B. Kerper and his son, and all made an inspection trip over the line. Later on a conference of the same gentlemen and John Kilgour, a large owner of stock in the Toledo, Bowling Green and Southern, was held in Cincinnati. The company operating this line is the Toledo Urban and Interurban Company, which is practically owned by the same people who own the road.

In the suit of the county treasurer to collect taxes added by the county auditor of Cuyahoga County to five public-service corporations Judge Lawrence of the Common Pleas Court has held that the auditor had no authority to place a tax upon franchises. In making additions, after the board of review had handled the matter, the auditor placed upon the tax books what he thought the franchises were worth. The companies refused to pay any of the additions made on the ground that he had no right to increase the amount over the heads of the board of review. The companies filed demurrers to the treasurer's petition, and it was on these that the ruling was made. The companies concerned are the Cleveland Electric Railway Company, the Cleveland Gas Light and Coke Company, the Cleveland Electric Illuminating Company and the People's Gas Light and Coke Company.

Congressman B. G. Dawes of Marietta and Col. M. M. Gillette have purchased the property of the Citizens' Electric Light and Power Company of Newark and organized the Licking Light and Power Company to operate it. The new company has a capital stock of $300,000. It is understood that the property was purchased for $175,000. Colonel Gillette, Henry G. Bohl, John P. Maynard, W. G. Barthalow and J. W. Danford are the incorporators.

The Lima, Findlay and Toledo Traction Company has filed a mortgage on the line between Lima and Findlay for $600,000 in favor of the Citizens' Saving and Trust Company to guarantee an issue of five-per cent. 20-year bonds.

The National Carbon Company of Cleveland will pay a dividend of 1½ per cent. on the common stock on July 15th. This is the second dividend on common.

Reports from the receivers of the Appleyard lines show that they have been making good gains over last year. It is not expected that anything further will be done toward the reorganization of any of these companies until in the fall.

It has been announced that the $1,500,000 bonds of the Cincinnati, Dayton and Toledo have been sold to a syndicate that was formed through the efforts of the Cincinnati Trust Company. The money received will be used for improving the road in the manner described in the Western Electrician some time ago.

An ordinance was passed by the City Council of Cleveland, formulated by Councilman Hitchins, renewing certain franchises and requiring the Cleveland Electric Railway Company to issue eight tickets for a quarter. The purpose of the ordinance, as announced by Mr. Hitchins, is to get the matter before the company in an authoritative way and reach a settlement if possible. It is probable that Mayor Johnson will use his veto power on this, as it does not comply with his three-cent ideas altogether.

It is denied that the United Gas Improvement Company has made a proposition to lease the property of the Cincinnati Gas and Electric Company, but in an interview a few days ago Briggs S. Cunningham is quoted as favoring such a lease, from the fact that it will bring more capital to that city and cause improvements of various kinds to be made.

The assets of the Barriett Electric Company of Cincinnati will be sold by Charles T. Greve, referee in bankruptcy, on July 10th. Bids have been asked for.

A time card in the form of a pamphlet has been issued giving the time and schedules for all electric roads diverging from Columbus. It will be issued monthly and corrected up to date. The book contains a map of all the sections reached from Columbus and other valuable information.

The reorganization committee of the Eastern Ohio Traction Company has recommended the sale of the property under foreclosure of consolidated mortgage bonds, and the organization of the Cleveland and Mahoning Valley Traction Company to take over the properties. The proposition is to issue $2,000,000 common stock, $1,000,000 preferred and $2,500,000 new first consolidated mortgage five-per cent. bonds. For various purposes the new company will need $878,000 in money.

At a meeting of the directors of the Toledo and Western a few days ago the capital stock was increased from $1,800,000 to $2,500,000 and provision was made for a new mortgage of $2,500,000. No additional capital stock will be issued, but the bonded indebtedness will be increased from $1,500,000 to $1,900,000, the proceeds to be used in taking up the floating debt and purchasing new equipment. This road does a heavy freight business and its expenditures for siding and equipment for the last few years has been large.

The name of the Crawford Gas and Electric Company of Galion has been changed to the Crawford County Gas and Electric Company. The common stock now amounts to $150,000 and preferred $50,000.

The American Automatic Light Company of Urbana has been incorporated with a capital stock of $10,000 by F. A. Zimmer, F. B. Patrick and others. O. M. C.

Northwestern States.

Minneapolis, July 1.—Work has been started on the new electric line from Iowa City, Iowa, to Alden. It will be utilized for the purpose of furnishing the latter place with electric lighting.

The contract for constructing a municipal electric-light and waterworks system at Alma, Neb., has been let to MacKean, Ball & Co. of Chicago.

The Depere (Wis.) Electric Light and Power Company has ordered two new 100-kilowatt dynamos from the C. & C. Electric Company of Garwood, N. J.

The Iowa Gas and Electric Company has been incorporated by G. S. and T. C. Carson of Iowa City with a capital of $50,000. The company will buy out the Washington Lighting Company of Washington, Iowa.

The Sioux City (Iowa) Homer and Southern Railroad Company has announced that construction work will be started on the new line at once.

A company has been formed at Dayton, Iowa, for the purpose of building a lighting plant. It is capitalized at $10,000.

The Interurban Company is planning to extend its line from Woodward, Iowa, to Boone.

The City Council has decided to purchase an $8,000 storage-battery outfit and will furnish an all-day current at Newton, Iowa.

The proposition to vote bonds for $90,000 to purchase the lighting system at Virginia, Minn., has been voted down. R.

Indiana.

Indianapolis, July 1.—The Wayne General Construction Company of Ft. Wayne has been incorporated with a capital stock of $10,000 to construct and equip street and interurban railroads and plants for the generation and distribution of gas and electricity. George W. Beers, Charles McCulloch, F. V. Culbertson and H. G. Keegan are the incorporators.

The Ohio Valley Traction Company, with headquarters in Indianapolis, has amended its articles of incorporation and increased its capital stock from $50,000 to $250,000. According to the amended articles the company will build a traction line from Indianapolis to Evansville. Joseph H. Larimer, A. E. Fauvre and D. H. Morgan are directors.

The South Bend Western Railway Company and the Laporte and Michigan City Traction Company, capitalized at $500,000 and $400,000, respectively, have been merged into the South Bend, Laporte and Michigan City Traction Company, with a capital stock of $1,000,000. The South Bend Western Company is now building an interurban line between Laporte and South Bend. The intention is to extend the line north to Chicago and east to Cleveland, Ohio.

The first car to run on the Lehanon-Thorntown traction line was sent out on June 30th and went as far as Hazelrigg. The line is almost completed.

During the 12 months ended May 31st the Indianapolis, Columbus and Southern Traction Company carried 1,048,443 packages on its line between Indianapolis and Columbus. No statement has been made public as to the earnings for the year.

Charles L. Henry, representing the Indianapolis and Cincinnati Traction Company, has been granted a franchise by the Shelbyville council to continue his line through Shelbyville to Greensburg.

A report current in local traction circles is that control of the Indianapolis and Martinsville Rapid Transit Company has passed from the hands of Stone & Webster of Boston, who recently acquired the property, to the Widener-Elkins syndicate of Philadelphia, represented by Hugh J. McGowan.

The petition for entrance to Indianapolis by the Indianapolis and Western Railway Company, the interurban line to Terre Haute, has been approved by City Engineer Jeup, and he recommends that the company be granted a franchise similar to that of other interurban companies.

Plans for a large holding company to take over all the electric traction lines centering in Indianapolis are understood to be approaching completion by the Widener-Elkins syndicate, represented by Hugh J. McGowan, in Indiana. It is said the new company will be called the Consolidated Traction Company. The syndicate already controls the Indiana Union Traction Company, the Indianapolis and Eastern, the Richmond Street and Interurban Companies, the Indianapolis and Martinsville line, the Plainfield line, the Fort Wayne and Wabash Valley line, the Indianapolis Traction and Terminal Company's line, and an interest in the Indianapolis and Western Traction Company's line, now building to Terre Haute. This leaves but three companies outside, according to report. S. S.

PERSONAL.

Thomas R. Mercein of Milwaukee, secretary of the Northwestern Electrical Association, was in Chicago last week.

C. R. Morley, president of the Stark Electric Company of Canton, Ohio, has returned from a trip around the world. Mr. Morley was absent six months and spent considerable time in Egypt and Palestine.

F. W. Roebling of Trenton, N. J., has been selected as one of the new directors in the reorganization of the Equitable Life Assurance Society of New York. Mr. Roebling is an officer in the John A. Roebling's Sons Company.

John F. Stevens of Chicago, until recently vice-president of the Chicago, Rock Island and Pacific Railway Company, has been selected as chief engineer of the Panama Canal, to succeed John F. Wallace of Chicago, who recently resigned.

The board of trustees of the University of Illinois has accepted the resignation of Prof. N. C. Ricker as dean of the college of engineering and has appointed Prof. J. W. White as acting dean. Professor Ricker, it is understood, will remain at the head of the department of architecture.

Blake A. Mapledoran has been appointed general manager of the Northern Texas Traction Company, the position made vacant a few weeks ago by the death of F. M. Haines. Mr. Mapledoran has been connected with street-railway interests at Memphis, Tenn., for some time and is well acquainted with the ideas and methods of the South.

James A. Brett, formerly of the Electrical Installation Company, is now in charge of the railway department of the Chicago office of the Westinghouse Electric and Manufacturing Company. Mr. Brett, whose wide experience entitles him to be considered a good judge, is a firm believer in the future of the electric railway and considers that single-phase operation will play an important part in heavy railroading.

W. A. Stadelman, eastern agent of the Wellman-Seaver-Morgan Company, who has been in charge of the eastern office at No. 42 Broadway, New York city, has been appointed general sales agent of the same company, with headquarters at Cleveland, Ohio. Fred Stadelman has been appointed assistant manager of the New York office. Harry V. Croll, M. E., for the last eight years with the E. P. Allis Company, and its successor, the Allis-Chalmers Company of Milwaukee, has resigned and accepted a position with the Wellman-Seaver-Morgan Company at the main office in Cleveland.

Harold U. Wallace, son of John F. Wallace, who has just resigned as chief engineer of the Panama Canal Commission, has accepted the third vice-presidency of J. G. White & Co. Mr. H. U. Wallace resigned as chief engineer of the Illinois Central railroad to accept this position. He has been connected with that road since 1894, and since 1902 has been its chief engineer. An important work carried out for the Illinois Central railroad by Mr. Wallace was the lake-front improvement in Chicago. This work included the depression and reconstruction of 20 miles of main lines and yard tracks.

ELECTRIC LIGHTING.

The Iowa Gas and Electric Company of Washington, Iowa, has been incorporated.

Fleshman & Harkrider of Center, Texas, have sustained a severe fire loss in their electric-light plant in that city.

The contract for the municipal electric-light and waterworks system at Alma, Neb., was awarded to the McKean-Ball Company of Chicago.

The board of control of the Marquette branch of Michigan State Prison will shortly let the con-

tract for the construction of a new heating and power plant for the institution.

E. E. Mandeville of Philadelphia, Pa., will apply for a franchise to install an electric-light plant at St. Augustine, Fla.

The Sioux Falls (S. D.) Electric Light and Power Company, with a capital of $100,000, has been incorporated.

An election will soon be held in Burlington, Wis., to vote on the question of issuing $12,000 bonds for a municipal lighting plant.

The city of Monroe, Ga., will receive bids for the construction of waterworks and electric-light plant, for which $45,000 of bonds has been voted.

The Harpers Ferry (W. Va.) Electric Light and Power Company has secured a franchise to construct and operate an electric-light and power plant in Brunswick, Md.

A committee of five has been appointed at Fort Dodge, Iowa, to investigate the advisability of constructing a gas and electric-lighting plant to be owned by the municipality.

The Missouri Heat, Light and Power Company of Kirksville, with a capital of $50,000, has been incorporated by O. H. Davidson and K. B. Davidson of Des Moines, Iowa, W. B. Kinnish of Adel, Iowa, and others.

Bids are being received by Captain Goodale, constructing quartermaster, United States Army, Astoria, Ore., for electric-light fixtures and installing an exterior and interior lighting system at Fort Stevens.

The Colorado Light and Power Company of Denver, with a capital of $200,000, has been incorporated, it is reported, by A. W. Mellon, R. B. Mellon, George S. Davidson and others of Canon City, Colo.

The McDonoughville Water, Power and Improvement Company of McDonoughville, La., has been organized by Henry Hart, C. A. Chandler and associates with a capital of $100,000. It is proposed to construct and operate a system of waterworks and an electric-light plant, for which the plans have been prepared.

ELECTRIC RAILWAYS.

The Indian Terrritory Traction Company of South McAlester, I. T., has passed into the hands of the Choctaw Railway and Lighting Company.

A company has been organized by Eugene Jaccard and others of Kansas City, Mo., to build an electric railway from Kansas City to Excelsior Springs.

While in Olathe, Kan., recently, William B. Strang stated that the proposed Kansas City, Olathe, Lawrence and Topeka electric railway is to be built at once.

It is reported that negotiations are under way for the sale of the Beaver Valley Traction Company of Newcastle, Pa., and that it will go to make up a portion of the traction system from Cleveland to Pittsburg.

Traction men of Cleveland, Ohio, who own the Muncie, Hartford and Fort Wayne Traction Company have disposed of $500,000 bonds in that company to Rollins & Son of Chicago, the proceeds to be used in the construction of the extension of the line from Bluffton to Fort Wayne, a distance of 25 miles. This portion of the line is being built under the name of the Bluffton and Fort Wayne Traction Company. Work was commenced on the line a few days ago.

AUTOMOBILES.

There are 3,800 licensed automobiles in Chicago.

The automobile industry in Austria, especially in Vienna, has lately experienced a slight impetus by reason of the fifth international automobile exposition, held in Vienna recently. About the time the exhibition was held a bill was before the Austrian Parliament to regulate the use of automobiles, which the manufacturers and dealers opposed on account of what they claimed to be unnecessary requirements. A recent United States consular report says that the automobile business in Austria does not offer inducements to Americans, considering the favor and sale of the machines at home.

POWER TRANSMISSION.

The largest undertaking for the transmission of electric power in Europe, says Richard Guenther, United States Consul-general at Frankfort, Germany, has recently been inaugurated by the Company for Electric and Mechanical Industry at Geneva, Switzerland. The waterpower for this plant is furnished by the river Isère, and up to 630,000 horsepower is intended to be utilized. Transmission will be by means of copper wires from Moutiers as far as Lyons. Owing to the great distance, a considerable loss of power has to be reckoned with. The current is to be sent at 56,960 volts, and it is expected that at arrival in Lyon a voltage of 50,000 will still remain.

The Maryland Telephone and Telegraph Company has awarded contracts for the necessary machinery to double the capacity of its new electric power plant, which is nearing completion in Baltimore, Md. The present plant will have a capacity of 4,000 kilowatts.

It is stated that the three corporations which have been figuring on the plans for electrical development on the lower Susquehanna River are about to be merged as one corporation under a single charter. These are the McCalls Ferry Power Company, which is said to have been underwritten for $8,000,000 by New York and Boston capitalists; the Susquehanna Electric Company, in which B. Harvey Welch and others of Philadelphia are interested, and the Susquehanna Electric Power Company, in which George K. McGaw, H. M. Houseman and others of Baltimore are interested. The McCalls Ferry Company, as planned, does not contemplate bringing power to Baltimore, but the deal now pending is expected to develop into an agreement to supply the United Railways with current. This company, with the United Electric Light and Power Company, would consume about 35,000 of the 50,000-horsepower development which is proposed.

SOCIETIES AND SCHOOLS.

The regular monthly meeting of the Ohio International Railway Association for the month of June was held at Crown Point, Ohio. The meeting was largely of a social nature, and many ladies were present. Freight business by interurban roads was discussed to some extent, but no action was taken.

The sixth annual meeting of the National Electrical Trades Association was held in Montreal, Can., on June 23d. This association is composed of about 300 representative houses in electrical and allied trades in the United States, Canada and Mexico. Questions of importance to the interests of the electrical trade came up for discussion.

The Illinois Electrical Contractors' Association held its third annual convention at Hotel Fey in Peoria on June 10th. At this convention the principal feature was the instruction of delegates to the national convention, to be held in Boston, July 19th. The following-named gentlemen were elected to the various offices: President, W. A. Robb, Rock Island; vice-president, C. E. Stapp, Peoria; secretary, C. R. Kreider, Chicago; treasurer, E. E. Gibson, Decatur; directors, Ernest Freeman, Chicago; Guy Carleton, Bloomington, and J. T. Marron, Rock Island.

At the twenty-fourth annual meeting of the New York Electrical Society, held in New York city last month, the following-named officers were elected: President, W. S. Barstow; vice-presidents, H. G. Stott, Putnam A. Bates, Max Lowenthal; secretary, George H. Guy; treasurer, H. A. Sinclair. The vice-presidents elected in 1904 for two years are Albert F. Ganz, Louis B. Marks, W. S. Rugg. The report of the secretary showed that 46 members had been elected during the season; the loss by death had been four, by resignation, 25; 10 had been dropped, and the total existing membership was 636.

PUBLICATIONS.

A new and interesting catalogue has just been issued by M. Klein & Sons, the well-known tool manufacturers of Chicago. Every lineman and user of tools is requested to send for this new publication.

The Aiton Machine Company has just issued its bulletin No. 20, showing three types of vertical stranding machines for the manufacturing of small wire ropes and light cords. Copies of this bulletin may be obtained at the offices of the company, 126 Liberty Street, New York city.

A little book which tells something about ideals in steam power-plant practice and gives a few suggestions toward accomplishing these ideals has been issued by A. L. Ide & Sons of Springfield, Ill. How the Ideal engine fulfills the requirements of ideal operation in a power plant is told in the book.

The Jeffrey Manufacturing Company of Columbus, Ohio, in order to bring its extensive line of screens more prominently to the attention of the trade has just issued a new catalogue illustrating many types of screens for various purposes, such as screening sand and gravel, etc. Some attention is also given in the catalogue to portable excavating and screening machinery and cylinder dryers.

The Pittsburg Transformer Company of Pittsburg, Pa., is ever on the alert to find likely subjects to adorn its monthly calendars. A "find" was certainly made for the month of July, and a single glance is sufficient to make manifest that the face and figure of the young lady representing July cannot be beaten in August, September or any other month in the year.

Type B integrating wattmeters form the subject of a bright little pamphlet issued by the Westinghouse Electric and Manufacturing Company of Pittsburg. These meters are for single-phase work —7,200 and 16,000 alternations—on three-wire circuits. The pamphlet besides describing the apparatus thoroughly, gives complete price lists of all style numbers for the convenience of those ordering meters.

Three new bulletins issued by the Electric Storage Battery Company of Philadelphia describe "The Application of Storage Batteries to Lighting and Power Plants," the "Two-plate Type of the Chloride Accumulator" and the "Carbon Regulator for Automatic Booster Control." Besides descriptions of the batteries and booster apparatus, the bulletins contain a number of curves of operation which are interesting.

The passenger-traffic department of the Great Northern Railway Company, of which F. I. Whitney is manager, has recently issued a neat pamphlet describing the resources of the country tributary to some new extensions the Great Northern is making in North Dakota. Four of these extensions are mentioned in the pamphlet—the Sarles extension, beginning at Edmore; the Thorne extension, beginning at York; the Maxbass extension, beginning at Towner, and the Sherwood extension, beginning at Granville. Some prosperous farming scenes are shown in the pamphlet, which altogether is an attractive one.

The Wagner Electric Manufacturing Company of St. Louis, a pioneer manufacturer of single-phase alternating-current motors in this country, has issued a comprehensive folder descriptive of this class of apparatus, which it is mailing to the trade. The company states that its line of product is being constantly enlarged and that its two forms of motor (constant-speed type BA and elevator type BS) will handle, with splendid results, practically every kind of power-motor service. In addition, it is prepared now to furnish two types of polyphase motors—type BM squirrel-cage armature, and type BR with external starting resistance.

The National Fire Protection Association, the secretary of which is W. H. Merrill, Jr., of 382 Ohio Street, Chicago, has issued its volume of proceedings of the ninth annual convention held in New York, May 23 to 25, 1905. The book contains 338 pages and includes many diagrams illustrating the various papers and committee reports. The president of the association is C. A. Hexamer, and the vice-president William A. Anderson. According to the membership lists contained there are now 50 active members, which consist of various associations and bureaus; one honorary life member, Mr. Uberto C. Crosby, and 597 associate members.

The Fort Wayne Electric Works of Fort Wayne, Ind., has issued five new bulletins, Nos. 1062 to 1066 inclusive. These bulletins describe in order type W induction integrating wattmeters, type W prepayment wattmeters, standard alternating-current switchboard panels for single-phase circuits, high-torque type K single-phase wattmeters and type K prepayment wattmeters. These bulletins are prepared with the good taste and typographical excellence characteristic of Fort Wayne literature. Besides the bulletins the Fort Wayne company has also issued two other pieces of literature upon wattmeters. One of these is an instruction book upon type K multiphase induction integrating wattmeters, and the other is a handsome little booklet entitled "Notes on Prepayment Wattmeters."

MISCELLANEOUS.

Reichelsheim, in the Wetterau District, Grand Duchy of Hesse, Germany, is to have an electric central station to supply power to various towns and industrial works in the district.

The Brooklyn Heights Railroad Company has closed contracts for two steam-turbine electric-generating units for extending the power equipment of the Brooklyn Rapid Transit system. The contracts call for turbine engines of a normal capacity of 10,500 horsepower and a maximum capacity of about 16,000 horsepower.

Operations for the extraction of radium are commenced by crushing the pitchblende, and then roasting the powder with carbonate of sodium. After washing, the residue is treated with dilute sulphuric acid; then the sulphates are converted into carbonates by boiling with strong carbonate of sodium. The residue contains radium sulphate, which is an exceedingly insoluble salt. The soluble sulphates are washed out, and the residue or insoluble portion is easily acted upon by hydrochloric acid, which takes out, among other things, polonium and actinium. Radium sulphate remains unattacked, associated with some barium sulphate. The sulphates are then converted into carbonates by treatment

with a boiling strong solution of carbonate of sodium. The carbonates of barium and radium are next dissolved in hydrochloric acid and precipitated again as sulphates by means of sulphuric acid. The sulphates are further purified, and ultimately converted into chlorides, until about 15 pounds of barium and radium chloride are obtained by acting upon one ton of crushed pitchblende.

TRADE NEWS.

The Singleton Electric Company of Macon, Ga., has been incorporated by W. H. Singleton, W. A. McKenna and M. O'Hara, to deal in electrical supplies.

American manufacturing works, says Richard Guenther, United States consul at Frankfort, Germany, ought to combine and establish branches and agencies in Europe for the purpose of contracting for electric plants, railroads and supplies for same, machinery, dry docks, and other large constructions.

Orders for steel rails continue to add larger tonnages than do those for any other kind of finished iron material, according to the Iron Trade Review, although the demand for structural shapes and for plates is strong. The principal orders for rails from steam railroads and electric lines are as follows: Vanderbilt system, 25,000 tons; Wabash, 5,000; Toledo and Chicago Interurban, 5,500; Long Island, 2,500; Chicago, Milwaukee and St. Paul, 300; trolley lines in Cleveland district, 5,000; trolley lines in the East, 1,000.

One of the latest companies to enter the electrical manufacturing field in the Middle West is the Lafayette Electrical Manufacturing Company of Lafayette, Ind., which was organized by local capitalists to prosecute chiefly the transformer manufacturing business. This company starts business under the management of Mr. William H. Hornberger, already well known for many years in the transformer field. The company will manufacture the Hornberger transformer in various styles to meet every requirement of present-day practice, not only in the electric-lighting field but the alternating street-railway field as well. A large three-story brick factory in Lafayette is now occupied by the company and a full line of transformers is expected on the market within 30 to 40 days. Mr. Hornberger, who has charge of the company's designing, has a well-earned reputation as a transformer designer. He is familiar with every feature of a transformer from a theoretical viewpoint and is also in thorough touch with the commercial side of the transformer business.

Sealed proposals will be received at the office of James Knox Taylor, supervising architect, Treasury Department, Washington, D. C., until July 21, 1905, for the installation of a conduit and electric wiring system, and until July 27, 1905, for the extension of and incidental changes to the low-pressure and exhaust-steam heating, mechanical ventilating apparatus, ash hoists, etc., for the United States postoffice and courthouse at Kansas City, Mo., in accordance with drawings and specifications, copies of which may be obtained at the supervising architect's office, or at the office of the superintendent of construction at Kansas City.

BUSINESS.

The White Marble Lime Company, Manistique, Mich., makes a specialty of white-cedar ties for electric railways, and invites electric-railway companies to obtain its prices before placing their orders.

The Chandler & Taylor Company of Indianapolis, Ind., was the successful bidder for the 150-horsepower high-speed self-oiling engine which is to be placed in the new power plant to be installed in the department store of Mandel Bros. in Chicago.

The Lindsley Bros. Company of Chicago, Spokane and Portland, has issued a list of various sizes of poles ranging from 25 feet up, which it has on its skids ready for immediate shipment. It invites users of poles to wire it for delivered prices at its expense.

The rapid advance of civilization in Japan has been closely followed by increased industrial activity. In no other way is this fact shown more forcibly than by the large orders for improved types of machinery which are being continually received by well-known American manufacturers. During the years 1903 and 1904 Takata & Co., agents for the Westinghouse Machine Company in Japan, have sold no less than 56 Westinghouse engines, ranging from 600 horsepower down to 12½ horsepower, and aggregating in capacity almost 8,000 horsepower. They are all of the vertical single-acting type, both simple and compound.

One of the attractive exhibits of the National Electric Light Association convention in Denver was that of the H. W. Johns-Manville Company, New York. This exhibit deserves special mention on acount of its attractive appearance and the interest which was shown by the delegates in the new National Electric Code standard fuse material. A complete line of Noark standard and also National Electric Code standard fuses, blocks, service, subway and special boxes, accessories and high-tension insulators were on exhibition. James W. Perry, manager of the electrical department, New York, was in charge, assisted by J. W. Hardy of the Milwaukee office.

The Bijur "High-duty" storage battery, manufactured by the General Storage Battery Company of New York at its new factory in Boonton, N. J., is the invention of Mr. Joseph Bijur, who has worked out the problem along original lines, both in the mechanical and chemical details. In the production of the plate it became necessary to develop a commercial process of lead welding, which would produce a perfect mechanical and chemical union between the "grill" and the supporting frame. This Mr. Bijur succeeded in doing without the use of solder, flux or foreign material of any kind. Owing to the excellent circulation of electrolyte and disposition of active material the difference in electromotive force between charge and discharge is a minimum, producing a very efficient cell in addition to one which is said to be very nearly "foolproof."

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) June 27, 1905.

793,060. Electric Time-switch. Martin Danziger, Gleiwitz, Germany. Application filed March 30, 1903. Renewed May 20, 1905.

A contact in the electric circuit is closed by one of the hands of the clock at any predetermined time.

793,063. Electrical Instrument. John J. Ghegan, Newark, N. J. Application filed January 27, 1904.

In combination with an electric circuit are a movable armature the extent of motion of which is governed by the strength of current in the circuit and a dash pot provided with a piston and piston rod, a contact carried by the piston rod, the piston rod and contact adapted to be moved by the armature to adjust the contact to the varying positions of the armature.

793,065. Rotary Snap-switch. Monroe Guett, Hartford, Conn., assignor to the Hart & Hegeman Manufacturing Company, Hartford, Conn. Application filed March 10, 1904.

In a rotary snap switch are poles and an operating handle connected therewith through a spring. Means positively lock the poles against movement during a predetermined movement of the operating handle and other means release the poles.

793,066. Electric Switch. Monroe Guett, Hartford, Conn., assignor to the Hart & Hegeman Manufacturing Company, Hartford, Conn. Application filed November 1, 1904.

Stationary and rotary blocks of insulating material are provided with flat opposing surfaces held in contact with one another. Co-operating contacts in the blocks are located in isolated recesses, the contacts in one block being yieldingly mounted and provided with binding posts and the contacts in the other block being electrically connected in such manner as to leave the active parts of the contacts isolated from each other.

793,076. Anode Plate for Batteries. Harry C. Hubbell, Jersey City, N. J. Application filed October 3, 1904.

The battery plate consists of a series of transverse troughs formed of strips of metal having their ends pinched together, and vertical U-shaped channel plates firmly connected to the ends of the troughs, the channel plates being crimped at their ends to hold the troughs in place.

793,077. Cathode Plate for Batteries. Harry C. Hubbell, Jersey City, N. J. Application filed October 3, 1904.

A storage-battery cathode is composed of hair-like fibers of nickel intertwined and embedded in a mass of nickel oxid, forming a plastic mat or cake.

793,078. Cathode Plate for Batteries. Harry C. Hubbell, Jersey City, N. J. Application filed October 3, 1904.

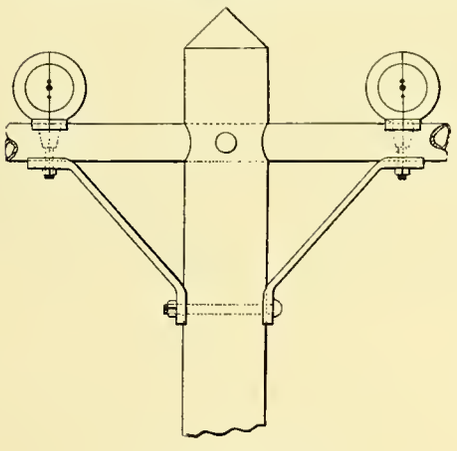
The cathode comprises a foraminous foundation, a silver-oxid mass deposited on the opposite sides of the foundation and keyed through perforations, a sheet of asbestos filtering material inclosing the plate and a wire-gauze pocket having binding-strips at its edges for inclosing the parts.

793,112. Vacuum Tube. Rome V. Wagner, Chicago, Ill. Application filed October 6, 1903. Renewed November 28, 1904.

Inclosed in a vacuum tube are a movable electrode, a hollow screw-threaded stem supporting it, a threaded post on which the stem is screwed, an armature connected to the stem, and an armature holder connected to the post.

793,117. Storage-battery Jar. Thomas S. Witherbee, Jersey City, N. J., assignor to the Witherbee Igniter Company. Application filed March 12, 1904.

Two sets of plates form a number of sets of electrodes within the jar, each set of plates secured to a suitable yoke. The yoke has an arm which extends inward and is then bent upward and outward, a binding post on the end of the arm being adapted to pass through the cover.



NO. 793,313.—INSULATOR.

793,118. Electric Water Heater. Arthur D. Wright and Eli E. Sager, Seattle, Wash., assignor of one-half to William C. Dice, Seattle, Wash.; said Wright assignor of his remaining right to Andrew Hemrich, Seattle, Wash. Application filed September 6, 1904.

An electric water heater comprises a shell, a bar disposed therein and a resistance coil wound about the bar, the coil being in contact with the bar at various points about its periphery and spaced therefrom at other points.

793,128. Method of Treating Oil and Gas Wells. Fulton Gardner, Chicago, Ill., assignor of one-half to Julia B. Follette, Chicago, Ill. Application filed October 31, 1904.

The method of treating oil and gas wells to promote the flow consists in introducing an electric heating device in the productive strata of the well, fixing a closure in the well above the heating device, sending electrical current through the heating device and subjecting the sealed part of the well to the combined action of heat and vapor pressure thus generated.

793,137. Electromagnetic Ore Separator. Erich Langguth, Euskirchen, Germany. Application filed June 18, 1904.

Combined with a primary pole piece is a rotary member provided with secondary pole pieces and arranged to rotate adjacent to and parallel with the primary pole piece. Part of the path of the rotary member is out of the field of influence of the primary pole piece. A casing of non-magnetic material is placed between the primary pole piece and the rotary member.

793,138. Electrolytic Decomposition of Saline Solutions. Arthur B. Larchar, Oldtown, Me., assignor to the Penobscot Chemical Fibre Company of Maine. Original application filed October 9, 1900. Divided and this application filed October 9, 1902.

An improvement in the electrolysis of saline solutions by the use of a diaphragm immersed in and separating two bodies of liquids, one containing the anode and the other the cathode, consists in regulating the depth of the cathode-containing liquid relative to the liquid in the anode chamber to control the passage of caustic soda and undecomposed salt through the diaphragm, and prevent the backward diffusion of the caustic soda through the diaphragm.

793,143. Jump-spark Apparatus. Herman C. Mueller, Fond du Lac, Wis. Application filed August 27, 1904.

In a jump-spark apparatus are a pair of induction coils having their primary windings connected in series, a separate core for each coil and a contact breaker provided with an armature plate having its face adjacent to the ends of the cores.

793,158. Electric Heater. Charles A. Rolfe, Adrian, Mich., assignor to the Rolfe Electric Company, Rochester, N. Y. Application filed November 14, 1903.

An electric heater comprises an electric incandescent lamp and a device for holding the article to be heated; the device is secured to and supported by the lamp so as to cause the article to be heated by the lamp filament.

793,188. System of Electrical Distribution. Charles M. Green, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 3, 1897.

Constant-potential mains are associated with a branch circuit across the mains containing translating devices in series. A source of electromotive force interposed between translating devices in the branch-circuit mains is used for "boosting" the potential of the branch circuit.

793,197. Flush Attachment-plug Receptacle. Harvey Hubbell, Bridgeport, Conn. Application filed February 25, 1905.

Combined with a base having a transverse recess and contact plates extending upward from the bottom are a covering block lying in the recess and having insulating chambers receiving the contact plates, contracted insulating passages leading into the insulating chambers and a center screw passing through the covering block and base whereby the parts are locked together.

793,211. Method of and Apparatus for Finishing Electric Lamps or Bulbs. George P. McDonnell, St. Louis, Mo., assignor to the American Electric Company, East Orange, N. J. Application filed November 2, 1904.

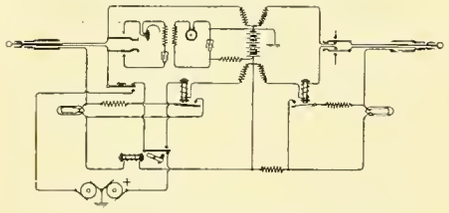
The method of finishing electric lamp bulbs consists in first heating the lamp or bulb, then applying heat to the teat while protecting the lamp proper, rotating the lamp at the time the heat is applied to the teat and then finally annealing the lamp.

793,223. Igniter for Combustible Vapor Engines. Willis J. Perkins, Grand Rapids, Mich. Application filed August 11, 1902.

In an igniter is a plug having truncated conical ends adapted to close alined openings in two separate walls. The plug also has a reduced middle portion connecting the ends, and electrodes extending through the ends and middle portion.

793,229. Heating Device for Curling Irons or the Like. Charles A. Rolfe, Adrian, Mich., assignor to the Rolfe Electric Company, Rochester, N. Y. Application filed January 12, 1905.

An envelop or casing is adapted to fit around an incandescent lamp, the curling iron being inserted inside the envelop next the lamp.



NO. 793,389.—TELEPHONE-SERVICE METER.

793,231. Automatic Time-stamping Device. Robert Rowley, New York, N. Y. Application filed January 9, 1904.

Combined with a clock mechanism are a wheel provided with notation and an automatic stamping lever having at one end a head disposed in the range of action of the wheel and having the opposite end bent upwardly and provided with an adjusting screw. A spring connects the screw with the clock case. An armature is mounted on the lever actuated by a magnet. A ribbon-feeding mechanism is actuated by the lever.

793,244. Electric Signaling System. Herbert B. Taylor, East Orange, N. J., assignor to the Advance Signal Company, Newark, N. J. Application filed September 1, 1904.

In a signal system comprising signals normally indicating danger are normally closed and energized signal-operating circuits, the circuits operating to maintain the signals in either danger or safety position. Normally closed track circuits control the signal circuits.

793,245. Automatic Block-signaling System. Herbert B. Taylor, East Orange, N. J., assignor to the Advance Signal Company, Newark, N. J. Application filed December 17, 1904.

Normally open rail-circuit blocks are provided in the system, also normal danger home and distant signals located to indicate in advance the condition of the home and distant blocks. Signal circuits operate the signals by electromagnetic devices connected to the rail circuits and actuated thereby.

793,304. Trolley Wheel and Guard Therefor. Fridolin Koenig, Newark, N. J., assignor of two-thirds to Charles Koenig, Newark, N. J., and Fridolin Koenig, Jr., New York, N. Y. Application filed December 17, 1904.

A pair of upwardly projecting arms are mounted on the trolley carrier, and between them are a pair of oscillating arms, the combination acting to keep the trolley upon the wire.

793,313. Insulator. Bertie B. Moss, Pekin, Ind., assignor to Leander G. Davis and Milton Hottel, Salem, Ind. Application filed February 1, 1904.

A braced cross arm on the pole carries insulators having stems which extend through the cross arm and braces, with nuts on the stems binding the parts together. (See cut on preceding page.)

793,325. Noise and Lightning Arrester for Telephone Wires. Alexander Stiles, Martinsville, Ind. Application filed November 10, 1903.

A tapering plug of soft copper has rounded corners terminating with a head or knob at one end and having a transverse perforation at the other through which one end of the divided wire is threaded and looped back and secured to the body of the wire. The plug has lateral wings which bend over and hold the loop.

793,344. Trolley Base. Peter Best, Elizabeth, N. J. Application filed September 29, 1904.

The trolley base comprises a hollow base or cup portion having means for attachment to the car. A turret is mounted on the hollow base and constructed to carry the trolley pole.

793,389. Telephone Service Meter. Frank R. McBerty, Evanston, and James L. McQuarrie, Chicago, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed November 19, 1902.

Combined with a telephone line is a central-office circuit and a connection switch for uniting the line with the circuit. A service meter connected with the line has means actuated in the closure of the connection switch for operating the meter to effect a registration. Rebating mechanism for the meter, under the sole control of the central office operater is adapted to cancel the record made. (See cut.)

793,424. Electric Oven. Levitt E. Custer, Dayton, Ohio. Application filed September 14, 1904.

An electric oven having an outer inclosing casing or shell is supplied with an interior heating chamber having its floor and walls formed out of porous material, and provided with perforations or cylindrical depressions. Crimped or looped wire conductors are arranged so as to evenly distribute the heat, and embedded within the floor and walls of the heating chamber.

793,429. Electrically Operated Hydraulic Valve. Carl Engberg, St. Joseph, Mich., assignor to the Engberg Electric and Mechanical Works, St. Joseph, Mich. Application filed February 23, 1904.

An electromagnet, controllable from a distance, actuates the valve mechanism.

793,430. Trolley. David C. Evans and Oliver Q. Patterson, Uniontown, Pa. Application filed March 15, 1905.

Details are described.

793,444. Microtelephone. Konrad Höflinger, Vienna, Austria-Hungary, assignor of one-half to Carl Wolffhardt, Jr., Vienna, Austria-Hungary. Application filed March 11, 1904.

Connected to a source of electric energy is an electromagnet and a diaphragm operatively disposed with reference to the electromagnet to form therewith a telephone receiver. Contacts are normally disposed to form an interrupter, one of them being carried by the diaphragm. A branch conductor comprises the other of the contacts, and means for closing a circuit comprising the branch conductor and the portion of the main circuit which includes the energy source are provided.

793,445. Lightning Arrester. Thomas J. Johnston, Brooklyn, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 8, 1901.

Combined with a circuit to be protected is a series of spark-gap terminals connected directly to the circuit. A grounded connection to the spark-gap terminals contains a non-inductive resistance, and a device possessing capacity is connected to the spark-gap terminals. (See cut.)

793,454. Multiple Switch Rheostat. Frederick Mackintosh, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 5, 1903.

Associated with a series of independently actuated manual switches are means for preventing their closure except in a definite order, and means for automatically opening them simultaneously.

793,480. Electrically Operated Railway Switch. Bryan S. Wakeman, Scranton, Pa., assignor to the Scranton Electrical Switch and Signal Company, Scranton, Pa. Application filed August 30, 1904.

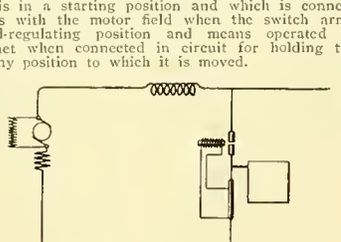
Combined with a railway switch having a movable switch point and a lever operatively connected to the switch point are a maagnet, a stop or bearing adjacent to a pole piece of the magnet and an armature hinged to the lever and forming a longitudinal extension thereof, the armature having its free end normally supported by the stop.

793,493. Rheostat. William C. Yates and Alexander M. Fenwick, Schenectady, N. Y., assignors to the General Electric Company, Schenectady, N. Y. Application filed September 26, 1904.

An adjustable resistance in the armature circuit has means preventing closure of its switch unless all the resistance is in circuit. Means for closing the field circuit of the motor and means preventing opening the field circuit before the armature circuit is opened are also provided.

793,494. Controller. William C. Yates, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 28, 1904.

In a motor-starting and speed-regulating rheostat having a switch arm are contacts co-operating therewith, a retaining magnet which is de-energized while the switch arc is in a starting position and which is connected in series with the motor field when the switch arm is in speed-regulating position and means operated by the magnet when connected in circuit for holding the arm in any position to which it is moved.



NO. 793,445.—LIGHTNING ARRESTER.

793,513. Circuit-controlling System. Arthur C. Eastwood, Cleveland, Ohio. Application filed December 19, 1904.

In a system including a current-actuated device are a main switch therefor, hand-operated switches independent of the main switch connected to cause opening, and others for causing closing of the main switch. Additional means open the main switch, both when the voltage of the supply circuit falls below a predetermined minimum and when the current flow to the current-actuated device rises above a predetermined maximum.

793,514. Circuit-controlling System. Arthur C. Eastwood, Cleveland, Ohio. Application filed April 15, 1905.

A circuit-governing system includes a controller having a rotatable element and mechanism for operating the element including a ratchet wheel. A solenoid turns the wheel, a spring acting opposition to the solenoid. A locking pawl for the ratchet, a second solenoid for actuating the pawl and a master controller including a gravity-actuated make-and-break switch for governing the action of the solenoids complete the apparatus. (See cut.)

793,537. Weighing Scale. Clarence W. McKee, El Paso, Texas. Application filed November 2, 1903. Renewed May 20, 1905.

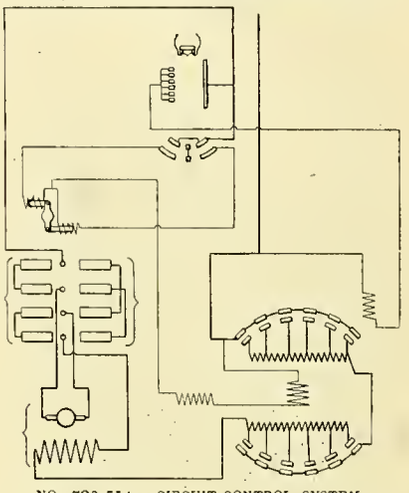
Contact points, brought together by the downward movement of the scale pan, close an electric circuit which rings a bell when the pan is loaded above the required amount.

793,541. Electrical Annunciator. Leonard F. Rose, Washington, Iowa. Application filed May 3, 1904.

Proper electrical appliances are used to trip the shutter of the annunciator.

793,563. Thermal Cut-out or Circuit Changer. Charles A. Brown, Chicago, Ill. Application filed April 5, 1902. Renewed January 15, 1904.

Combined with a heat-producing element in the form of a heat coil are switching means controlled thereby and a wire rod surrounded by the coil for conducting the heat produced. Heat-responsive material engages the rod for normally maintaining the switching means in one operative position and for releasing the switching means upon abnormal current flowing through the coil.



NO. 793,514.—CIRCUIT-CONTROL SYSTEM.

793,570. Motor-controlling System. Arthur C. Eastwood, Cleveland, Ohio. Application filed April 15, 1905.

Electromagnetic devices are constructed to actuate their respective mechanism under different conditions of current flow. Means render the current flow through the devices independent of variations in the voltage of the source of supply and other means vary the current flow at will to cause successive operation of the electromagnetic devices.

793,578. Electrical Signaling System. Clayton E. Frederickson, Denver, Colo., assignor of one-half to Jean F. Webb, Denver, Colo. Application filed August 1, 1904.

Selective signaling mechanism comprises a source of electric energy, a main and a supplemental circuit, a current-shunting switch common to both of the circuits for shunting the current into either of the circuits and a circuit-closing member operated by the main circuit. A signaling bell and the circuit-closer member are connected in series in the supplemental circuit.

793,593. Electric-current Collector Ring. Hermann A. Knoener, East Orange, N. Y., assignor to the Crocker-Wheeler Company, Ampere, N. J. Application filed February 20, 1905.

An annular supporting member has mortises in the exterior periphery. Insulating plugs are set in the mortises and outwardly projecting metal studs are set in the insulating plugs. A collector ring having a groove in its iner periphery is engaged by and supported on the ends of the studs.

793,603. Service Meter. Frank R. McBerty, Evanston, Ill., and James L. McQuarrie, South Orange, N. J., assignors to the Western Electric Company, Chicago, Ill. Original application filed January 18, 1904. Divided and this application filed November 25, 1904.

A service-meter comprises a counting wheel, a pawl adapted to turn the wheel in one direction, another pawl adapted to turn the wheel in the opposite direction, a magnet and an armature therefor controlling the movement of the pawls.

793,608. Apparatus for Alternating Currents. Valdemar Poulsen, Frederiksberg, Denmark. Original application filed June 19, 1903. Divided and this application filed September 15, 1904.

Apparatus for producing alternating currents of high frequencies consists of electrodes between which an electric arc can be formed, means for supplying an electric current thereto, means for subjecting the arc to an atmosphere containing hydrogen and a circuit including the electrodes, a self-induction device and a device having capacity.

793,626. Electric Hoist. Philip J. Darlington, Glenridge, N. J., assignor to the Sprague Electric Company, Application filed January 28, 1904.

A controlling switch in circuit with the motor has an operating member, means for locking the operating member to the movable contact-carrying members of the switch and means operated by the motor for unlocking the members.

EXPIRING PATENTS.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on July 3, 1905:

385,344. Porous Cup for Galvanic Batteries. Asahel K. Eaton, Brooklyn, N. Y.

385,357. Combined Speaking and Signaling Apparatus. John E. Kelly, Camden, N. J.

385,363. Switch Signal. Adelard F. Martel, Montreal, Canada.

385,379. Current Collector for Series Electric Railways. Sidney H. Short, Denver, Colo.

385,384. Method of Joining Pipes by Electricity. Elihu Thomson, Lynn, Mass.

385,385. Method of Electrically Welding Chains and Links. Elihu Thomson, Lynn., Mass.

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LIBRARY OF ELECTRICAL ENGR'G

Starting of the First Unit of the Ontario Power Company.

By Orrin E. Dunlap.

In accordance with its agreement with the commissioners of Queen Victoria Park, the Ontario Power Company on Saturday, July 1st, demonstrated that it had power ready for commercial service by starting the first unit in its power station at Niagara Falls. Thus it is evident that another power company will shortly be prepared to furnish a generous supply of electric power on the Canadian side at Niagara as well as for transmission to the New York side of the river.

The Power House is Shown on the Right at the Water's Edge; Distributing Station on Bluff above; Horseshoe Falls to the Left.

POWER HOUSE AND DISTRIBUTING STATION OF ONTARIO POWER COMPANY AT NIAGARA FALLS (CANADIAN SIDE).

The power station of the Ontario Power Company is located at the water's edge on the Canadian side, almost in front of the New York end of the Horseshoe Falls. The first section of the building is now being completed, and it is expected that the installation will supply 60,000 horsepower. The turbines that are being installed by this company were designed and built by J. M. Voith, Heidenheim-on-the-Brenz, Wurtemberg, Germany, and are of the inward-flow, double, Francis type, the two runners of which are 78 inches in diameter, each capable of developing about 5,700 horsepower. The water is controlled at the turbine by swivel gates, and these act as guides. In height the turbines are about 13 feet, while the bed-plate measures 21 by 29 feet. Under a head of 175 feet they will make 187½ revolutions per minute. The head of 175 feet is made up of 155 feet above the shaft and 20 feet below it.

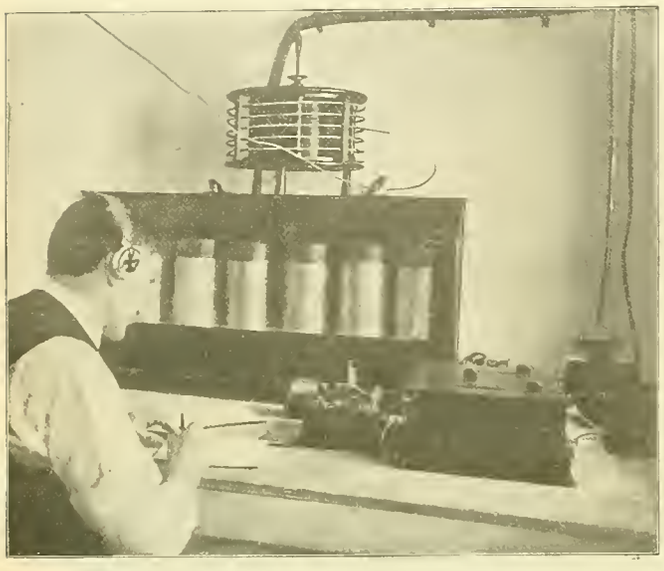
It has been found that the work of the Ontario Power Company on the Canadian side at Niagara is about as interesting as any of the power projects over there. It was this company that built great wing-dams out in the upper river to uncover a large area for the river bed, and when the rocks were high and dry it proceeded to build two forebays on the uncovered section. These forebays were recently completed and the water let into them for the first time. From the lower end of the inner forebay a steel flume 18 feet in diameter extends to a point on the high bank over the power station. This flume empties into an open relief or spillway near old Table Rock, and from this point the penstocks carry the water supply to the turbines located in the power house in the gorge below. Eight penstocks will connect with each 18-foot flume and drop through shafts and tunnels excavated through the cliff to the power station. It is expected that each big flume will deliver 3,900 cubic feet of water per second, the water flowing through the pipe at about 15 feet per second. Only one steel flume has been built so far, but this is expected to supply enough water for the development of 60,000 horsepower.

Power from this station is to be delivered at the international boundary line to the Niagara, Lockport and Ontario Power Company, which company is now engaged in erecting a transmission line eastward from Niagara Falls, the announced intention being to pass through Lockport, Medina, Albion and other places on the way to Rochester, N. Y. The point where the transmission line will cross the Niagara gorge has been selected, and a force of men is at work there getting ready to string cables across the river. The point is a short distance below the Devil's Hole, where steel towers are to be erected to support the cables in their passage down the Canadian cliff and up the New York cliff. On the Canadian side the heavy timber growth has been cut away for several hundred feet, making a bad scar on the beautiful section of the river bank, the finest of the gorge. Foundations are now being built for the towers on both sides of the river. Connections between the banks has already been made. This was accomplished by James Wadsworth of Queenston, Ont., rowing across the rough stream and carrying the line with him, letting it unreel as he progressed. The trip was successful, and now the line hangs high above the water and will serve as the means to pull wires and cables across. A large transformer house is being erected on the top of the high bank on the New York side, the cost to be about $50,000.

In the accompanying illustration the relation of the station of the Ontario Power Company and the Horseshoe Falls of Niagara are for the first time accurately portrayed, while high on the bluff, up from the power station, the new distributing station of the Ontario Power Company is shown. This distributing station is 550 feet back from the power house and about 255 feet above it. It is expected that this distant control of the current will remove some of the dangers common to such work and operation. The cables and wires for control will leave the power house through the penstock tunnel, and from the top of the bank will run to the distributing station through clay conduits. The low-pressure bay upon the main floor of the distributing station contains the 12,000-volt automatic oil circuit-breakers, while in the chamber beneath are the sectional duplicate bus bars and their immediate connections. The transformers stand in pits in the transformer room.

Floating Poolroom with Space-telegraph Equipment.

The latest move of the gambling fraternity of Chicago to evade the law is the remodeling of the City of Traverse, a good-sized lake steamer, on which has been equipped a "poolroom" for the taking of bets on horse races. Presumably, the method of transmitting the results of races to the boat is by space telegraphy, as the boat has on board a complete space-telegraph outfit of two kilowatts capacity. Suspended from a 100-foot mast is the antenna, and on the main deck, surrounded by board partitions, are a number of telephone receivers through which the wireless messages are received, and the news is posted on blackboards which extend for 150 feet lengthwise of the boat. The picture herewith, reproduced by the courtesy of the Chicago Daily News, shows an operator receiving a wireless message on the boat.



RECEIVING WIRELESS MESSAGES IN FLOATING POOLROOM.

Several trips were made on Lake Michigan by the floating poolroom while the city authorities were deciding whether its owners were violating any law under which the police would have jurisdiction, and, if so, how to stop the gambling. The poolroom men evidently believed they were safe when operating beyond the three-mile limit, or, if necessary, they could go a little further out in the lake to where the Illinois, Indiana and Michigan state lines converge, which would make the situation still more complicated for the authorities.

Operations on the boat have been suspended, however, for the time being at least, as the police conceived the idea of raiding the space-telegraph plant on shore which transmitted the messages to the boat. Warrants were served on William H. Ocker, manager, and two operators, in the Chicago office of the De Forest Wireless Telegraph Company, in the Railway Exchange Building. The instruments of the one-kilowatt plant in this building were taken out by the police. The company also has a large plant of 15 kilowatts capacity on the South Side and one of two kilowatts capacity on the North Shore. The latter has been fully described and illustrated in the Western Electrician.

When interviewed as to his company's connection with the poolroom, Mr. Ocker said that the company is now in a position to do a commercial space-telegraph business, and was glad of the opportunity to transmit commercial messages to the City of Traverse. By the arrangement with the owners of the boat anyone could send a message to the boat by the payment of $1 for the first 10 words and five cents for each additional word. He said that his company was sending from 200 to 300 messages a day to the boat until the police seized the instruments. Some of these messages were in cipher, but Mr. Ocker did not consider it his business to ascertain their meaning before allowing them to be sent.

The De Forest company has filed a bill in the United States Circuit Court asking a perpetual injunction against the city of Chicago and its agents to restrain them from interfering with the company's instruments in the Railway Exchange Building. It is asserted that damage to the extent of $2,000 was done in the raid to stop gambling on the City of Traverse, and that $100,000 will be lost if the authorities carry out their threats. The bill was filed by J. Hamilton Lewis, counsel for the telegraph company, and was accompanied by a petition requesting the court to issue immediately a temporary injunction. The petition cites the city of Chicago to show cause why a permanent injunction should not issue against its officers to prevent interference with the telegraph company's business.

Mr. Lewis is reported to have said the De Forest company underwent a change of officials at its annual election a few days ago, and that some of the new men had not decided upon a definite policy. Officials, however, were not disposed to quarrel with the city. The point involved was the company's right as public carrier to serve its patrons with all the news offered for transmission, and this point, when settled by the United States Supreme Court, will settle the company's rights, not alone in Chicago, but in every city in the United States.

Protection Against Reversal of Energy in Motor Circuits.

In the operation of alternators in parallel, if the field current of one is broken, a reversal of energy will take place in the circuit connecting it to the other generators, and a heavy reverse current will flow, which may result in damage. In order to guard against such reversal of energy, it has been proposed heretofore to employ a differential electromagnetic device supplied from two transformers, one in shunt and the other in series in the circuit to be protected. Normally the currents from the two transformers oppose each other in the protective device; but on a reversal of energy flow in the circuit the current in the series transformer is reversed relatively to that in the potential transformer, and the two currents assist each other in operating the device. When a series transformer of the ordinary construction, with an unsaturated core, is employed no sharply defined point at which the device will operate can be obtained. But, by the use of a series transformer having a core adapted to be saturated by a fraction of the full-load current of the circuit a sharply defined point for operation may be obtained. The saturation of the core, however, produces a relative phase displacement of the primary and secondary currents of the series transformer, so that instead of being nearly 180 degrees out of phase they are little more than 90 degrees out of phase. In protective devices adapted to operate on two currents substantially in phase it is difficult to secure proper operation with a saturated core in the series transformer unless the potential impressed upon the primary of one of the transformers is shifted in phase relative to the other.

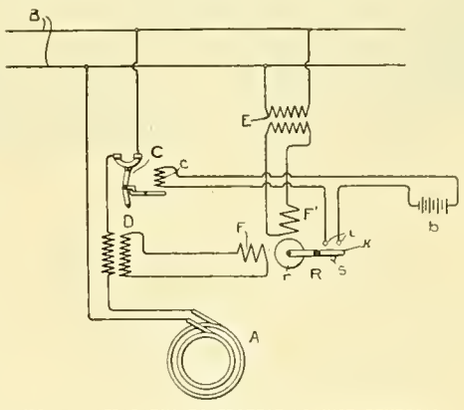


FIG. 1. APPARATUS TO PROTECT AGAINST REVERSAL OF ENERGY.

A device recently patented by Leonard Wilson of Pittsfield, Mass., and assigned by him to the Stanley Electric Manufacturing Company, consists of a novel arrangement, whereby a series transformer with saturated core may be connected in the same phase with the potential transformer, no phase-shifting devices being employed. This is accomplished by employing an electromagnetic device adapted to operate on two out-of-phase currents. In other words, the invention consists in the combination of a series transformer having a saturated core and a potential transformer of a polyphase electromagnetic device energized from the secondaries of the two transformers.

Fig. 1 shows diagrammatically an electric circuit provided with protective devices in accordance with the invention, and Fig. 2 is an explanatory diagram.

In the former, (A) represents an alternating-current generator connected, through a switch or circuit breaker (C) to the bus bars (B). A transformer (D) has its primary in series with the generator leads. Another transformer (E) has its primary connected in shunt to the bus bars. The secondaries of the two transformers are connected to the relatively displaced stationary coils (F) (F'), respectively, of the relay (R), which consists, essentially, of a small induction motor provided with the short-circuited rotor (R).

If the series transformer (D) is of the ordinary type with unsaturated core, the current in the coil (F) for different values of current flow in the generator circuit will be indicated by the line (1) in Fig. 2, in which the abscissas represent the flow of current in the generator circuit and the ordinates the current in the coil (F). Since the line (1) is substantially a straight line, no clearly defined point of operation can be obtained. If, however, the transformer (D) is provided with a core adapted to be saturated by a comparatively small fraction of the full load of the current on the generator, the current in coil (F) for different values of current in the generator circuit will be indicated by the line (2) in Fig. 2. It will be seen from this line that a very small variation of current flow in the generator circuit on either side of zero will produce a large variation in current flow in the coil (F). As has been stated, the saturation of the core of the transformer (D) produces a phase displacement between the primary and secondary currents—that is, the current in coil (F) will be little more than 90 degrees out of phase with the current in the coil (F') for non-inductive load on the generator; but this phase displacement is precisely what is required for the proper operation of a relay of the type shown.

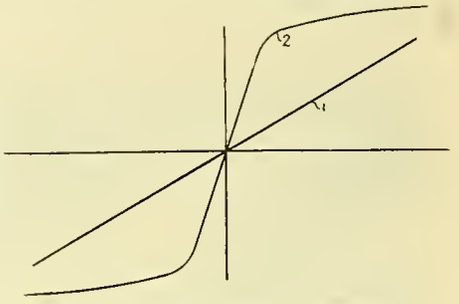


FIG. 2. EXPLANATORY DIAGRAM OF CIRCUIT PROTECTIVE DEVICE.

The short-circuited rotor (r) is provided with a contact arm (H), which is normally held against the stop (s) by gravity or other suitable force. The coils (F) (F') are so connected that with normal conditions of the generator circuit the torque produced in the relay assists in holding the arm (H) against the stop. If the generator (A) should fail and energy should flow from the bus bars to the generator, the current in coil (F) would be reversed relatively to that in coil (F'), and the torque in the relay would be reversed. The arm (H) will consequently be moved away from the stop (s) and engage the contacts (i). This closes a circuit from the battery (b) or other source of current through the tripping coil (c) of the circuit breaker (C), and the generator is thereby disconnected from the bus bars.

New Central Station in San Francisco.

The new electric power plant of the San Francisco Gas and Electric Company on Jesse Street, San Francisco, will be one of the most complete in the West. It will be a three-story structure of steel construction, with an exterior of brick and white-glazed terra cotta on a granite base. One of its features will be a sculptured pediment at the main entrance in symbolic figures, by Alphonse le Jeune. The interior will be trimmed in white glazed terra cotta and white enameled brick. The working plant will include four 4,000-horsepower generators, 12 transformers, 296 bus-bar compartments for connecting the electric circuits, a switchboard 62 feet long, and on the third floor 304 high-tension switches, the compartments of which will be in solid concrete with twisted iron bars. The station will be known as the Central Station and will be finished by December 1st.

German Electric Street-railway Sprinkling Car.

The accompanying illustration shows a large electrically driven sprinkling car in operation in the city of Cologne, Germany. This car has a total weight of 13,000 kilograms empty, and when filled with water and ready for operation weighs 23,000 kilograms. It is provided with double trucks and two direct-current motors operating at a pressure of 500 volts, and each having a capacity of 35 horsepower. The sprinkling nozzles throw the spray a distance of 2.5 meters, and a rotary pump is utilized for forcing the water. This pump is directly

GERMAN ELECTRIC STREET-RAILWAY SPRINKLER CAR.

driven by a four-horsepower shunt-wound 500-volt motor.

The tank, which holds 10 cubic meters of water, is filled at the various hydrants of the city waterworks system, and it requires about 10 minutes entirely to fill the tank by means of two pipes, each 45 millimeters in diameter. The tank will sprinkle an area of 500,000 square meters a day, the car operating at a speed of 12 kilometers an hour. At this speed, sprinkling a breadth of roadway of from eight to 14 meters, a distance of five kilometers can be covered with a single tank of water having a capacity of 10 cubic meters.

The cost of operation of this motor sprinkling car is said to be about $4.76 a day, while it would require five small sprinkling cars, each having a capacity of two cubic meters when hauled by horses to do the same work as the electric car shown in the illustration. The cost of operating each of the small sprinklers hauled by horses is said to be $2.38 a day, or a total of $11.90 for the five sprinklers, which would represent a saving of $7.14 a day by the electric sprinkler, or $714 for 100 working days. Each of the sprinklers, having a capacity of two cubic meters, would sprinkle an area of about 100,000 square meters a day.

The car shown in the illustration was constructed by Zypen & Charlier of Cologne-Deutz, Germany.

P.

Proposed Electric Railway in Panama City.

Panama City in the Republic of Panama expects soon to have a comprehensive system of electric street cars, and proposals are invited until July 24th for the building of the system. The conditions governing the construction of the system are given in a consular report dated May 23, 1905, from United States Consul-general Joseph W. J. Lee of Panama City.

The line, which is to be operated electrically, is to start at the Plaza de Armas and extend to the new station of the Panama Railroad Company, the public market and the cemeteries. The contractor, who is also to operate the system for a term of 50 years, must draw up the plans of all the tracks and circuits in such a manner as to make electrolytic action on waterworks, drainage and other pipes impossible. The entire circuit must be metallic.

Work must be begun within six months after the approval of the plans and service on the main and branch lines to the market and cemeteries within the term of one year after work is begun.

The rate of fare is not to exceed five cents and the contractor is to have the privilege of operating freight cars, charging for such service a rate which is to be approved by the municipal council. After the expiration of the contract the system is to revert to the municipality without remuneration. The municipal treasurer is Mr. R. Chiari.

Protection Against Theft of Current.

[From Question Box of the National Electric Light Association.]

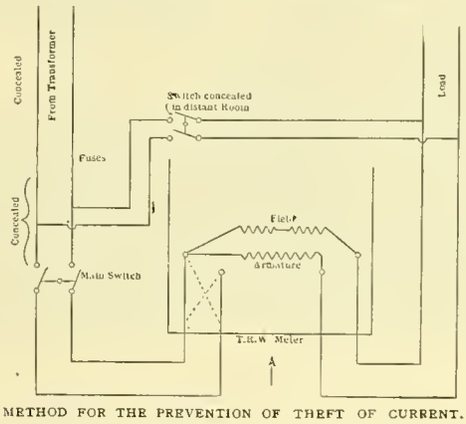
QUESTION.

What effective means, if any, have been found to make it impossible for a customer to beat a recording wattmeter, or what special precautions can be taken by an electric-light company to detect the same?

ANSWERS.

W. H. Greenslit, Vicksburg Railway and Light Company, Vicksburgh, Miss.: The accompanying diagram will show a case I once found and its remedy. The customer had concealed wiring in the house and only main-line cut-out and meter loops were exposed. This was remedied by crossing the wires in the meter according to the dotted lines and sealing the meter; consequently when he had closed both concealed and main-line switch it would blow a fuse. Even this left a chance for him to beat the meter, yet in a quiet way it informed him that we were familiar with it.

Elberd D. Kelley, Hillsboro Gas and Electric Company, Hillsboro, Texas: Keep your meters sealed, and in wiring do not allow the main cut-



METHOD FOR THE PREVENTION OF THEFT OF CURRENT.

out and circuit blocks to be put too close together; in my system of wiring, one is in front and the other behind the meter. A meter man should study character; if things are suspicious, go at unusual hours for inspection or reading.

G. R. Radley, Milwaukee Electric Railway and Light Company: Put a strongly made wooden box, with inside screwed hinges, close to the service end. Run service wires directly into the box or use iron pipe if not possible to locate the box there. Have the neutral run through solid—without fuse—and locate closely rated enclosed fuses in box after meter. This arrangement will prevent the customer from purposely blowing one service fuse on the side from which the meter takes its potential, and then burning half (or by bridging over all) his lights without any registration. The box must be three inches larger than the meter to prevent external magnets being used to create strong stray field. The inside of the box should be painted black, so that small drill holes will be conspicuous when inspecting the meter. Use a good Yale padlock and obliterate the maker's key code, which is stamped on the side. Keep track of the customer's consumption and if it does not check out, examine the meter at night.

R. C. Lanphier, Sangamo Electric Company, Springfield, Ill.: A device has recently been patented by W. W. Fuller, superintendent of the Charleston (S. C.) Light and Power Company, which is intended to cut off the lights in a building if the meter is tampered with, or if the shunt circuit is broken. The device has not yet been put on the market, so far as the writer knows, but seems to have the elements of a satisfactory apparatus for this purpose, and it is only a question as to whether or not the cost of the device, if it should be made, would justify any company in adopting it. The number of Mr. Fuller's patent is 782,386, of February 14, 1905.

W. W. Titzell, Public Service Corporation of New Jersey, Jersey City, N. J.: The most effective means to prevent the customer beating the meter are: First, an all-glass instead of a metal cover, as the latter can be drilled and a piece of wire inserted to stop the disk; second, connections of both legs of circuit through the meter, so that cutting one leg will prevent the flow of current; third, enclose the meter and connections in a locked box, inaccessible to anyone except the holder of the key; fourth, have the inspector examine carefully and frequently all connections and lines from the main cut-out to prevent bridging.

A. H. A., New York Edison Company: We do not know of any effective means to make it impossible for a customer to beat a recording wattmeter. Even with meters of the sealed type with internal connections for the service and house leads an occasional case may be found where there has been a deliberate attempt at theft of current. The precautions should be a very careful system of examination by inspectors, meter readers and meter testers, examination of seals of the meter, wiring and service conditions.

E. A. N., New York Edison Company: The question of proper protection to service and meter appliances is one that will ever be important to lighting companies. There is no system of surveillance that can be relied upon to detect all cases of interference. If a customer's account decreases suddenly the bookkeeper should advise an investigation; likewise, all inspectors, meter readers, meter testers—in fact, all persons connected with the lighting company and visiting customers' premises should instantly note any irregularity and report it to the office. The value of a good detective force will be appreciated here, for it should be its duty to follow up the case, detect, and if necessary secure the conviction of the guilty parties.

Difficulties for Chicago Freight Tunnels.

The Illinois Tunnel Company is at present undergoing a series of difficulties relative to its large system of freight tunnels in downtown Chicago. Besides accommodating the cables of the automatic telephone system the tunnels are already being used extensively for the removal, by electric narrow-gauge trains, of excavations and wreckage and the conveying of building material in the replacing of old buildings with new structures. Connections have also been made with the basements of many large buildings in anticipation of an extensive transfer business between these buildings and the tunnel company's terminal yards and the steam-railway terminals.

Of late there has been noticed in Chicago a slight sinking of streets in certain localities, and a few large buildings are said to have settled considerably. Several causes for this condition have been advanced by engineers, and among them is a charge that the tunnels are responsible. The commissioner of public works of the city has decided to make an investigation and has named E. C. Shankland, J. M. Ewen and Louis Ritter, engineers, to investigate the tunnels and determine if there is any truth in the allegation that they are responsible for the sinking of streets. These men are to go into the work done by the company, report on the size and condition of the bores, and examine into the faithfulness with which the contract and permits have been utilized.

Albert G. Wheeler, president of the tunnel company, and four others, including several former city officials, are at present defendants in a suit in which it is alleged that the City Council records were altered at the time the tunnel franchise was passed in order to strengthen the company's financial position. Charges of bribery in "consummation of the forgery" are also made in the case.

Waterpowers of the Southeastern Appalachian Region.

The region which is covered by the Appalachian Mountains is one in which undeveloped waterpower abounds, as pointed out in a paper upon this subject read by Dr. F. A. C. Perrine at the Asheville convention of the American Institute of Electrical Engineers last month. In the southeastern portion of this region the people are beginning to realize the advantages which will be afforded them by the development of these waterpowers.

On account of the physiographic characteristics this region is pre-eminently a waterpower country. The rainfall over its entire extent is in no part less than an average of 35 inches, increasing to 60 inches in the mountains. This precipitation does not occur in a wet season of limited duration, but is well distributed throughout the year. The soil itself is generally porous, and for those streams from the head waters of which the forests have not been cut the rainfall is retained, and neither the floods nor the low waters are as serious difficulties as are encountered in the middle states.

On account of the generally loose character of the soil throughout almost the entire territory the rivers carry immense quantities of silt, which must be considered in planning canals and other hydraulic work. Commercially the fact that southern industries rarely operate more than 11 hours per day requires a most careful study of the opportunities for storage, which will enable the full use of the river during this working period of each day.

The manufacturers of the South, as in New England, have for many years been accustomed to appreciate the value of waterpower to their steam plants, and of the steam plant as an auxiliary to the waterpower; in consequence a market for power beyond the amount of the minimum streamflow is readily obtained, and should always be considered in planning for developments in this territory.

The author enumerated the more important rivers of the region and described in brief the characteristics of each, the amount of water flowing into them per square mile of area drained, and other facts bearing upon their adaptability for waterpower purposes.

One of the most important of these drainage areas is the Mobile watershed, covering practically the whole of the state of Alabama, and extending into the northwestern corner of Georgia and the northeastern corner of Mississippi. The greater portion of this watershed is mountainous and well wooded; in consequence there are many valuable waterpower sites. Some of the highest heads available in the eastern states are to be found in this territory. Commercially, the development of the coal and iron mines and the types of manufacturing to which these raw materials give rise have furnished opportunities for the power market, though the presence of coal mines renders caution necessary in the selection of sites for development.

In this watershed there have been reported sites for power development aggregating 150,000 horsepower, many of the sites being within close competitive distance of each other. Although the country is mountainous, still it is so far south that these mountains carry no snow and the evaporation is high; hence the minimum rate of run-off is never high. Certainly a minimum rate of 0.2 second-foot per square mile will be found in any important Alabama river. The flood flow tends to be a maximum at the rate of 20 second-feet per square mile.

Electricity at the Portland Exposition.

By Waldon Fawcett.

Electrical interests are well represented at the Lewis and Clark Exposition, which is now in progress at Portland, Ore. This unique world's fair, the first international exposition ever held west of the Rocky Mountains under the auspices of the United States government, commemorates the exploration by the expedition headed by Captains Lewis and Clark of "the Oregon country"—the only territory ever added to our national domain through discovery. The "Oregon country" comprised what is now the states of Oregon, Washington and Idaho, with parts of Montana and Wyoming, and it is primarily to illustrate the wonderful resources and development of this section of the country that the present exhibition has been held, although in magnitude and scope of exhibits it is distinctly a world's fair.

The Portland Exposition occupies a site covering 406 acres, of which 220 acres is represented by Guild's Lake—a natural body of water and the largest lake ever enclosed within an exposition fence—and 186 acres is land. Of this land area 60 acres is a peninsula which extends out into the middle of the lake, and upon which is situated the exhibit building erected by the United States government.

ELECTRICITY BUILDING AT LEWIS AND CLARK EXPOSITION.

INTERIOR VIEW OF ELECTRICITY BUILDING AT LEWIS AND CLARK EXPOSITION.

Most of the other exhibit palaces are situated in one long row on the mainland, occupying the crest of a grassy slope leading down to the lake. All of the main structures are in the architectural style of the Spanish renaissance, with ivory-tinted walls and red roofs, save the Forestry building, which is a huge log cabin constructed of sections of the giant trees of the Pacific Northwest in their virgin state.

The electrical illumination of the exposition is declared by experts who have visited all the international exhibitions during recent years to be one of the most effective on record. There is an absence of the glare of light formed by massing great numbers of lamps, which has been a feature of certain other expositions, the Portland officials having confined their efforts to outlining the buildings and providing a glowing setting for the landscape masterpieces of the Fair, but it is a question whether the ensemble effect is not far more artistic than that afforded by more garish display. In addition, there are several special features in illumination, of which mention will be made later.

Unlike other big shows, the Lewis and Clark Exposition has not provided a separate power station on the grounds, but obtains current for light and power from the Portland General Electric Company, which has one of the most modern and best-equipped power plants in the United States. Especially with a view to providing power for the Fair the company installed at its plant two 1,500-kilowatt Curtis turbines. One of the company's power stations (10,000 horsepower) is located one-third of a mile from the Exposition grounds, and here all switchboards are located.

In outlining the buildings of the Exposition there are utilized more than 100,000 eight-candlepower frosted lamps. The illumination of the great dome of the Agricultural Building, the largest structure on the grounds, is particularly impressive, and may be seen for miles. About 5,000 50-candlepower Meridian lamps in electroliers are used to illuminate the avenues and driveways of the grounds, particularly the Bridge of Nations, an ornate structure of wood and staff, in imitation of solid masonry, which connects the government peninsula with the mainland and the Lake Shore Esplanade—a wide promenade, which follows the shore of the lake for nearly half a mile. Clusters of lamps upon ornamental standards are advantageously placed at every landing of the Grand Stairway—the central spectacular feature of the exposition, and which extends from a parapet at the head of Lakeview Terrace, on the crest of the slope, to a boat landing on the shore of the lake.

In addition to the above, Mr. James R. Thompson, the electrical engineer who designed the illumination and who is in personal charge on the grounds, has devised several new features. The most important of these is the submarine illumination of Guild's Lake, the exposition's surpassing water feature. At intervals of three feet on each side of the Bridge of Nations and the Lake Shore Esplanade there have been placed on the bottom of the lake 50-candlepower lamps in marine receptacles. The lake is only about six feet deep and the water is clear, so that the illumination is sufficient to make it possible for spectators on the Bridge of Nations and the Esplanade to see the water plants and the fish—principally black bass, golden carp, salmon and trout, with which the lake has been stocked from the government fish hatcheries.

Another rather unique effect in electrical illumination has been obtained by scattering single lamps at varying intervals among the dense foliage of the natural park which occupies an area of considerable extent in the heart of the exposition grounds. A searchlight is operated from a tower on the shore of the lake, and the two towers of the United States Government Building, each rising to a height of 260 feet, afford exceptional opportunities for a striking electrical illumination, the effect of the display being emphasized when viewed from the mainland, with a broad expanse of water in the foreground.

The electric current is fed to the exposition system on 2,200-volt feeders and is distributed to various transformer pits located just outside the buildings. The secondary wire distribution is at 117 volts. Electrical power is employed in the operation of all the various working exhibits in the different buildings, including the coin press and other machinery in the Government Building. For transportation between the mainland and the government peninsula there is in service a fleet of about 20

large electric launches built and operated by the Truscott Boat Company.

Whereas electricians will find much of interest on every hand at the Fair, the chief goal of a majority of technical visitors is, of course, the Electricity Building, which is situated on Concourse Plaza, a triangular court at the eastern end of the grounds. The building devoted to electricity is the longest in the grounds, its dimensions being 500 by 100 feet. Ornate work in the case of this structure is confined almost entirely to the main entrance, which is located in the center of the west façade. This has a large arch richly ornamented with two pilasters, one on each side of the doorway. A cornice of liberal projection, supported by classic brackets and festooned with sculptured flowers, ornaments the entrance. Extending at right angles from each end of the Electricity Building is a wing, 100 by 100 feet in size, made necessary by the remarkable demand for exhibit space. The cost of the building exceeded $30,000.

Entering the Electricity Building, the visitor finds, straight ahead of him, and occupying a liberal portion of the central section of the building, the exhibit of the General Electric Company, which is in charge of Mr. G. H. Patten of Schenectady. The company displays, among other things, a Curtis steam-turbine set; a Brill No. 27F truck; a crane hoist, with electric motor; a Pelton waterwheel in operation; 13-inch and 24-inch searchlights; an induction motor, class 4, of two horsepower, 1,800 revolutions, direct connected to a Price pump, and a 50-horsepower electric locomotive, built for the coal department of the Delaware, Lackawanna and Western railroad. There is a display of meters, including induction and Thomson recording wattmeters, and comprehensive exhibits of wire and other supplies, insulators of all kinds and switchboards. The General Electric Company also shows a mercury rectifier of 30 amperes capacity for charging automobiles; Terrell regulators, forms T. A. and T. D.; a line of small motors for operating sewing machines, fans, printing presses, etc.—these various machines being shown in operation—and an assortment of electric cooking utensils as well as induction motors, forms K. and K. S. The central feature of the exhibit is a white and gold pavilion which serves as an office and a rest room for callers. In the illumination of the exhibit and electric signs there are utilized eight arc and several hundred incandescent lights. In one corner of the exhibit space there has been erected a small Japanese house of bamboo construction, outlined by miniature incandescent lamps.

The Pacific Steel and Wire Company of San Francisco, the Pacific Coast branch of the National Steel and Wire Company, has an attractive booth in which are displayed to advantage the company's various products, including underground and submarine cables, electrical cords, seamless rubber-covered telegraph and telephone wire, etc. The Electro-Radiator Manufacturing machine, a health-promoting apparatus, is exhibited by William Rickards of Portland, Ore., the inventor, patentee and manufacturer. John A. Roebling's Sons Company of Trenton, N. J., shows insulated wires and cables and galvanized telegraph wire.

Fairbanks, Morse & Co. of Chicago make a very extensive exhibit. They have a 50-horsepower, four-cycle multiple-cylinder, vertical type of gas engine direct connected to a 30-kilowatt 125-volt direct-current dynamo, both being of their own manufacture; also a 12-horsepower four-cycle vertical type of gas engine, direct connected on one base with a 7½-kilowatt 125-volt dynamo. A 15-horsepower dynamo is belted to a Nissen two-stamp battery and an Elspass four-roller quartz mill of 50-ton capacity, both in operation daily. Incidentally, as illustrating the value of these working exhibits, it may be cited that the company secured orders for four of these mills during the first few weeks of the Fair. The firm of Fairbanks, Morse & Co. also makes an instructive display of motors, dynamos, motor-driven power pumps, etc. The exhibit occupies a space of 5,200 square feet, and 3,000 incandescent lights are utilized in illuminating the signs and space.

Another exhibit which attracts much attention is that of the Westinghouse Electric and Manufacturing Company, which has a space 64 by 24 feet in size, the exhibit being in charge of Mr. C. L. Wernicke of Pittsburg, Pa. The Westinghouse company illustrates its unit-switch system of multiple control and displays a 100-kilowatt motor-generator set, 110-kilowatt alternating-current generator, single-phase railway motors, direct-current railway motors; complete set of lightning arresters; high-tension oil switches; fuses, switchboard instruments; 15-horsepower hoist, with type F induction motor; 25-kilowatt rotary converter; two-kilowatt generator, direct connected with Ohmen engine; line of induction motors; standard direct-current motors; crane controllers; elevator controllers; automatic controller for filling water tank; standard line of transformers; 400-kilowatt turbo-generator set; Westinghouse-Parsons turbine, with generator connected; 110-kilowatt air-blast transformer; line of crane-hoist motors; line of portable instruments, etc.

The Pacific States and Sunset telephone companies, the Pacific Coast branches of the Bell telephone company, have in operation in the Electricity Building a common-battery working exchange, operating the telephone system which is in use throughout the exposition grounds, and which has about 100 stations. Three operators and a chief are on duty during the day and two operators at night. The pedestals of this working exhibit display convincing statistical statements showing the growth of the Bell telephone interests throughout the country. The Bell automatic telephone is also on exhibition. Near at hand the Baldwin Locomotive Works of Philadelphia exhibits a Westinghouse-Baldwin electric locomotive.

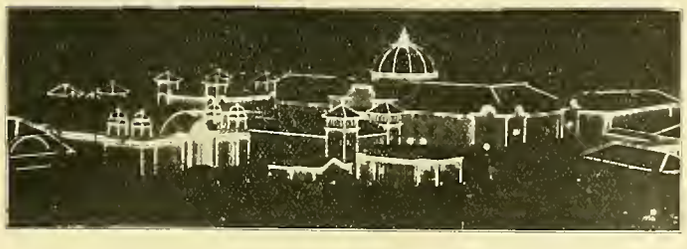
Especially imposing is the exhibit of the Western Electric Company of Chicago. It occupies a space approximating 2,000 square feet, and its central feature is of especial significance, in that it consists of a 500-kilowatt three-phase revolving-field engine-type generator. This exhibit marks the entry of the Western Electric Company into the field for the manufacture of polyphase machinery. The display also includes a complete exhibit of direct-current motors of 12 to 50 horsepower; 75-kilowatt generator, direct connected to a Fuller-Cornish cycle engine; belted direct type 100-kilowatt current generator; full lines of crane motors and sewing-machine motors; alternating-current series 50-arc-lamp system in operation, with transformers and regulators; sample of each type of lamp manufactured by the company, and an extensive representation of the supplies handled by the company, including the Bryant & Perkins goods, Thomas high-potential porcelain insulators, Electrose overhead-railway material, D. & W. enclosed fuses, "Sunbeam" lamps, etc. The superintendency of the exhibit is in the hands of Mr. William S. Taussig.

The Standard Underground Cable Company of Pittsburg shows its various products, including electric-light and power, telegraph and fire-alarm, street-railway and telephone wires and cables. Near at hand is the extensive display of the B-R Electric and Telephone Manufacturing Company of Kansas City, Mo., and Portland, Ore. The exhibit, which is in charge of Mr. W. D. De Varney, the Pacific Coast representative, embraces a wide range of telephone apparatus. A feature of the display (to which, it is noted, a large proportion of the visitors are paying especial attention) is the exhibit of farmers' telephones.

The Northern Electric Manufacturing Company of Madison, Wis., exhibits a creditable line of motors and generators, as well as an A. B. C. disk fan, standard vertical motor, electric buffer, electrically operated emery grinders, etc. The Shaw Electric Crane Company of Muskegon, Mich., has installed one of its electric traveling cranes of 10 tons capacity, which has a span of 50 feet and is operated on a 450-foot runway, extending nearly the entire length of the Electricity Building. This crane is operated, however, by the Willamette Iron Works Company of Portland, Ore., which originally employed it for the installation of its heavy exhibit of lumber-working machinery, but which now has a concession to carry visitors back and forth through the building in an ornamental cage suspended from the crane.

GRAND STAIRWAY AT LEWIS AND CLARK EXPOSITION, SHOWING ELECTRIC STANDARDS.

The Exposition Illuminated.



Another View of the Exposition Illuminated.

Government Building and Bridge of Nations.

NIGHT VIEWS OF THE LEWIS AND CLARK EXPOSITION, PORTLAND, OREGON.

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DATES AHEAD.

National Electrical Contractors' Association (fifth annual convention), Mechanics Hall, Boston, Mass., July 19th, 20th and 21st; electrical exhibition, July 15th to 22d.

Ohio Electric Light Association (annual convention), Hotel Victory, Put-in-Bay, August 16th to 18th.

International Association of Municipal Electricians (annual convention), Erie, Pa., August 23d, 24th and 25th.

Old Time Telegraphers' and Historical Association (annual meeting), New York city, August 29th to September 1st.

FOR SEVERAL reasons the starting of the first generating unit in the power house of the Ontario Power Company on the Canadian side at Niagara Falls is of unusual interest. The plant has horizontal-shaft units of 10,000 horsepower each, and in the arrangement of intake, the design of main conduit and spillway, symmetry of plan, centralization of control, and protective isolation of apparatus, it presents much that is new and worthy of careful study. Furthermore, power from this station is to be transmitted across the international boundary into New York state and delivered to various cities and towns in Western New York, probably as far as Rochester, which is about 70 miles from the Falls. All these features combine to make the plant a noteworthy one, and it has been the subject of several articles in the Western Electrician. The latest, presented in this issue, is from the pen of Mr. Orrin E. Dunlap, and is rendered particularly attractive and valuable by the reproduction of a striking photograph, showing very clearly the relative position of the new power house and distributing station and the great cataract.

SOME authorities are of the opinion that electricity will ultimately oust the hydro-carbon engine as the motive power of the future submarine boat. Widespread concern is already manifested as to the dangerous nature of the gas-engine-driven submarine, and of the two accidents to British submarines, the A1 and A8, the former is directly attributable to the nature of the fuel employed. The superiority of the hydro-carbon or petrol submarine at present lies solely in its greater radius of independent action. With the electrically propelled boat this radius of action is, of course, dependent upon the storage battery. The primary office of the submarine is, however, purely that of an accessory to the battleship or the shore fortification, from which its operations are mainly conducted. The storage battery, then, is not such a drawback as might be supposed, since the operations of a submarine extend at most but a few miles from the parent vessel.

At an English shipbuilding yard there was recently launched a new electrically propelled submarine which is of unusual interest. It carries two torpedo tubes and will be manned by a crew of three. It is only 34 feet long by six feet nine inches in diameter. Its small size makes it possible to lift it out of the water onto the deck of a battleship. Electricity is the sole motive power, and with a full charge of the batteries the boat has a radius of action of 40 miles.

That electricity on board a submarine may be a source of danger has been feared, and it was believed that the disaster to the A8 was in some way due to this cause. That it was not, however, was made plain by evidence given by Captain Bacon at the inquest on the victims of the accident. He said that though there was an explosion on board which was attributable to the electrical equipment, it was evident that this explosion occurred after the boat had gone down for good, and that the electrical parts were in no way responsible for the accident. It appears that after the boat sunk sea water got into the battery tank, which is provided with a gauze-covered vent pipe, and that chlorine was given off as a product of electrolysis. The captain also attributed the explosion to the ignition of an explosive mixture of hydrogen and oxygen, also products of electrolysis. He ventured the opinion that " a short-circuit or fusing" would provide the necessary ignition.

MR. DUNNE has been mayor of Chicago about three months. Before his election he said that only two things were needed to accomplish municipal ownership of the street railways in Chicago—the will of the people and public officers with the disposition, courage and virility to carry out the people's will. One of these obstacles was swept away by the election, for he, standing on an "immediate-municipal-ownership" platform, was elected mayor by a plurality of 24,000 votes. That gave the new mayor the mandate of the people. Therefore, if, at this early date, the municipal-ownership programme is abandoned, as is practically the case, Mr. Dunne either was mistaken or else is not proving a public officer with "the disposition, courage and virility to carry out the people's will." Either horn of the dilemma is not especially flattering to the occupant of the mayor's chair; but although Mayor Dunne is not proving a particularly strong executive, we believe that he was fundamentally wrong in his conception of the character of the problem rather than that he is lacking in the disposition to carry out the will of the people.

What the mayor now proposes, and sets forth in an official message to the City Council, is what he calls a "contract plan." This plan provides for the incorporation of a company managed by five men "who command the confidence of the people of Chicago for their personal integrity, their business ability and their pronounced sympathy with municipal ownership." To this corporation, bound by contracts "insuring the performance of the undertaking wholly in the public interest," would be given control of streets over which the city has authority through the expiration of street-car franchises granted to the old companies. Having issued stock calling for dividends of six per cent. and sold by popular subscription, it would proceed to construct a street-railway system with the proceeds, no bonds being issued. Net profits of the business beyond those paid out in dividends would go into a fund for the city's benefit to be used in purchasing the lines. After these lines were constructed the city would have the privilege of purchasing them at any time that it succeeded in raising the money by the sale of Mueller certificates or otherwise.

It will be observed that this is not municipal ownership but private ownership—the ownership of a private stock company. It is true that the mayor advocates this plan "as a means of accomplishing the object in view—namely, the earliest possible installation of good service and the establishment of municipal ownership of the entire street-car system of Chicago." He contends that by this kind of a private company—a new company pledged to do certain things in certain contingencies—there would be no delay in realizing the policy of municipal ownership in substance," even while such judicial, financial, legislative and referendum proceedings were being taken as might be necessary to perfect it in form or to guard it by business adjustments against encroachments of the spoils system." But this is merely juggling with words. The simple fact is that the mayor abandons "immediate municipal ownership" and suggests a "contract plan" for street-railway lines to be built on streets where franchises have expired, with the possibility of ultimate municipal ownership of this property. This plan is now before the City Council. It would greatly complicate the situation, and the aldermen may not sanction it. But if they do, there will still be difficulties in the way of its execution. For one thing, the popular subscriptions may not prove sufficient to provide the needed funds.

Another blow to the mayor's municipal-ownership theories is the apparent lukewarmness, if not decided opposition, of James Dalrymple, the Glasgow municipal tramways manager, brought over here by Judge Dunne to give aid and comfort to the movement. But Mr. Dalrymple found that, under conditions prevailing in American cities, private ownership is best. At least these are generally believed to be his views, although Mr. Dalrymple has sanctioned no public utterance on the subject. Mayor Dunne admits having received Mr. Dalrymple's report, or at any rate a formal communication from him on the subject, written since he embarked for his return voyage. Significantly enough, the mayor refuses to make public this letter—at least for the present. This looks as though the recipient of the communication was dissatisfied with its contents.

When Judge Dunne was elected mayor the Western Electrician said: "The mayor-elect professes to expect to see municipal ownership within the term for which he is elected—two years—but it is likely that he will be doomed to disappointment." We hardly thought that the mayor's disillusionment would come within the space of three months, but such appears to be the fact.

Mayor Dunne's "Contract Plan" for Street-railway Operation.

In a message to the Chicago City Council last week Mayor Dunne presented two plans for the acquiring of a street-railway system by the city. The plan which he recommended as the best and simplest is conspicuous in that it is directly opposite to his earlier "immediate municipal ownership" ideas, by the enactment of which Judge Dunne thought at the time of his election that Chicago could come into possession of its street-railway systems by the end of his term of office.

The new plan which the mayor suggests does not contemplate the acquiring of the existing lines of the Chicago City Railway Company and the Union Traction Company. Negotiations for the purchase of these systems seem to have been indefinitely abandoned. The recent plan of building a 10-mile municipal system in Adams and several other streets, bids for which had already been advertised according to the plans drawn by B. J. Arnold, has also been set aside.

As the result of extensive investigation in which he was assisted by Mayor Johnson of Cleveland, Ohio, and others, Mayor Dunne now thinks he sees how the city can build a system of probably 240 miles. The principal steps necessary in building such a system are set forth in Mr. Dunne's latest "contract plan" about as follows:

1. The incorporation of a company under the laws of Illinois by five persons well known to the people of Chicago as possessing the confidence of the people for their personal integrity, their business ability, and their pronounced sympathy with the policy of municipal ownership of street-car service. This company to be incorporated for the express purpose of building, acquiring and operating street-railroad lines in Chicago in the interest of the city, and to have the power to issue capital stock to secure the money necessary to build, acquire and operate such property. The capital stock to constitute the only incumbrance upon the property, and its amount to be limited to the actual cost of the property. Dividends upon the capital stock to be limited to 6 per cent per annum.

2. The granting by the city council to such company of duly guarded franchises to acquire, build, and operate street railroads on designated streets between fixed termini for a period of twenty years, at 5 cents car fare, with appropriate transfers, and with a reservation on the part of the city of the right to take over all or any part of such road, at any time, at the price and upon the terms to be contractually specified in execution of this plan.

3. The directors, president and manager of the company to be compensated, until the city takes over the property, with salaries to be approved by the city council.

4. All expenditures, contracts and specifications for the building or other acquisition of street railroad properties by the company to be approved by the city council before being incurred or executed by the company.

5. During the operation of the lines by this company the city council to have the right at any and all times fully to inspect its business, and also to reduce fares below the franchise rate to the extent of one-half the net earnings of the property, in excess of operating expenses and dividends; all the net earnings to be set aside as a purchase fund for the acquisition of the property for the city, or to be used in the betterment of the property, as the city council may from time to time direct.

6. In order to secure to the directors the control of the property and to preserve to the city the unobstructed right at any time to acquire such property in accordance with this plan, the capital stock of the company should be issued in trust to a trust company, to be selected by the directors, with the approval of the city council, which trust company should issue on the basis thereof an equal amount of marketable trust certificates to the company for the purpose of obtaining capital by sale thereof, and hold the capital stock in trust to preserve the control of the aforesaid trustees for the management of the said street-car lines and the consummation of this plan for securing municipal ownership and operation.

The said trust company should be required to sell the stock of the said company, as represented by said certificates, by public subscription, duly advertised. In the event of oversubscription it should be required to make allotments in the order of the receipt of subscriptions. In the event of undersubscription the directors should be authorized to contract for the underwriting of the entire offering at a cost not to exceed 2½ per cent, and the chosen trust company and any of the directors should be at liberty to become underwriters.

7. Upon the payment to the aforesaid trust company by the city of Chicago of an amount equal to the cost of the property less the accumulated amount of the sinking fund hereinabove provided for the said trust company should be required by the preliminary contracts to use said sum so paid, together with said sinking fund, in such way as to redeem all outstanding certificates issued by it upon the security of the capital stock of said proposed street-car company, and to use the said capital stock held by it in trust in such way as to transfer all the street-railroad property of the said street-railroad company immediately to the city of Chicago for direct municipal ownership and operation.

As an adviser in the building of the road proposed in the above plan the mayor asked the local transportation committee to appoint A. B. Dupont of Detroit. Such action was opposed, it is said, by a majority of the committee. Two of the members of the committee declared that B. J. Arnold could give the city government all the expert advice it needed, and the services of another expert were unnecessary.

The mayor's message was accompanied by an ordinance presented to the local transportation committee intended to put the "contract plan" into effect, but the council has not yet given it consideration, and as that body adjourned at its meeting this week until September 25th, the fate of the new plan remains to be seen.

The mayor also submitted an alternative plan which he called the "city plan," as contrasted with the "contract plan." The "city plan" proposed the city go ahead at once to take over the same streets referred to in the "contract plan," and operate street cars in them. The objections the mayor raised to it were: In order to work directly under the Mueller law it is necessary to prepare plans and specifications for the particular systems to be installed and advertisements must be made for them; the construction of such systems must be let to the lowest bidders; on account of the limit on the bonded indebtedness of Chicago all payments must be made in Mueller law certificates, which cannot be issued in greater amount than the cost of the property to be acquired, plus 10 per cent.; then, having acquired the property, the city, under the Mueller law, would have to ask for another vote of the people authorizing it to operate it, to pass which would require a three-fifths vote. With this majority failing, the city could do nothing else but lease the property it had acquired.

The mayor's "contract plan" has found a number of critics, among them being Carter Harrison, former mayor, who pointed out that the new plan left the 99-year and other franchise disputes in the air. He thought that the tentative ordinance drawn under his administration was much better, as it would clear the entire controversy, improve the service at once and bring about absolute municipal ownership if desired, at the end of 13 years.

The expected communication from James Dalrymple of Glasgow, Scotland, giving his views and advice as to municipal ownership of street railways in general and those of Chicago in particular, reached Mayor Dunne this week. The mayor, however, has not made public what is contained in the communication, but the inference is that it is probably not favorable to municipal ownership in Chicago at this time.

Pacific Coast Engineering Congress.

The first Pacific Coast engineering congress concluded a two-day session at Portland, Ore., on June 30th. The congress originated with Milner Roberts, professor of civil engineering of Washington University, Seattle. Participating societies were the Pacific Northwest Society of Engineers of Seattle, the Technical Society of the Pacific Coast of San Francisco, the Pacific Coast Electrical Transmission Association, the Montana Society of Engineers and the Washington branch of the American Institute of Electrical Engineers. The attendance was about 200. An excursion of three cars, organized by George P. Low, brought the delegation from San Francisco.

The congress was called to order by H. W. Goode of the Lewis and Clark Exposition, and the permanent organization was formed by the selection of George W. Dickie of San Francisco as chairman and Milner Roberts as secretary. The general executive committee consisted of Franklin Riffle and Messrs. Roberts and Low. After the opening proceedings the joint session was divided into a general congress section and an electrical transmission section.

Many excellent addresses and papers were presented at the sessions by the following-named: Frank W. Hibbs, president of the Pacific Northwest Society of Engineers; George W. Dickie, president of the Technical Society of the Pacific Coast; George P. Low of San Francisco; F. G. Sykes, superintendent of the Portland General Electric Company; Charles H. Baker; J. R. Thompson, electrical engineer of the exposition; Allen E. Ransom, electrical engineer with the Lewiston-Clarkson Company; G. H. Patten of the Portland General Electric Company; M. P. Randolph of the Westinghouse Electric and Manufacturing Company, Seattle; O. B. Caldwell of the Portland General Electric Company; W. W. Wheeler, superintendent of the Northern California Power Company; J. D. Ross, assistant city engineer of Seattle; F. A. C. Perrine of New York; R. W. VanNorden, superintendent of the Central California Electric Company; C. A. Copeland, consulting engineer of Los Angeles, and others.

On Friday, June 31st, the congress again held a joint session. On this day the Pacific Coast Electrical Transmission Association elected the following-named officers: President, George P. Low, San Francisco; vice-president, H. H. Sinclair of the Edison Electric Company of Los Angeles; secretary, S. G. Reed of the Portland General Electric Company.

On Saturday the delegates went on a steamer excursion up Columbia River, accompanied by officers of the United States Engineer Corps, to inspect river improvements at the Dalles. Sunday was enjoyed by an excursion on Willamette River to the hydro-electric plants of the Portland General Electric Company at Oregon City. On Monday a special train, tendered by the Oregon Water Power and Railway Company, conveyed the delegates to Cazadero to examine the dam for the new plant under construction.

The California delegation made a tour of the Sound cities, and visited the lighting and power plants at Snoqualmie, Tacoma, Seattle and Electron. The delegation was bountifully entertained by H. F. Grant, general manager of the Seattle Electric Company, who took them in a special car over the electric lines about Seattle, and over the interurban road to Tacoma, where he gave a dinner at the Rainier Club. H.

The Tantalum Lamp.

A good contribution to the growing literature upon the tantalum lamp is to be found in the lecture by Dr. O. Feuerlein, delivered before the joint session of the technical and electrotechnical associations of Frankfort, Germany, on May 9th last. Dr. Feuerlein is the director of the incandescent lamp works of Siemens & Halske of Berlin and plays an important part in the development of the lamp to its present commercial state. Some selections from his lecture are given by Mr. Richard Guenther, United States consul-general at Frankfort, which are of interest.

Tantalum occurs in nature in various minerals. There are two groups of tantalum ores—tantalite and columbite. The tantalum ores, which are found in Australia and Scandanavia, contain tantalate of iron and tantalate of manganese. The columbite ores contain, in addition to tantalite, niobate of iron and of manganese, and were first found in North America (in New England). From these ores tantalum is first separated as tantalitic acid, which is converted into a double fluoride of tantalite and potassium, from which tantalum is finally derived as a pure element.

Tantalum as a metal was first found by the Englishman Hatchet in 1801. As the real discoverer of this element, however, must be named Eckeberg, who made investigations in 1802. Berzelius was enabled, in 1824, to free tantalum of its associated element, but even he did not succeed in obtaining pure tantalum.

Dr. von Bolton, chemist of the Siemens & Halske works, after very laborious and paintaking experiments, first succeeded in obtaining pure tantalum. Tantalum is a heavy mineral with a gray metallic luster, extremely resistant to acids and alkalies. Only fluoric acid affects it. Its specific weight is 16.8. Pure tantalum has the hardness of soft steel, but possesses a much greater tensile strength. It can be worked into thin sheets and extremely fine wires. Its melting point lies between 2,250° to 2,300° Celsius. Through repeated annealing it acquires such hardness that tantalum sheets withstand even a diamond borer.

The technical use of large quantities of tantalum, says Dr. Feuerlein, is at present impracticable, as one pound of this element still costs nearly $5,000. Of what importance the chemical and physical properties of tantalum are for the industries is shown by the fact that Siemens & Halske, for the various processes of manufacture and use of tantalum, have taken out more than 200 patents in Germany and other countries. The incandescent lamp with a tantalum instead of a carbon thread has various advantages over other means of lighting. The tantalum lamp requires only one-half the current of ordinary incandescent lamps of equal light power. With the same strength of current the tantalum lamps give double the light of the carbon incandescent lamp, and the light is much whiter. The lamp is pear-shaped, like the ordinary incandescent lamp, and the thread has a length of 650 millimeters and is 0.5 millimeter in diameter. The lamp can be placed in any position.

Dr. Joseph Hyde Pratt of the United States Geological Survey has recently prepared a report upon the production of zircon, gadolinite and columbite or tantalum minerals, which are all used in the manufacture of electric incandescent lamps.

The output of zircon and gadolinite is employed almost exclusively in the manufacture of chemical compounds that are utilized in the construction of the glower of the Nernst lamp. The zircon is mined for its zirconia content, and from the gadolinite is obtained yttria, these two oxides representing the principal ores used in the glower. The zircon is obtained entirely from the deposits in Henderson County, North Carolina, and the gadolinite is obtained from Llano County, Texas.

The use of tantalum is now much augmented by the invention of the tantalum lamp. The localities in North Carolina, Connecticut and South Dakota, where tantalum minerals have been or may be found, are enumerated in the report, and a list is given of minerals that contain tantalum, together with their chemical composition and the localities where they have been discovered. The quantity of tantalum required in the manufacture of lamps is exceedingly small, however, so that a few tons of these minerals will go a long way in supplying the demand for the metal.

Contractors' Convention and Electrical Exhibition in Boston.

Boston, July 8.—A convention with an exposition accompaniment is not unusual, but seldom does a convention of allied interests assume such proportions that it warrants the amount of preparation and attention to detail which are involved in an undertaking of the sort scheduled for the week of July 15th to 22d in Boston.

The National Electrical Contractors' Association, which comprises a number of state organizations having affiliations with one another and with the central national body, is to be the guest this year, when it holds its fifth annual convention, of the Electrical Contractors' Association of Massachusetts, and the latter organization has planned for the event an exhibit of really large dimensions.

The Mechanics' Building on Huntington Avenue, which has been the scene of most of the larger fairs and expositions held in Boston in the last decade or two, is engaged for the affair, which opens on the 15th and closes on the 22d of this month. The convention will be held in the last four days of this period, beginning July 19th and closing July 22d. Its proceedings will take place in the most commodious of the several auxiliary halls above the exhibition floor, probably in the well-lighted and ventilated art-gallery section.

About 75,000 square feet of floor space has been taken for the exposition features. There is much variety also in the exhibits, for nearly 100 different concerns have made preparations to be represented by a display of their products at the exhibition hall. The General Electric and the Westinghouse companies will be the largest exhibitors, and the American Circular Loom Company of Chelsea, Mass., comes next. The Edison Electric and Illuminating Company of Boston will be one of the largest space occupiers, and will give some handsome effects in illumination. The Westinghouse exhibit will include an hourly biograph tour of the works. This is the same feature which the company had at the St. Louis Fair. Earle L. Ovington of the Ovington Manufacturing Company of this city will personally demonstrate some of the most recent marvels in spectacular experiments with transmission of electricity through the human body.

There will be X-ray demonstrations by the Heinze Electric Company of Lowell, Mass., and C. S. Knowles will display a mammoth transformer, the largest ever built, brought here especially for the occasion from the Polytechnic Institute of Worcester.

Another notable feature will be a working model of the wireless electric-railway system. There will be a working model also of an electric announcer of next stations and stopping places, to be shown in car interiors as they approach and reach successive stations on the line.

Some of the most important figures in the electrical trade are interested in this gathering of the electrical contractors. The association numbers in the aggregate about 650 members, representing a total capitalization of more than $25,000,000, and delegates from nearly all of the states in the Union have signified their intention of being present. Invited guests for the opening day of the convention, July 19th, include the governor of the commonwealth, the mayor of Boston, and a number of prominent engineering, railway and business leaders in Boston and elsewhere in the state.

John P. Coghlin of Worcester, first vice-president of the Massachusetts association, is chairman of the special committee of arrangements, and Frank L. Barnes of Boston, president of the state organization, is the treasurer. A. T. Sampson of Lynn is the secretary, and there are two other members, T. T. Kelly of Boston and F. A. Richardson of Worcester. The manager of the exposition is Chester I. Campbell of Boston, who is doing great preparatory work for the success of the event.

The convention programme, briefly summarized, is as follows:

July 15—Exhibition opens, in Mechanics' Building.

July 16—Headquarters in the exhibition hall will be open and the reception committee will be in attendance to receive members and guests who arrive.

July 17—Registration of arrivals to attend the convention.

July 18—Directors of the national association meet at 10 a. m. Receptions, informal, in the afternoon and evening.

July 19—Opening session of the convention at 10 a. m. Address of welcome by President F. L. Barnes of the Massachusetts association. Addresses by representative officials of the city of Boston and of the state of Massachusetts. Response, in behalf of the association by President E. McCleary of the national association. Topics before the convention in papers and addresses by members, with opportunity for discussion. Dinner at 6 p. m.

July 20—Executive session at 10 a. m. Harbor excursion at 2:30 p. m. Dinner at 6:30 p. m.

July 21—Executive sessions at 10 a. m. and 2 p. m.

July 22—Unfinished business in executive session, if necessary.

Several trips to points of interest in the city and suburbs have also been arranged, more especially for ladies of the party, while the members are assembled in convention.

This year's officers of the National Electrical Contractors' Association are: President, E. McCleary of Detroit; vice-presidents, W. J. Gray of Minneapolis, Walter C. McIntire of Philadelphia and J. P. Coghlin of Worcester; treasurer, John R. Galloway of Washington; secretary, W. H. Morton of Utica; sergeant-at-arms, J. C. Sterns of Buffalo.

The nominations for the coming term, subject to ratification at the convention, contemplate only two changes in the list. James R. Strong of New York is the candidate for president and F. E. Newbery of St. Louis is the candidate for third vice-president. The association was organized in 1901 in Buffalo. Charles Eidlitz of New York was its first president.

In addition to the exhibition committee named above, the following have been appointed to the several committees which will have charge of the convention details:

Executive committee—J. P. Coghlin, chairman; A. T. Sampson, secretary; H. S. Potter, treasurer; H. A. Holder, S. B. Wetherbee.

Reception committee—F. L. Barnes, chairman; F. A. Swan, P. S. Deane, G. E. Brigham, H. D. Temple, H. F. Sawyer, R. H. Hallowell, P. A. Coghlin, P. V. Latour.

Printing and advertising committee—H. A. Holder, chairman; J. Wilkinson, W. E. Clark, G. E. Brigham, T. W. Byrne.

Entertainment committee—S. B. Wetherbee, chairman; F. W. Lord, F. A. Richardson, H. D. Temple, A. H. Andrews, T. T. Kelly, F. Bryant, M. M. Jacobs, E. C. Lewis, T. P. Curtis, I. L. Mattson, D. H. Fisher, H. S. Potter, H. M. Lobdell, J. A. Cole.

Following are the names of exhibitors:

General Electric Company, Schenectady, N. Y.; Westinghouse Electric and Manufacturing Company, Pittsburg; American Electric Novelty Manufacturing Company, New York; American Circular Loom Company, Chelsea, Mass.; American Electric Contractor Company, New York; American Electric Sign Company, Boston, Mass.; Automatic Electric Train and Station Annunciator Company, Lexington, Mass.; Appleton Electric Company, Bridgeport, Conn.; Booth & Co., Boston, Mass.; Bryant Electric Company, Bridgeport, Conn.; Benjamin Electric Company, New York; L. E. Bova, Boston, Mass.; S. H. Couch Company, Boston, Mass.; Couch & Seeley Company, Boston, Mass.; Charles A. Cotton, Boston, Mass.; Chase-Shawmut Company, Boston, Mass.; S. B. Condit, Jr., Electrical Company, Boston, Mass.; Dale Company, New York; De Veau Telephone Company, New York; Dossert & Co., New York; Delaware Hard Fibre Company, Wilmington, Del.; Philip Dorn, Boston, Mass.; Electric Gaslight Company, Boston, Mass.; Economical Electric Lamp Company, New York; Eastern Carbon Works, Jersey City; Electro-dynamic Company, Bayonne, N. J.; Edison Electric Illuminating Company, Boston; Eastern Electric Cable and Wire Company, Boston; Elm City Engineering Company, New Haven, Conn.; Erickson Electric Equipment Company, Boston; Peter Forg, Somerville, Mass.; A. C. and M. L. Felkin, Boston; John L. Gleason, Jamaica Plain, Boston; Gould Storage Battery Company, Boston; Homes Manufacturing Company, New York; Harvey Hubbell, Bridgeport, Conn.; W. S. Hill, Electric Company, New Bedford, Mass.; Johnson & Morton, Utica, N. Y.; H. W. Johns-Manville Company, New York; C. S. Knowles, Boston; McKenney & Waterbury Company, Boston; Colman J. Mullen, Brooklyn, N. Y.; Manhattan Electrical Supply Company, New York; Minimax Company, Boston; Marshall Electric Manufacturing Company, Boston; Miller Anchor Company, Norwalk, O.; National Carbon Company, Cleveland, O.; Ovington Manufacturing Company, Boston; Pass & Seymour, New York; Pettingill-Andrews Company, Boston; Proctor-Raymond Company, Detroit, Mich.; J. W. Poole, Boston; Renim Specialty Company, Boston; Ridgeway Dynamo and Engine Company, Boston; John A. Roebling Sons Company, New York; Steel City Electric Company, Pittsburg, Penn.; Safety Armorite Company, New York; Sprague Electric Company, New York.; Swazey & Smith, Boston; Stuart Howland Company, Boston; Starbuck Sprague, Boston; Trumbull Electric Manufacturing Company, Plainville, Conn.; Valentine Electric Sign Company, Atlantic City, N. J.; O. C. White Company, Worcester, Mass.; Wireless Railway Company, Philadelphia; Greenwood & Daggett Company, Boston; Smith-Premier Typewriter Company, Boston; Oriental Manufacturing Company, Boston, Mass.; Chester I. Campbell, Boston; Dunton & Field, Cambridge, Mass.; Alvin T. Fuller, Boston, Mass.; Durcen & Kendall, Boston; American Electric and Controller Company, New York; Meitz & Weiss, Boston; F. B. Smith (Bassert Electric Company), Boston; Appleton Electric Company, Chicago; National Telautograph Company, Boston; H. T. Paiste & Co., Philadelphia; Worcester Electrical Manufacturing Company, Worcester, Mass.; Yale & Towne Manufacturing Company, Boston; Alphaduct Manufacturing Company, New York; R. M. Cornwall, Syracuse, N. Y.; J. S. Codman, Boston; Charles Garrison, Boston; Underwood Typewriter Company, Boston; Cooley General Development Company, Jamaica Plain, Mass.; Heinze Electric Company, Lowell, Mass.; Munroe & Munroe, Boston; Olds Gas Engine Company, Boston; C. E. Osgood, Boston; Holtzer-Cabot Company, Brookline, Mass.; Newton Street Railway Company, Newton, Mass.; Adressograph Company, Boston; Herbert W. Smith and Charles A. Thompson Company, Boston; Randliff Motor Car Company, Boston; A. R. Bangs, Boston; E. B. Wood, Boston.

The Northwestern Elevated Railroad Company of Chicago made steady gains in traffic during the year ended June 30th. The total passengers carried during the year just closed was 26,812,825 compared with 25,497,079 for the previous 12 months. The revenue from traffic for the last year was $1,340,641, an increase of $65,787 over last year. The Chicago and Oak Park elevated road also shows a slight gain for the year ended June 30th. The revenue from traffic increased from $805,460 to $820,252.

To Systematize Work of Electrical Inspectors.

The Western Association of Electrical Inspectors, which was organized in Chicago on June 1st, has just appointed a number of special committees for the purpose of making a more equitable and systematic apportionment of the labor incident to carrying on the work of the association. An outline of the jurisdiction and duties of these committees is as follows:

Committee on Uniformity in Rulings shall decide all questions relating to the interpretation of the National Electrical Code, concerning which there is a general difference of opinion. It shall promulgate to each member of the association its decision on the questions submitted and if approved by a two-thirds vote of all members the decision shall be considered as sustained and binding upon the association membership.

Committee on National Electrical Code shall receive and prepare for submission to the association all proposed amendments to the National Electrical Code, which are to be forwarded in the name of the association to the electrical committee of the Underwriters National Electric Association for consideration at the annual meeting held in December of each year.

Committee on Outside Wiring shall have charge of all questions concerning the hazard to life and property involved in outside wiring.

Committee on Theater Wiring and Show Equipment shall prepare detailed specifications for the installation, maintenance and operation of electric wiring and apparatus used for theatrical purposes.

Committee on Grounding of Conductors for Safety shall prepare supplementary instructions for the grounding of conductors as contemplated in the National Electrical Code.

Committee on the Construction and Installation of Electric Signs shall prepare instructions for building, hanging and wiring of electric signs.

Committee on Show Window and Display Lighting shall prepare instructions for the safe installation of wiring and apparatus used in show windows or for displays of a temporary character.

Committee on Instructions to the Public Concerning the Safe Operation and Maintenance of Electric Wiring and Apparatus shall prepare a simple set of instructions which shall be suitable for distribution to the public.

Committee on Laws and Ordinances shall draft bills and ordinances for submission to city councils, state legislatures, etc., covering the electrical hazard, and shall assist in the enactment and enforcement of such laws and ordinances. It shall also be the duty of this committee to prepare a simple system of office records, blanks, etc., suitable for the use of municipal or insurance electrical inspection departments.

The committees are to have reports in the hands of the secretary by September 15th, and members are asked to make suggestions, offer information or present such matters as they wish considered to the various committees. The secretary of the association is William S. Boyd of Chicago. Inspectors having local problems may call upon the association for assistance.

Motor Omnibuses versus Electric Railways.

The increase in the number of motor buses for passenger traffic in London and other towns and cities of the United Kingdom has been very marked. The price of the standard double-deck omnibus, carrying 36 passengers, is $4,623 net, London; of the single-deck type, carrying 18 passengers, $4,136 net. The London Daily Mail of recent date says that from working figures so far available the profits and convenience of the motor omnibus would seem to be "immeasurably greater" than those of the electric railways. But Frank W. Mahin, United States consul at Nottingham, entertains a somewhat different opinion. He says: "The experimental use of motor omnibuses has gone to a considerable length in this country, but, contrary to a previous supposition, the result apparently demonstrates the greater utility and economy of electric street railways. As respects utility, it is concluded that the electric motor-driven vehicle is much simpler and possesses superior power in sundry ways in comparison with a petrol motor vehicle. But particular stress is laid on the greater cheapness of operation and maintenance of the electric railway in comparison with the motor omnibus. Experience shows, it is claimed, that the rubber tires of the omnibus cost for maintenance about four cents a mile, against 2½ cents a mile per car for rails, allowing for the capital expenditure in the original cost. This difference is figured at not less than $500 per annum for each vehicle.

"The cost of propulsion is also given as much less for the electric car. For each ton-weight thereof the cost of electricity is placed at 24 cents, while for each ton-weight of vehicle propelled by a petrol motor the cost of petrol is placed at 80 cents. It is further estimated that the cost of petrol is likely to rise as the demand increases, while the cost of producing electricity is steadily falling, and it is noted that the expenditure therefor would be even less than it is if street-railway cars were allowed to go as fast as motor omnibuses."

Chicago Pipe-bending Machine.

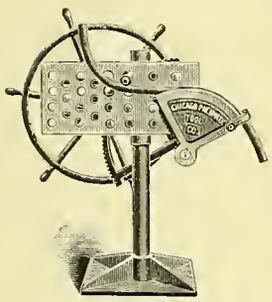
The pipe-bending machine illustrated herewith, while being of a somewhat simple character, will accomplish a large variety of work in line of its intended duty. Moreover, it demands the services of an ordinary helper only, who can, it is said, with the aid of this machine, bend an amount of pipe to any desired complex curvature in one-tenth of the time that a skilled mechanic would require to perform the same work with ordinary means. Being light in weight, it is readily carried from shop to job, or vice versa, and can be secured to any column, stanchion or any available support in a few minutes, or a suitable stand can be furnished as shown.

The machine is valuable in connection with conduit work. Piping of steel, iron, brass, copper or other material can be bent cold up to two inches diameter by one man.

It also finds many applications in shipyards, pipe-shops, locomotive works, sugar-houses and other places where pipe is used to any extent. Makers of heating plants, structural and architectural iron workers, fire-escape manufacturers, will also find the portable pipe-bender especially useful. It also has special dies that can be readily attached for bending light angles, flats or T bars to any desired radius as easily as bending pipe.

When pipes are coated by the Sahin process, galvanized, tinned, etc., this machine will bend the pipe to any desired shape without breaking the coating in any way. One man can bend a piece of two-inch pipe to an S bend in three minutes, no other assistance or device being used or needed. The cost of repairs, where it has been used 10 hours a day in shipyards, railroad shops and other places, is slight.

The device is manufactured by the Chicago Pneumatic Tool Company of 1010 Fisher Building, Chicago, and 95 Liberty Street, New York.



CHICAGO PIPE-BENDING MACHINE.

Scheme to Supply New York with Water from Great Lakes.

The project of Charles G. Armstrong, a well-known engineer, to supply New York city with pure water from the Great Lakes through a system of great cement ducts is an interesting one, and is a combined civil and electrical-engineering proposition. Mr. Armstrong's plan is to use electro-hydraulic "boosters" to accelerate the speed of the water in the ducts, and also to hold back the flow on down grades by means of waterwheels which will supply power to the boosters on the up grades.

It is proposed to run the ducts beneath the surface so as not to interfere with the use of the land for farming purposes, following the undulations of the surface. In order not to have the tubes too thick, it is proposed to build a power plant at Niagara Falls and transmit current to a series of booster pumps along the line. These are to be located at places where there is any considerable dip which would add too much to the static strain on the tubes. Waterwheels and generators are also to be installed on the down grades, which will act to relieve the strain at those points and at the same time furnish current to pump the water up over the succeeding up grades. In this way a much thinner tube may be used.

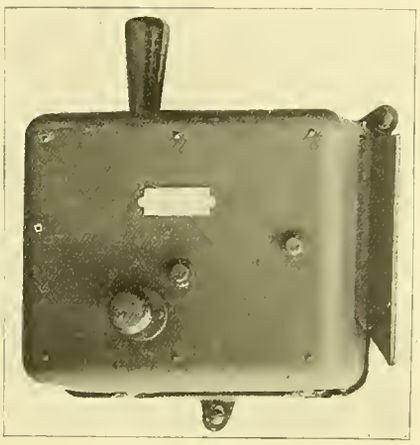
By this method Mr. Armstrong proposes to deliver water in New York city at a head of 580 feet, which corresponds to about half the actual difference in level. This would be sufficient to deliver water to the highest points in the city.

This scheme is put forward as a substitute for the proposed widening of the Erie Canal, which will cost $101,000,000. Its backers say, Why not use this sum of money for an up-to-date improvement, which will be an everlasting benefit? They also contend that if the canal project was abandoned the route could be shortened about 100 miles. It would then be possible to build in the bed of the Erie Canal land at least a four-track freight road that could be operated 12 months in the year, to be owned by the state, having a carrying capacity of 40 such canals, with freight rates to tide water one-fourth the present canal rates, and time of transit one-fortieth of present canal time. There would then also be on either side, to protect the banks, these great water tubes that would bring health, irrigation and pure water to every city along the line, from Lake Erie to New York city.

The bill for this project which was put before the Legislature of New York did not pass, but a state commission was appointed which, it is believed, will give the proposition careful consideration.

Railway-type Direct-current Circuit-breaker.

The street-railway circuit-breaker shown in the illustration combines in one piece of apparatus a safety device and main switch, as it automatically opens the circuit on overload or short-circuit, and can be operated by hand to disconnect the car from the trolley circuit. It is intended to be installed over the motorman's head in the place usually occupied by the canopy switch, but may be placed elsewhere if desired. It can be quickly closed, thus avoiding the inconvenience and delay incident to replacing a fuse.



RAILWAY-TYPE DIRECT-CURRENT CIRCUIT-BREAKER.

STOMBAUGH GUY ANCHOR AND ROD.

This circuit-breaker is intended for direct-current use and is made for capacities of 60, 100, 150 and 200 amperes, with a range from 90 to 225 per cent. of normal rating. The mechanism is mounted on a cast-iron base and enclosed by a pressed-metal cover. The handle for resetting projects conveniently from the side of the case and the plunger for tripping by hand extends through the cover and is provided with a composition handle for the hand to strike against. The resetting handle is connected to the switch lever through a compression spring which insures a firm pressure and good contact regardless of the natural wear to which the parts may be subjected in service.

The arc is broken in a powerful magnetic field, which effectually opens the circuit under the most severe conditions. The contacts on which the arc occurs are surrounded by a shield of insulating and arc-resisting material which prevents the arc from being communicated to any other part of the breaker. The contact is made up of copper strips separated by spaces, each acting independently of the others, and in this way a slight irregularity or burr will affect the individual strip only without disturbing the other strips, as would be the case in a brush made in the usual way with laminations without spaces. An auxiliary contact at the end of the switch lever, which can easily be removed and replaced by a new one, serves as an arcing tip. This circuit-breaker is manufactured by the Westinghouse Electric and Manufacturing Company. A feature is the accessibility when the cover is removed.

The current adjustment is made by means of a knurled head screw which engages a nut attached to a coiled spring, which in turn opposes the pull of the magnet on the armature. A trigger holds the switch in the closed position and is in range with a projection on the armature of the tripping magnet. When the armature is drawn down by an excessive current in the coil this projection strikes the trigger and releases the switch lever, which is opened instantly by a coiled spring.

The largest electric sign ever constructed in the copper country has been built by the Superior Construction Company of Houghton, Mich., for the Houghton County Street Railway Company's "Electric Park." The sign is 20 feet in length and 6½ feet high.

Improvements to Stombaugh Guy Anchor.

Some improvements have recently been made to the Stombaugh five and six-inch guy anchors which are manufactured by W. N. Matthews & Brother of 203 North Second Street, St. Louis.

The five and six-inch anchors have one-half and five-eights-inch round rod, and a wrench must be used to screw them into the ground in order to overcome the torsional strain. Formerly the anchor rod was made 5½ feet long and the wrench shaft a little shorter. The rods are now all made exactly six feet long and with a larger eye, permitting the use of a one-half-inch guy thimble.

The wrench is now made just long enough to permit the eye of the anchor to protrude about an inch out at the top of the wrench. This permits the insertion of a wedge, which prevents the key of the wrench from slipping off the anchor during the operation of installation.

INSTALLING IMPROVED STOMBAUGH GUY ANCHOR.

This accident has, no doubt, frequently caused those who were using the anchors for the first time to condemn them because they were not able to get them into the ground far enough to hold well. The wrench key is now brazed on to the shaft of the wrench, instead of riveted, as formerly. This makes a much stronger and much more satisfactory wrench.

These improvements have greatly increased the efficiency of the Stombaugh guy anchor, and it is now possible to get a perfect anchorage every time and one that will hold beyond a question of a doubt.

New York's Proposed Municipal Lighting Plant.

As reported by the New York correspondent of the Western Electrician last week, a report upon the cost of construction and operation of a municipal lighting plant for New York city has been submitted by the commission which was appointed to investigate the matter. This commission consists of Dr. Cary T. Hutchinson, Nelson P. Lewis and Prof. George F. Sever.

The report asserts that each arc lamp now operated for city lighting, and now costing the city $146 a year, can be operated for $64.07 a year. It is proposed to locate a central station upon the city's property bounded by Avenue A, Ninetieth and Ninety-first Streets and the East River. The specifications call for two 5,000-kilowatt turbo-generators, three 3,000-kilowatt turbo-generators and one turbo-generator of 1,000 kilowatts capacity. There is also specified one turbine or engine-driven exciteer of 200 kilowatts capacity. The generators are to be three-phase, 60-cycle, working at 11,000 volts. Inclined water-tube boilers of 600 horsepower, working at 200 pounds pressure, are called for. Twenty-four of these boilers will be required, each having approximately 6,000 square feet of actual water-heating surface. Superheaters raising the temperature of the steam 150° F. are also specified.

Power is to be delivered to nine sub-stations in Manhattan and five in the Bronx. At these part of the power will be transformed to supply constant-current arc lamps of 7.5 amperes. The remainder will be transformed to 2,200 volts, constant pressure, for secondary distribution.

The building is to comprise a boiler room, turbine room, with switchboard galleries, and two wings for offices. The boiler room is to be 88 feet wide by 260 feet long, the turbine room the same length and 103 feet five inches wide and the wings 50 by 53 feet.

Rotary Converters and Motor-generators.[1]

By Louis E. Bogen.

It has been the writer's privilege in making estimates upon inquiries for electrical machinery for the last several years to note the development of central systems of distribution. An inquiry for a 500-kilowatt 120-volt generator is now a rarity. For 240 volts there is naturally still a call for machines as large as 2,500 kilowatts. But we find that when a demand for an increase in power occurs the want is more and more frequently being supplied by installing alternators in anticipation of the demand for power and light at greater distances from the station together with means for tiding over the wants nearer the station. It is not at all intended here to convey the idea that the use of direct current is already obsolete, but that because of the necessity of distributing over a much greater area it will be restricted to its own peculiar field of local distribution over a limited area. This brings us, then, immediately to the consideration of means for the conversion of alternating into direct current as well as the reverse.

In this country the rotary converter and motor-generator stand out as the means of accomplishing the transformation of energy here referred to, although we cannot ignore the rectifier nor can we refrain from expressing our admiration of that ingenious device, the Cooper Hewitt vapor rectifier. Since the question often arises as to whether to install rotary converters or motor-generators, it may be interesting to consider some of the characteristics of each.

Rotaries.

In the design of electrodynamic machinery the speed is a very important item. For a unit of given output the greater the speed the less the cost up to a certain limit, beyond which there is again a very sharp increase. There is, therefore, a reasonable speed for any machine of a given rating. In alternating-current machinery there is an additional limitation fixed by the adoption of the standard frequencies of 25 and 60 cycles.

For 25 cycles we find the possible synchronous speeds changing by large percentages. This, together with the fact that at reasonable speeds the number of poles of a 25-cycle rotary are limited, makes it best adapted to the higher electromotive forces because the current per stud will not be excessive. The 25-cycle rotary is an excellent device for railway circuits as well as for 240 volts. At 120 volts it would have to be operated at a comparatively slow speed to have a commutator of reasonable size.

On the other hand, the 60-cycle rotary, by virtue of its greater number of poles, is better adapted to lower than to higher voltages. In fact, the design of a 60-cycle rotary is limited to such a narrow choice of dimensions as to be almost fixed. We all know what it means to run a commutator at 4,500 feet per minute and upward. The brushes cannot help chattering. This jumping of the brushes is always attended by slight sparking, due to the breaking of the current, and should the change in load be large enough and the voltage high enough there will be flashing over from stud to stud. This is especially so because the distance between studs, as well as the thickness of a commutator bar, are both very small, even with the high peripheral speeds used on the commutators. Sixty-cycle rotaries are, therefore, good for 125 volts, passable at 240 volts, but are to be avoided on high-voltage power and railway circuits, where big changes in load necessarily occur. One flashover may more than pay for a motor-generator set.

The Cascade converter is a device for lessening the troubles on 60-cycle conversion. It is being used in Europe to some extent and consists of a double machine composed of a form of induction motor and a rotary in series. The frequency applied being 60 cycles, for example, if the rotor revolves at half synchronous speed, it will in turn impress a 30-cycle electromotive force upon the armature of the converter proper. The very fact of the existence of such a machine indicates that a want is felt for something better than 60-cycle rotaries.

There are a number of methods of starting converters, the simplest and best method being to start the machine as a direct-current motor from the bus bars, using an ordinary starting box, changing the field strength by means of a field regulator until synchronous speed is reached, when the machine may be thrown on the alternating-current lines. Certainly it can also be run to a point above synchronism and then allowed to fall back to synchronous speed, the direct-current armature circuit having been meanwhile disconnected from the direct-current line, and when synchronism is reached the alternating-current side is thrown on to the lines. This is merely a modification. A simple and convenient method is to start the machine by means of either a direct-connected or geared-induction motor having a higher synchronous speed, bringing the machine up to or above synchronism, then connecting it to the lines at the proper time. Another method of starting up from the alternating-current side is to throw the machine on about one-half of the line voltage by means of choke coils or taps in the transformers or an ordinary induction motor compensator. In starting up in this manner the immense number of turns on the shunt fields form the secondary of a transformer of which the armature, when at rest, is the primary. A very large voltage is thus induced in the shunt fields and, for large machines, it is necessary to divide the field winding into a number of sections. This is done conveniently by the so-called "break-up switch." A machine will sometimes "lock" at half voltage when so started. Closing or opening the field circuit will usually remedy this difficulty because it changes the conditions of operation. In small plants it may be possible to start up the rotaries with the generators from a standstill, leaving them right on the lines.

In starting up from the alternating-current side the polarity may be either normal or reversed. This may be obviated by noting the action of a direct-current voltmeter connected to the armature. As the armature approaches synchronism so that the frequency is low enough to affect the voltmeter the needle of the latter will swing violently first in one direction and then in the other, and finally come to a position, indicating either a positive or negative direction of current, showing that the polarity is normal or reversed. An interesting experiment was recently made on a rotary running from half the normal alternating-current voltage. The "break-up switch" was so arranged that the fields were short-circuited in pairs. To ascertain whether or not the machine was in synchronism a disk was attached to the shaft, this disk being divided into eight alternate black and white sectors to correspond to the number of poles of the rotary. An arc light a short distance from the disk was operated from the same source of alternating current. When the disk apparently became stationary the machine had reached synchronism. When synchronous speed was reached the fields were thrown across the armature and, if the machine was of the proper polarity, nothing further was necessary, but if it came up in the reverse direction, by reversing the field connections by means of a double-throw switch, the armature was found to drop out of step and fall back, one-half the pole pitch remaining steady at this point and running at synchronous speed. Under these conditions the direct-current voltage came down very close to zero. The fact that the machine had not dropped back one complete pole was ascertained by measuring, by means of small copper wires, the voltage from one brush to a point half way between two brush studs. This was found to be 250 volts. The direct-current brushes sparked badly and the armature leads became very warm, showing that large currents were flowing within the machine. It was then found that by reversing the field when it was very weak, either self or separately excited, this did not occur, but the armature fell back one full pole when the fields were reversed. This reversing could be much more definitely accomplished when the neutral period of the rotary was ascertained. It was found that when running at synchronous speed it would take just 11 seconds for this particular machine to fall back one full pole. Therefore, if the machine was found to have the wrong polarity, by opening the alternating-current switch and waiting 11 seconds to throw it on again, 11 seconds after opening it, the machine could be caught in the right position.

Everyone familiar with the operation of rotaries has no doubt observed that there is a certain point at which the machine takes a minimum amount of alternating-current current for a given direct-current current which it may be delivering; and that if the field strength be either increased or decreased beyond this point the alternating-current will increase for the same direct current delivered. This extra current is a wattless one, and is leading if the field excitation is more, and lagging when it is less, than the amount required to give minimum alternating current for the given direct-current output. It produces unnecessary heating in the armature and is therefore to be avoided as far as possible.

Hunting or pumping is an action common to all synchronous apparatus under certain conditions and indicates a giving and taking of power to or from the line. This phenomenon may be produced by a prime mover having a non-uniform angular velocity or because the alternator has poor inherent regulation. An armature current of varying power factor may produce a shifting of the fields under the poles of the alternator, which gives the equivalent of fluctuation in speed, even though the speed is constant. Hunting is very frequently induced in a rotary converter by other synchronous apparatus operating upon the same system. The armature of the rotary, being of comparatively small mass, takes on and may accentuate the irregularities in a system, and it is wise to avoid operating the machines in parallel, especially on both the alternating-current and direct-current sides. In one large system which the writer has in mind the consulting engineers very wisely did not operate the two 1,000-kilowatt generators directly in parallel, but connected them beyond the step-up transformers; thus they were enabled to operate a 400-kilowatt rotary in this station directly from each generator and were able to parallel the direct-current ends of these rotaries.

Motor-generators.

The starting of a motor-generator is accomplished most simply, as in the case of a rotary, by starting the direct-current machine as a motor. When it is not possible to start from the direct-current end, synchronous motors are often started by means of choke coils or low-voltage taps on the transformers just like the rotaries. The currents here also may be extremely large, and the writer is aware of more than one plant which has been shut down by starting in this manner, the synchronous motor drawing so largely from the line. An induction motor starter may also be used. A very pretty scheme has been adopted in a number of cases. A small single-phase motor is used to start a small rotary converter, and the large generator is started from the direct-current side of the rotary, the rotary being steadied by the single-phase motor which was coupled to it, thus giving it a considerable overload capacity.

From the standpoint of operation the synchronous motor has one very great point in its favor, especially from the fact that induction motors are being installed in factories at a distance from the central station, i. e., that it may be very conveniently used to keep up the power factor on the line. It is evident that since, in factories operating with motor-driven tools, the average load in the factory will be as low as one-fifth the total capacity of the motors installed, and that, therefore, a large percentage of the motors are operating at light loads, the power factor of the plant will be quite low. Indeed, the writer has in mind a plant in which the average power factor is something like 40 per cent. Inquiries are not infrequent for synchronous motors to be used solely for the purpose of increasing the power factor of a system. It is well to keep this point in mind in the selection of a unit to provide a balance between the alternating-current and direct-current systems of a station. However, the point must not be lost sight of that if a synchronous motor is to develop a certain output in brake horsepower and to supply a corrective current for increasing the power factor it must be considerably larger than if it were to deliver its load at or near unity power factor.

The fact that power must not only be distributed in large towns but often sent to its environs makes it necessary to employ frequency changers. Sufficient thought is often not given to the correct choice of a frequency changer. It must be remembered, for instance, that if the energy is to be converted from 25 cycles to 60 cycles, the highest possible speed to get this exactly is 300 revolutions. Naturally, for small units, this speed is such that the price becomes high; therefore a compromise is effected and an odd frequency is adopted; for instance, frequency changers are built of 100 and 200-kilowatt capacity operating at 750 revolutions per minute, transforming from 25 to 62½ cycles. Now, in starting a set of this kind, there are but two positions where it is possible to operate both the 25-cycle and the 62½-cycle ends in parallel with other units, and it therefore requires some manipulation to get the machines into one or the other of these positions when starting up. In operating a frequency changer in parallel with either another frequency changer or with a generator on the high-cycle end, there is but one way to throw the high-cycle end in parallel with the other unit. If the other unit happens to be of the same capacity and characteristics the excitation of the generator end of the frequency changer must be the same as that of the unit with which it is to be brought in parallel, because after it is thrown in parallel, change in excitation on neither the motor nor the generator will produce anything but an interchange of wattless current between the sets.

1. Abstract of a paper read before the Denver-Colorado Springs convention of the National Electric Light Association, June 6, 1905. Mr. Bogen is an engineer of the Bullock Electric Manufacturing Company.

First Electric Trains Operated on Long Island Railroad.

The first electrically propelled passenger trains on the Long Island railroad—which are asserted to be the first instance of the actual conversion of a steam railroad, in America—are about to be put in operation, or perhaps have been before these lines are seen by the reader. The first trains will be run on the Rockaway Beach division, from Long Island City, a stretch of track about 16 miles long. The Long Island railroad has already received 50 of the 150 steel motor cars, and has also converted 100 of its existing coaches to be used in conjunction with the motor cars. The new steel cars are a little more than 52 feet long, and seat 52 passengers. The third rail on the Rockaway division is guarded with a double wooden sheathing, so that it is impossible for anyone to come into contact with the rail unless he does so wilfully.

A New Carbon Filament.[1]

By John W. Howell.

I have the pleasure of presenting to you some data on a new carbon filament, which has characteristics so differing from those of any previously known filament as to seem to indicate that it is a new form of carbon. Besides being very interesting on account of its physical characteristics, this filament is of considerable value on account of its much better life or efficiency, as compared with the carbon filaments heretofore known. This new filament is the result of work done in the Research Laboratory of the General Electric Company, and in the laboratory of the lamp works, at Harrison, N. J.

In briefest outline, the new characteristics of the filament may be said to be due to the proper application of excessively high temperatures to the ordinary carbon filament. The value of the product is determined by the conditions under which the high temperatures are applied.

It is well known that an ordinary incandescent filament in an evacuated lamp may be heated to excessive temperatures by the application of high current without producing any beneficial change in the filament. To produce the effects described in this paper the heat is externally applied to treated filaments at atmospheric pressures. The simple application of the highest attainable temperatures to the plain carbonized cellulose fiber, i. e., the so-called "filament base," is also incapable of producing any considerable change in the filament. This high temperature treatment of the base is, however, a beneficial step in the process here described.

Before describing the new process, it may be

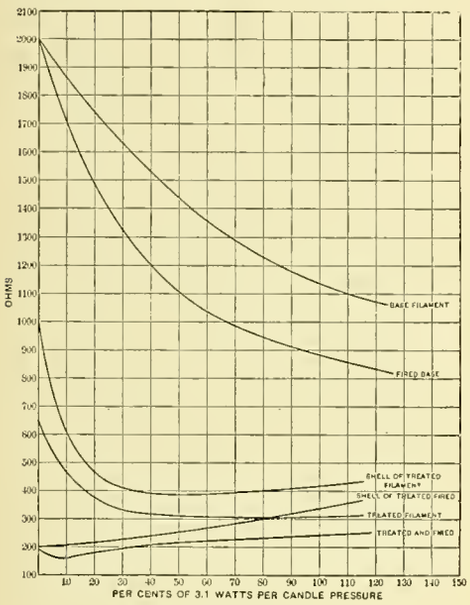


FIG. 1. CURVES OF RESISTANCE AND TEMPERATURE OF VARIOUS FILAMENTS.

well to recall the steps by which the standard filaments are made. A solution of cellulose is squirted through a die into a liquid that hardens the cellulose. The resulting fiber is dried, then shaped into the desired form for the finished filament and heated in a muffle until carbonized. In this process the highest temperature of a gas furnace is employed. The product at this point is called a "base filament." The base filaments are usually separately heated by a current passed through them while they are surrounded by an atmosphere of hydrocarbon vapor, and in this way a coat or shell of graphite is deposited upon them. They are then said to be treated filaments. The best quality of standard carbon incandescent lamps of today owe their superiority to the use of treated filaments.

In attempting to graphitize carbon filaments it was discovered that treated filaments undergo very remarkable changes when subjected to the highest possible temperature of an electric-resistance furnace. The furnace consisted of a carbon tube, held at the ends by large water-cooled copper clamps: the tube was imbedded in powdered carbon to prevent its combustion. The filaments were packed in small, cylindrical carbon boxes, which were fed into the heated tube. The temperature was usually between 3,000 and 3,700° C.

Under such firing the ordinary treated filament changes in appearance; its graphite coating looks as though it had been melted, and its specific resistance is greatly reduced. The resistance of one of these filaments, measured at ordinary temperature, may be reduced as much as 80 per cent. by the firing.

The curves representing the resistance at different temperatures are also remarkable. Fig. 1 shows curves of resistance and temperature of a regular base filament, a base filament fired, a regular treated filament, a treated filament fired, a shell of regular treated filament and a fired shell.

The resistance in ohms is plotted against the temperature, as indicated by the percentage relation of the pressure on the filament to the normal pressure at which the filament has an efficiency of 3.1 watts per candle.

The curves show a more rapid fall in resistance of the base filament after firing, but little change in the character of the curve.

The change produced in the treated shell by firing

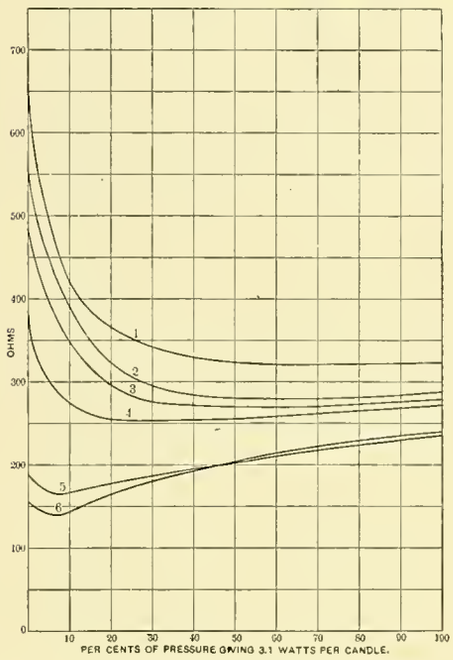


FIG. 2. ACTUAL RESISTANCES OF FILAMENTS FIRED AT DIFFERENT TEMPERATURES.

is very great, the cold resistance being reduced from 1,000 to 200 ohms, while the great change in the character of the curve of the fired shell brings the hot resistance of the two shells nearly together.

The resistance curve of a fired treated filament depends upon the relative thicknesses of base and coating and upon the temperature of firing. Figs. 2 and 3 show curves of filaments fired at five different temperatures and of a similar filament that has not been fired. In Fig. 3 the resistances are shown in percentages of the cold resistances, and in Fig. 2 the actual resistances are shown.

These filaments were heated in the carbon-tube resistance furnace. They were enclosed in a cylindrical carbon box, placed inside the tube, one end of which was left open for observation. An indication of the temperature was obtained by looking directly into the open end of the tube at the box

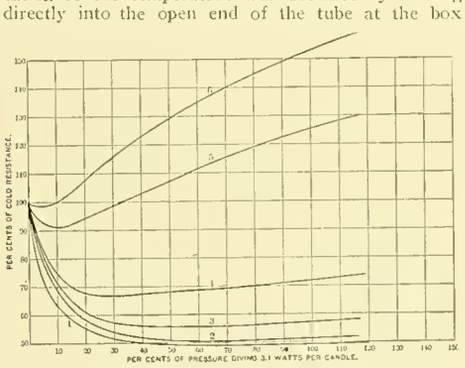


FIG. 3. RESISTANCES SHOWN IN PERCENTAGES OF COLD RESISTANCES.

holding the filaments, and holding in the line of vision the filament of an ordinary 50-volt lamp, the temperature of which was adjusted until the filament became invisible against the incandescent-carbon box. The pressure on the lamp was then observed, and the box of filaments taken out.

Curve No. 1 is the resistance curve of a regular treated filament.

Curve No. 2 is the curve of a similar filament heated in the tube to a temperature corresponding to the temperature of a carbon filament operating at 153 per cent. of its normal pressure, or at 125 candles for a normally 16-candlepower lamp.

Curve No. 3 is the curve of a filament fired at a temperature corresponding to the temperature of a lamp at 161 per cent. of its normal pressure, or at 163 candles.

Curve No. 4. 183 per cent. of normal pressure, or at 230 candles.

Curve No. 5. 200 per cent. of normal pressure, or at 280 candles, for a 16-candlepower lamp.

Curve No. 6 is the curve of a filament heated hotter than No. 5. The temperature was not measured by this method for fear of breaking the comparison lamp.

An attempt was made to measure the temperatures by means of an optical pyrometer (Wanner) which indicated temperatures up to 3,700° C. at the highest heats.

Fig. 4 shows the resistance curve of a filament made from a thin base having quite a thick treatment: this shows a resistance increasing to 250 per cent. of its cold resistance.

The change in the resistance curve of this coating from negative to positive seems to be due, in part at least, to the action upon the shell of some substance driven out of the base filament by the high temperature. This is indicated by the considerable change in the curve of a treated fired filament produced by heating the base filament to the same high temperature before it was treated and then reheated.

Fig. 5 shows resistance curves of carbons fired at the same temperature after treating, but with the base fired at different temperatures before treating. The base filament in Curve A was unfired; in B, C, D and E the base was fired at successively higher temperatures.

It will be observed that the curves made from filaments, the bases of which have been heated to high temperatures before being treated, are much less positive than the others. The conclusion that the effect is produced by material being driven out of the base seems to be borne out by the fact that during the preliminary heating of the base at high temperatures it loses practically all of its mineral-ash constituents, and also by the fact that, if some of the elements that the base loses in its high heating be separately placed in the furnace with the

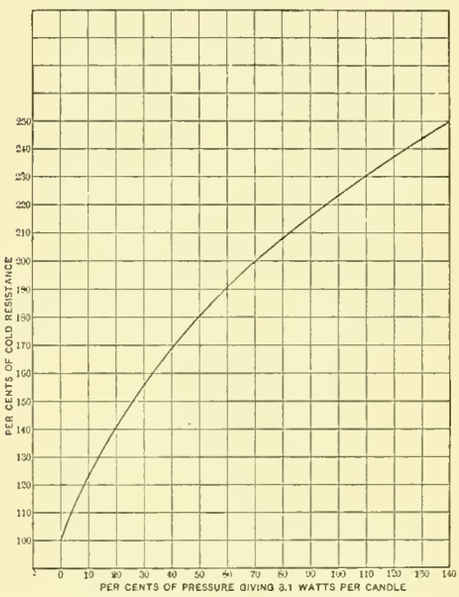


FIG. 4. RESISTANCE CURVE OF THIN-BASE FILAMENT.

treated filaments, effects are produced similar to those observed when the base has not been previously heated.

The effect of some agency besides heat is also indicated by the fact that the lamp filament used in the temperature observations, although maintained at the same temperature as the filaments in the furnace, and for a sufficiently long time showed no indications of such a change as was produced in the filaments in the furnace.

The appearance of a filament fired both before and after treating is very different from that of one fired after treating only. The former has a

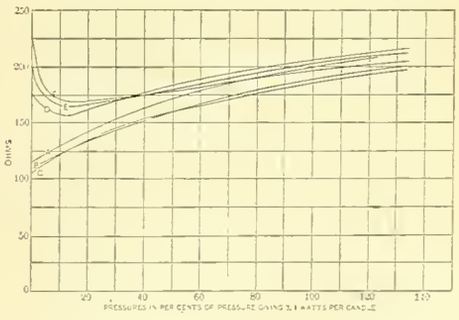


FIG. 5. RESISTANCE CURVES OF CARBONS.

slightly pebbled appearance, as seen through a microscope, and a rather dull-gray color.

The single-fired treated filament is generally very much blistered, many blisters extending outward a distance greater than the diameter of the filament. These blisters indicate an outflow of gas from the base when the shell was in a soft condition. The surface of the filaments is highly lustrous.

The specific resistance of the highly heated coating has been found to be as low as 0.00006 ohm

1. A paper presented to the American Institute of Electrical Engineers at Asheville, N. C., June 22, 1905. Mr. Howell is an engineer of the General Electric Company.

per cubic centimeter, which is very much lower than the specific resistance of any other known form of carbon or graphite.

Its specific gravity is also much higher than it was before heating.

Its changed nature is also indicated by its toughness and flexibility. The coating of a double-fired filament may be pulled off in short tubular sections, which, if pressed flat, will spring back to their original form when the pressure is removed. The same coating before being fired is comparatively brittle, and will break with very little pressure. On account of the positive-resistance curve and physical characteristics of these filaments, they have been given the name "metallized filaments."

The treated coating on filaments even before firing, is graphite, as determined by the chemical test established by Berthelot—the production of graphite acid (a yellow insoluble substance) when treated with a mixture of anhydrous nitric acid and potassium chlorate. Ordinary carbon is dissolved by these reagents. The coating on the treated filament has also the greasy feeling of graphite, and gives the characteristic mark of graphite on white paper.

After being heated to high temperatures in the electric-resistance furnace, these characteristics continue and the chemical action is much more marked.

Metallized filaments blacken the lamp bulb very much less than ordinary filaments. This may be due to the removal from the former of practically all the mineral ash and other impurities, or it may be due to the changed character of the carbon itself.

Bamboo, coated by dipping in a solution of asphalt, is altered by firing, the coating changing to graphite and giving the characteristic positive curve. Silk, dipped in a sugar solution, also gives the same result.

The base of a metallized filament, from which the treated coating has been removed, when mounted in a lamp has been found to give the resistance curve of a fired base. Pieces of the coating, about 1.5 inches long, mounted in lamps, have been found to give the strongly positive resistance curve that is characteristic of the metallized filament. These observations show that the change is practicallly all in the treated coating and not in the base.

Metallized filaments, as above described, are much more stable at high temperatures than ordinary carfilaments. The most effective carbon-filament lamp now in general use operates at 3.1 watts per candle, and under accurate test conditions gives a useful life (to 80 per cent. of its initial candlepower) of about 500 hours. At the present time metallized filaments that give the same useful life at about 2.5 watts per candle are being produced with a fair degree of uniformity.

OBITUARY.

T. C. Wales, Jr.

Thomas C. Wales, Jr., chief electrical engineer of the New England Telephone and Telegraph Company, who was brought from Rutland, Vt., recently on a special train to be operated on for appendicitis, died at the Boothby Hospital in Boston a few days later. Mr. Wales was active among controlling men in the telegraph and telephone affairs of the United States. Although but 35 years old, he had achieved an unusual degree of success. About 15 years ago, shortly after his graduation from the electrical engineering department of the Massachusetts Institute of Technology, he became associated with the central headquarters of the American Bell Telephone Company in Boston, and during the succeeding 10 years filled many responsible positions. A little more than three years ago he became associated with the New England company and had general supervision of its exchange business. Less than a year ago he was made chief engineer. He had much to do with the development of the modern central-energy switchboard.

Charles F. Hutton.

Charles F. Hutton of Ennis, Mont., died at Niagara Falls, N. Y., on the evening of Tuesday, July 4th, of Landry's disease, a form of paralysis. The death of Mr. Hutton has shocked electrical and engineering circles of Niagara because of the popularity of the young man and the manner of his death. Mr. Hutton was 22 years old, and before going to Niagara was in the employment of the Telluride Power Company of Utah, of which L. L. Nunn is general manager. When the Nunns received the contract for the Ontario Power Company at Niagara, Mr. Nunn selected Mr. Hutton as one of the engineers to go to Niagara, where he had been since February, 1904. While living at Niagara Falls Mr. Hutton kept in good health until the latter part of June, when he complained of his feet troubling him. It was not felt that the trouble was serious until he was sent to the Memorial Hospital on June 29th. Dr. E. J. Fuller, a New York specialist, was summoned to the Falls to attend him, but found he could do nothing, pronouncing the disease incurable. Mr. Hutton died as stated above. He graduated from the Montana State College in 1902 with honors, being the youngest graduate ever turned out by that institution. The body was sent to Montana for burial.

Central Railway System in Havana, Cuba.

Mention was made in the Western Electrician of June 17th of the Havana (Cuba) Central Railway Company, recently organized. The following outlines of this company's extensive railway building about Havana will be of interest. The company has placed orders with the foreign department of the General Electric Company for complete electrical equipment of a network of interurban electric-railway lines radiating from Havana and covering considerable territory inland.

The system will consist of a central power house in Havana and eight outside sub-stations together with line material for about 125 miles of trackage and rolling stock for passenger and freight service over the entire system. The power house in Havana will furnish 5,000 kilowatts of 19,000 volts, 25-two 2,000-kilowatt generators and one 1,000-kilowatt Curtis turbo-generator at 2,200 colts, stepped up through air-blast transformers to line voltage. The transmission lines will parallel the various lines of the railway to the sub-stations, where step-down transformers will supply low voltage to rotary converters furnishing 600-volt direct current to trolley lines and feeders.

From Havana one branch will run southeast through Cuatro Caminos, Lomas de Candela, Guines, Providencia to Rosario, a distance of about 40 miles. Sub-stations will be located at Cuatro Caminos, Lomas de Candela and Providencia. A second line will run from Havana 17 miles south to Bejucal with a sub-station on the line at Santiago de las Vegas. A third line running southwest from Havana to Mariel will have a length of 37 miles and branch lines running north and south to El Carmelo, Santiago de las Vegas and Tuira de Malena, amounting to about 30 miles in addition. Sub-stations on the line to Mariel will be placed at Marianao, Hoyo Colorado and Guanajay and at San Antonio Melena.

The rolling stock for passenger service will consist of 24 30-ton cars seating 50 passengers and equipped with four G. E. 74 motors geared for a maximum speed of 40 miles per hour. The freight service will be handled by 10 40-ton General Electric locomotives equipped with four G. E. 55 motors geared for a speed of 17 miles per hour when hauling a 300-ton train.

One particularly interesting feature is that the entire system will have double overhead trolley, both in Havana and on the interurban lines. The high-potential transmission lines will be designed for future potential of 30,000 volts to provide for extensions. The transformers in the Havana power house and in the sub-stations are also suitable for use on the increased potential. It is expected that the system will be in operation inside of 18 months and that portions of it will be giving service before that time.

The New Beck Arc Lamp.

A new arc lamp has been invented by Heinrich Beck of Meiningen, Germany, and will be introduced in this country by Eli Tecter of New York. The lamp was shown to a representative of the Western Electrician, though considerable secrecy is maintained concerning the details of its mechanism, pending the completion of the patents.

The Beck lamp is ingenious in several ways. The most striking point is in the fact that the carbons are arranged side by side at a slight angle, and the arc, which is gaseous, throws the whole illumination downward, from the under side of a small but specially designed reflector. It is asserted that the lamp gives 3,200 candlepower at a downward angle of 90 degrees, and a hemispherical illumination of 2,000 candlepower. When seen in operation the lamp was taking only 7½ amperes at 44 volts, but the inventor allows one ampere and one volt more.

The mechanism is extremely simple. When not burning, the tips of the carbon rods touch each other at the lower ends, but when the current is applied a solenoid operates a counter weight and separates them. An adjusting screw maintains the tips at the proper distance apart. The positive carbon is of slightly larger diameter than the negative. When the arc is burning, a good deal of flame is seen, and there is some slight spluttering and falling of fused carbon, but this does not interfere with the steadiness of the light. In size and weight the lamp is much smaller than arc lamps of a similar illuminating power, but it is slightly longer from top to bottom. Exhaustive tests by Professor Wedding of Berlin show that the lamp will give eight candlepower per watt.

10,000-horsepower Steam Turbines.

Two new steam-turbine sets of 10,000 horsepower each are being installed at the Rhenish Westphalian power station. They are the largest in Europe. They are of the Parsons two-bearing type. Each unit comprises a turbine running at 1,000 revolutions per minute, an alternating-current generator having a capacity of 5,000 kilowatts at 5,000 volts and 50 cycles per second, and a direct-current generator of 1,500 kilowatts, giving 600 volts. The turbines are operated from a central steam plant. Each set is 20 meters in length and weighs 190 tons, of which 9.4 meters and 107 tons apply to the turbine. The maximum height of the turbine above the floor is 2.6 meters and the maximum breadth is the same.

Municipal Electrical Association of Great Britain.

The tenth annual convention of the Incorporated Municipal Electrical Association was held at Edinburgh, Scotland, on June 27th to 30th. The association was welcomed by the Lord Provost of Edinburgh (Sir Robert Cranston). The president of the association, Mr. F. A. Newington, then gave his address, in the course of which he remarked: "One of the aims of a municipal electrical undertaking is to utilize the machinery during the daytime as much as possible, and therefore electricity for power or heating purposes is sold at a low rate. But there is a weak point in this arrangement. The motors are used during the time of maximum lighting load during the winter months, and, therefore, additional machinery must be provided for them."

During the session a number of papers were read, which were well discussed by the members. The papers are as follows: "Load Factor—its Effect upon an Electricity Station," by Alexander Sinclair, chairman of the electric-lighting and tramways committee of Swansea; "Street Lighting," by E. E. Hoadley, chief electrical engineer of the city of Maidstone; "Notes on Costs and Tariffs for Electric Supply," by Hamilton Kilgour, chief electrical engineer of the city of Cheltenham; "The Supply of Electricity in Industrial Areas from a Municipal Point of View," by William Hodgson, deputy chairman of the Salford corporation electricity supply committee; "Extensions to Outlying Areas," by A. B. Mountain, chief electrical engineer of the city of Hudderfield, and "Electricity Supply by Free Wiring and Prepayment Meters," by Alfred R. Sillar, chief electrical engineer of the city of Colchester. There was also the annual report of the electrical inspector of factories and workshops, made this year by Mr. G. Scott Ram.

Mr. Vanderbilt Inspecting Electric Railways.

William K. Vanderbilt, Jr., representing the trolley interests of the Vanderbilt family, made an inspection of two electric-railway systems in Northern Ohio and one in Michigan last week. The object of Mr. Vanderbilt was to learn all he could of the manner in which trolley systems in that section are constructed and managed. He said that people of Cleveland and the West had been building interurban systems longer than they had in the East and had solved many of the problems that confront the builders. Horace Andrews of Cleveland and Mr. Vanderbilt are both interested in the Andrews-Vanderbilt syndicate, which owns most of the interurban lines in Central New York.

It has been rumored that Mr. Vanderbilt is contemplating the purchase of electric lines paralleling the Michigan Central and Lake Shore. Mr. Vanderbilt was the guest of H. A. Everett in his private electric car Josephine on a recent inspection trip, and is said to have been favorably impressed with what he saw. It is known that the electric lines between Detroit and Cleveland comprised by the Lake Shore electric between Cleveland and Toledo, and the Detroit, Monroe and Toledo, between Toledo and Detroit, have cut into the earnings of the Lake Shore and Michigan Central steam railroads, which are paralleled by them, and this is given as the reason for the purchase of these lines.

British Pacific Cable Conference.

Under date of June 28th the London correspondent of the Western Electrician writes as follows: "The conference of the various British colonies contributing to the all-British Pacific cable, which has been postponed several times, owing to the inability of the delegates to meet together, was held in London last week. Unfortunately it is impossible to give any accurate details of the conference, as it is being held with closed doors, but the idea first emanated from the fact that the working of the cable is resulting in a large deficit, and while this may be the main object of the conference, other matters are being incidentally considered. One of the most important 'incidentals' is the question of the preference which is being given by the South Australian to the cable company which is competing with the Pacific Cable Board. It is alleged that special landing and collecting facilities are being given so that the company can offer inducements in soliciting business which the Pacific Cable Board cannot."

City water tunnels in the down-town district of Chicago are to be rebuilt and placed deep enough to avoid interference with foundations in the construction of new buildings. An appropriation of $400,000 has been authorized by the council for the reconstruction work and bids are about to be asked.

Automatic Synchronizing of Generators and Rotaries.[1]

By Paul MacGahan.

The tendency in central-station development is to eliminate as much as possible the personal element in operation; to introduce labor-saving devices, reducing the cost of operation, and automatic apparatus of every description to minimize the amount of attendance required, so as to prevent errors and accidents, and to insure continuous operation.

The synchronizing of generators or rotaries has been the stumbling block in most installations; for a good many years the incandescent-lamp method was the only one successfully employed to indicate when the machines were ready to couple. If the lamps were connected across the main switch to similar phases, the voltage across their terminals would be a minimum when the machines were in phase, and a maximum when in opposition, thus indicating by their dark period the proper instant for throwing the switch in, and by their flickering or pulsation the amount the incoming machine differed in frequency from the bus bars. When the lamps were cross-connected, they would indicate the proper instant when at their maximum brilliancy. Much was left to the judgment of the operator, for the lamp did not indicate whether the incoming machine was too fast or too slow, the illumination was a function of the voltage as well as the phase, and, moreover, the darkness of the lamps embraced a very large angle of phase difference. It was necessary to estimate half the time of the dark period, and this was difficult to do, as incandescent lamps have a period of their own, requiring an appreciable time to heat up and cool off. Many will remember the time, and the careful, patient manipulation required to synchronize by means of lamps.

The first improvement in methods of synchronizing was the introduction of the "synchroscope," an instrument that rotated a pointer in synchronism with the difference in speeds of the machines; this instrument has the widest general application today, for it gives perfect indications of the phase relation between the machines at any instant, and whether the machine coming in is too slow or too fast. It does not, however, make an allowance for the time required to close the coupling switch.

The electrically operated switches generally used for high-tension work, and sometimes even for low-tension work, require a certain definite time to close after the closing current is established. This time varies for different kinds of switches, and the operator has to make an allowance for it in synchronizing, and must close the tripping contact in advance of the actual instant of coincidence of phase, to connect the machines in a safe and satisfactory manner. Moreover, he has to take into consideration the speed at which the synchroscope pointer is approaching the zero point, and to make a greater angular allowance on the dial, when the speed is greater. He has to judge what difference in speed gives a safe coupling, and, as a usual rule, will wait until he gets the pointer practically stationary before throwing the switch in. Given a variable speed, or sudden surges in the power, in addition to the above variable elements, the operator has to contend with a combination of circumstances that prevent the synchronization being made quickly, and which require a man of judgment to control properly.

Thus it will be seen that if a device could be designed that would automatically respond to the above variables, and close the circuit at the proper instant in a safe and positive manner, the skilled operator could be dispensed with, and the coupling could be done in much less time.

There have been many attempts in the past to devise a satisfactory automatic synchronizer, but none of them heretofore have been successful, as the apparatus did not fulfill all of the above conditions.

One of the best known of the early attempts at automatic synchronizing was the Pearson synchronizer. This device consisted of two controlling magnets mounted in the same case, each magnet serving to close a contact. The two contacts were connected in series with the closing coil of an electrically operated switch, the magnet coils being connected in parallel, and connected to the incoming machine and bus bars in the same manner as incadescent lamps are connected in synchronizing. One of the magnets was provided with a movable iron core, retarded in its motion by a dash-pot, thus requiring an appreciable length of time to make contact, and operated to select a wave, or "dark period" of the lamps of sufficient length to give the main switch time to act and still render coupling safe. The other magnet had a free, or instantaneous, action, adjusted to close its contact only when the voltage across the synchronizer coils corresponded to a coincidence of the phases. Thus in action, the magnet with the time element would close its contact when the difference in speed was small enough, and the other magnet would complete the switch-closing circuit when the machines were in exact synchronism.

1. Abstract of a paper read before the Denver-Colorado Springs convention of the National Electric Light Association June 6, 1905. Mr. MacGahan is an electrical engineer of the Westinghouse Electric and Manufacturing Company.

It will be seen from the above description that the device makes no allowance whatever for the length of time required by the switch to act; it is true that the quick-acting contact may be adjusted to operate at a voltage corresponding to a slight difference in phase, so as to make contact ahead of time, but this would mean that it could make contact the same length of time too late; if the speed suddenly changes after the slow solenoid has closed its contact, there is danger of the second contact closing. Besides, the angular advance of the contact would not vary with differences in speeds, thus coupling the machines at too early a period when they approximated in frequency, and too late when they differed considerably, for the switch requires a constant time to close. These defects alone were sufficient to cause accidents in operation, except under particularly favorable circumstances, and thus rendered the device commercially a failure. However, the inventor deserves great credit for taking the first step in automatic synchronization, and pointing out the advantages that would accrue with a device that would infallibly do the work.

The latest development in automatic synchronizing is a new device perfected very recently by the Westinghouse Electric and Manufacturing Company. It differs entirely in its operation from the Pearson synchronizer, which was described quite fully, so as to accentuate the features necessary for a successful synchronizer, as well as to throw a light on early progress. This new synchronizer consists of a pair of solenoids, each actuating a laminated iron core, supported from opposite ends of a rocker arm. Each solenoid is wound in eight separate sections, alternate sections being connected in series, thus forming two circuits in each solenoid; one circuit of each solenoid is connected in series with a circuit of the other solenoid, thus forming two independent circuits in the instrument, each circuit having half of its turns on each solenoid. One circuit is connected to a pair of binding posts deriving current from the bus bars, and the other circuit to binding posts connected to the incoming machine. The connections of the various sections are so made that when the incoming machine is in phase with the bus bars, the currents in the right-hand solenoid act in conjunction, thus pulling down the core, and the currents in the left-hand solenoid neutralize or cancel each other magnetically, and produce no pull. On the other hand, when the machine is in opposition to the bus bars, the currents in the right-hand solenoid neutralize, and the left-hand solenoid exerts a pull, its currents acting in conjunction.

The cores are suspended so as to reach the magnetic neutral of the coils at their extreme down stroke; thus, when the machines differ in speed, the horizontal beam rocks to and fro, with a harmonic motion. As the incoming machine approaches the frequency of the bus bars, the motion becomes slower, and finally ceases when the machines are at the same frequency; if the machines are in phase, the right-hand core will stop at its lowest position, unless the voltages differ considerably, when the currents will not neutralize, and the core will not be able to reach its extreme stroke. The left end of the rocker arm carries a contact spring, marked (a) in Fig. 1, which slides along the top of a fiber segment (b). This segment has a platinum strip (c) on the top, which, in conjunction with the stationary spring (d), forms the contacts of the relay circuit. The springs and contact are of such length that, when the segment is stationary, contact can only be made when the right-hand core has reached its extreme position.

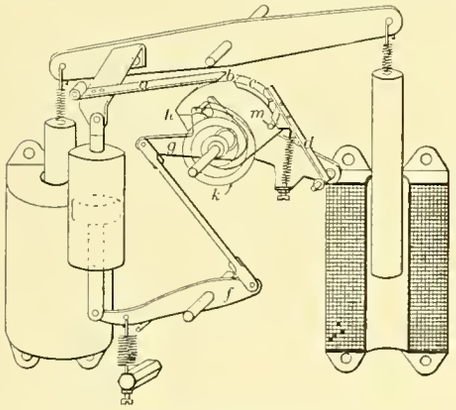


FIG. 1. CONTACT MECHANISM OF AUTOMATIC SYNCHRONIZER.

The vital characteristic of this instrument—the one that makes it successfully cover the requirements given for automatic synchronizing not heretofore met is the peculiar motion imparted to the contact segment. Instead of being stationary, it is pivoted on a shaft concentric with the rocker-arm shaft, which latter on its left half carries the chamber of a dash-pot, the motion of whose piston is opposed by a spiral spring, in the manner shown in Fig. 1.

When the left end of the rocker arm rises, it tends to lift the piston of the dash-pot, and elongate the spring (e). Upon the return stroke a valve in the dash-pot opens, allowing a quick return motion.

The piston rod of the dash-pot carries an arm (f), which is so attached to the contact segment as to shift the latter to the left, thus advancing the position of the contact when the rocker arm moves up with a sufficient speed to draw up the dash-pot piston. The slower the motion of the rocker arm, the less the piston of the dash-pot is raised, and consequently, the less the contact segment is advanced.

It will be noted that the arm (f) does not act directly on the segment, but operates a brass fork (g), between the prongs of which is a pin (h), which is screwed into the contact segment. There is a spiral spring (k) between the contact segment

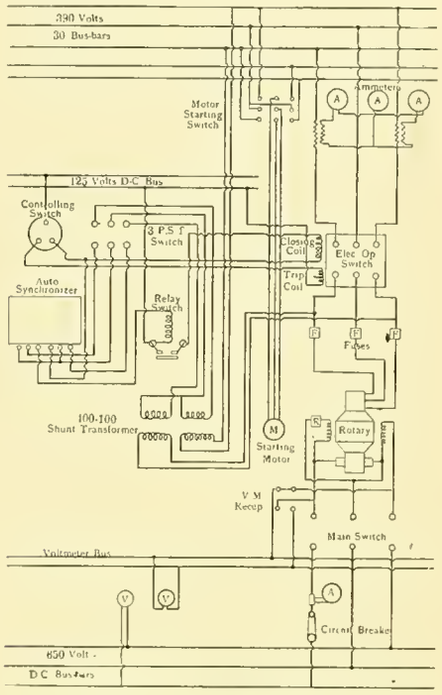


FIG. 2. CONNECTIONS OF ROTARY CONVERTER EQUIPPED WITH AUTOMATIC SYNCHRONIZER.

and the fork which tends to keep the pin against the right prong of the fork. The pin has thus about one-eighth of an inch of play, the purpose of which will be apparent later.

Turning our attention to the right-hand, or stationary, contact spring, it is seen that this spring carries a cam (l), the inclined edge of which is met by the pin (m) upon the return stroke of the contact segment. This stationary contact spring is of such strength that the pin (m) cannot raise the inclined edge of the cam, for the contact segment is being actuated through the weaker spring (k). Thus, upon its return stroke, the contact segment is delayed for an instant, until the left prong of the fork (g) touches the pin (h), and thus forces up the cam. As soon as the pin (m) reaches the end of the inclined plane, the contact segment is free, and is snapped over by the spring (k). The position of the stationary or right-hand contact spring can be varied. This, in conjunction with the adjustment of the spring (e), is for the purpose of adjusting the difference in speed of the incoming machine at which the synchronizer will couple. Thus, when the difference in speed is too great to allow safe coupling, the dash-pot piston will advance the contact segment sufficiently to drop the stationary spring away from the contact plate and down upon the insulated portion of the contact segment (n), thus preventing the contact from being closed when the right-hand core comes down. The retarded motion of the contact segment prevents contact being made as the right-hand core rises, allowing time for the left contact spring (a) to get out of the way.

As the voltage of the incoming machine builds up and it approaches the approximate frequency of the bus bars, the rocker arm oscillates violently, the dash-pot piston advancing the contact segment so far that no contact is possible, no contact being possible on the return stroke. As the speed of the incoming machine increases, the rocking becomes slower, and the dash-pot piston advances the contact segment less, until finally the right contact spring no longer drops away from the contact, and as the right-hand core descends the left-hand contact spring advances to meet the contact, thus energizing the auxiliary relay which operates the switch-closing circuit just sufficiently ahead of the point of coincidence of the phases, so that actual coupling takes place at the exact instant of synchronism. If the machine approaches the point of synchronism more slowly, there is less advance of the contact segment, and the actual time allowed for the switch to act is the same as before. In

the extreme condition, when the machine is coming in very slowly, there is no appreciable advance of the contact segment, the dash-pot having time to exhaust. The amount of the advance of the segment can be adjusted to suit switches having different times of closing, by varying the tension of the spring (e).

Fig. 2 is a complete wiring diagram of a rotary transformer equipped with the automatic synchronizer; by means of proper synchronizing plugs such as are used for either the lamp method, or the indicating synchroscope, one automatic synchronizer can take care of any number of machines.

New Storage-battery Cell without Lead.

An interesting account of a new storage-battery cell which does not make use of lead in the electrodes is given by Dr. Grefenberg at a recent meeting of the German Bunsen Society at Carlsruhe. The positive electrode is formed of black nickel hydrate, obtained by chemical oxidation of the lower nickel hydrate formed at the anode in an electrolytic cell. The negative electrode is formed of iron powder, obtained by reducing ordinary forge scales of iron oxide by hydrogen gas at 380° C. The nickel oxide is then mixed with 40 per cent. graphite, and the pulverized iron with 10 per cent. of the same, this graphite being covered with a coating of electro-deposited nickel before use.

The materials are then pressed into briquettes, and these are enclosed in small capsules of thin nickel sheet, and again submitted to pressure. Ten of these charged capsules are joined together to form the positive and negative plates of the cell. The author exhibited such a cell, containing six pairs of plates, enclosed in a box of sheet steel, this box being pressed out of one sheet, and, therefore, without joints. The total weight of this cell was three kilograms, made up as follows: Active materials of the cell, 900 grams; metal capsules and supports, 750 grams; electrolyte, 625 grams; steel box, etc., 725 grams; total, 3,000 grams.

The electrolyte used is a 20 per cent. solution of potassium hydrate. Under normal conditions of four hours' discharge the cell yields 35 to 40 ampere-hours, with a mean electromotive force of 1.23 volts, representing 16 to 18 watt-hours per kilogram of total weight.

The capacity of the cell diminishes only slightly with increasing current densities, so that it is especially adapted for use on a large scale. By quick discharge after charging, the current efficiency of the cell is 95 per cent. and the energy efficiency 65 per cent. Twenty-four hours after charging, the corresponding figures are 63 per cent. and 42 per cent., respectively. This difference arises from the gas production and self-discharge which occurs on standing, due to decomposition of the water in the cell. The iron electrodes are acted upon by air, so that transport of the cell is not effected without difficulty. The reduced iron electrode burns in air, while the oxidized electrode oxidizes further to the higher oxide, and this oxide is very troublesome to again reduce to the metallic state. On the other hand, the new form of secondary cell stands rough usage well, and short-circuiting does not even harm it. After 100 discharges the cell loses only 12 per cent. of its original capacity; after 200 this loss has risen to 17 per cent. The cause of this depreciation is not yet explained.

The Edison Medal.

At a recent meeting of the Edison medal committee of the American Institute of Electrical Engineers the first question of importance to be considered was the award of the medal for the year 1904. It was decided, in view of the great difficulty involved, and the late period at which the committee organized, that it was impracticable to award the medal for the year of 1904. A sub-committee appointed to carry on correspondence with the various institutions of learning that might wish to compete for the medal sent to each of the institutions which it considered eligible, to the number of 137, a letter and a copy of the by-laws. From the 137 only five answers were received. The only explanation of this was that the colleges did not think that a reply was necessary until such time as a student was entered for the competition. The chairman of the Edison medal committee is Mr. John W. Howell of Harrison, N. J.

Five Ships in Wireless Converse.

An unusual space-telegraph conversation in mid-ocean was reported by the French liner La Savoie, which reached port at New York from Havre a few days ago. Five ships participated in the reported conversation—La Savoie, La Lorraine, the Lucania, the Celtic and the St. Louis. Two of the liners—La Lorraine and the Celtic—were eastbound. The other three were going west. The talk lasted 12 hours. La Savoie, at the western end of the line, began talking when it picked up the Lucania, which was following it into port. The Lucania in turn caught a signal from the St. Louis, while the St. Louis made the connection with the Celtic. The Celtic connected with the easternmost ship, La Lorraine. The distance between La Savoie and La Lorraine was about 500 miles.

Ohio Telephone Notes.

In passing upon the case of Farmer & Getz and the city of Salem against the Columbiana Telephone Company, in which the authority of the company to advance its rates over those agreed upon in the franchise was tested the Supreme Court says that telephone companies organized in Ohio obtain their power to construct their lines along the streets and public ways of municipal corporations from the state and not from the municipal authorities. The latter have the power to agree with such companies as to the mode of use and upon compensation for such use, but not beyond what may be necessary to restore the streets to former state of usefulness. They have not power to exact or receive compensation by way of free-telephone service for themselves or for citizens, or to fix rates for telephone charges.

The Morrow County Telephone Company has changed its policy of making extensions and improvements because of the great demand for service. Heretofore the extensions have been built from the profits on the business after the expenses were paid. A few days ago the authorized capital stock was increased from $30,000 to $150,000, and such portion of this will be sold as required to make the extensions.

Twelve men have been put to work connecting the new automatic telephone instruments at Columbus and several hundred telephones will be put into operation at once. It is thought that all will be connected up with the new switchboard in a short time.

The Cleveland Telephone Company now has 250 branch exchanges in operation, having increased the number something like 100 in a little over a year. These exchanges have 3,800 stations.

The following members have been added to the board of directors of the Cuyahoga Telephone Company: J. S. Brailey, Jr., Jay K. Secor and W. F. Robinson of Toledo, and J. B. Hoge of Cleveland.

The City and Suburban Telephone Company of Cincinnati installed its first street-telephone box a few days ago. These boxes were installed in Cleveland by the Cuyahoga Telephone Company some time ago and have been patronized very well so far, although there is not yet a large number of them.

A temporary injunction has been granted against Sol P. Kineon and the Home Telephone Company to prevent the erection of poles and lines in Newport, Ky. City Attorney James Thornton brought the proceedings, alleging that the company was about to erect poles and string wires without authority and that it would be a difficult matter to secure any revenue from the business for the city if this was allowed. This is a continuation of the fight against Kineon, who is endeavoring to secure an entrance into Cincinnati for his line, which now covers considerable territory in Kentucky.

The Hiram Telephone Company of Hiram has been incorporated with a capital stock of $10,000 by H. C. Hurd, William Dudley and others.

C.

Indiana Telephone Items.

The Home Telephone Company of Noblesville has increased its capital stock from $15,000 to $30,000 for the purpose of extending the line and making other improvements. Thomas Griffin is president and Eli Hawkins secretary.

The mayor and City Council of Greenfield have locked horns with the Morrison Telephone Company over the refusal of the company to disclose the number of the telephone through which a false fire alarm was sent. During the run to answer the call one of the fire horses was permanently injured. When the fire chief requested the number of the telephone responsible the operator declined to give it, saying it was against the rules of the company. The city authorities are determined to compel the company to answer and the matter is likely to get into the courts.

The Central Union Telephone Company recently secured a franchise in Converse, having purchased the right of the Amby Home Telephone Company, and is now installing a new switchboard and other material.

Rumors are current in Lafayette to the effect that the Central Union Telephone Company is trying to arrange for the transfer from the present owners to the Bell system of country telephone systems in Tippecanoe County. By securing possession of a network of lines about Lafayette the Central Union would strengthen its chances to buy the plant of the Lafayette Telephone Company, for which it has made an offer. The Independents refused the offer and made a counter proposition, which, when rejected, was followed by the announcement that the Lafayette company would install an entire new common-battery multiple system. The Central Union is also arranging to build a model new system in Lafayette, although it has less than 1,000 subscribers.

The City Council of Kokomo has refused to modify the franchise under which the Citizens' Telephone Company is operating so as to permit it to enter into an arrangement with the Bell Telephone Company for long-distance service. In this fight the New Long-distance Telephone Company of Indianapolis has seemingly scored a complete victory. It has been putting up a vigorous fight against the Bell's efforts to gain control of the local situation in Kokomo. It is the opinion of some that the Citizens' company can furnish long-distance business to the Bell company for points not reached by the New Long-distance Company's wires, notwithstanding the provision in its franchise that it shall not enter into any arrangement with the Bell under a penalty of forfeiture.

S.

Telephone News from the Northwest.

The local telephone company at Granite Falls, Minn., will build a new exchange.

The New Richland (Minn.) telephone exchange has been sold to Milo Hodgkins of Yankton, S. D., for $4,000.

A new telephone company has been formed at Spooner, Wis., to build to Long Lake and Sarona. George W. Harmon, W. C. Crocker and E. P. Baker are interested.

The Norwood-Young America Telephone Company of Norwood, Minn., has sold its toll lines to the Tri-state Telephone Company, which will install a copper circuit to Minneapolis.

The telephone company at Bismarck, N. D., is arranging for the construction of a toll line from Bismarck to Jamestown, N. D., where connection with the Northwestern Telephone Exchange Company will be made.

The Northern Telephone Company of Bottineau, N. D., will build lines between Kenmare and Bisbee, Minot and Anamoose, Minot and Berthold and elsewhere, a total of 325 miles.

The Hallock (Minn.) Telephone Company will extend its lines to connect with Mattson, Bronson, Lancaster and other points.

The telephone company at Pilot Mound, Iowa, has moved into its new building.

The Nebraska Telephone Company will erect an addition to its present building in Omaha. It is understood that the improvements will amount to $75,000.

W. E. Ege and others have incorporated as the Centerville (S. D.) Rural Telephone Company with a capital of $25,000.

The Farmers' Mutual Telephone Company of Oto, Iowa, has been incorporated with a capitalization of $10,000. John Hilfiker is president and H. P. Simmons secretary.

R.

Telephoning from London to Rome.

At the invitation of the Italian government and with the co-operation of France, the General Post Office of Great Britain has for some time been endeavoring to hold a direct conversation with the head Italian office at Rome. Recently a connection was effected, and officials in London conversed with officials at Rome, across the Dover Straits and half a continent. London is already in direct communication with Paris, and Paris is in communication with Rome via Turin. A junction of the two lines was effected in order to carry out the experiment.

An official of the General Post Office has given information that the conversation with Rome was carried on under the greatest difficulties, and he could hold out no hope that the general subscriber, under the present system would ever be able to ring up his friends in Italy. The experts at the head office were only just able to follow the conversation. The submarine portion of the line which runs between St. Margaret's Bay and Calais is considered to be the chief cause of the non-success of the initial experiments. The longest submarine telephone cable is that which runs to Belgium, starting from Harwich, England.

NEW COMPANIES.

D. G. Adams and associates of Fulton, N. Y., have incorporated the Patrons' Telephone Company, to operate in and around Fulton. The authorized capital is $25,000.

The Coast Line Telephone Company of Jersey City, N. J., with a capital of $1,000,000 has been incorporated by D. A. Reynolds, Eugene H. Brock and Edward P. Clark.

John Eckerd, C. W. Hayes and C. C. Price have incorporated as the Polo Mutual Telephone Company, Polo, Ill., for the purpose of furnishing telephone service. The capital of the company is $5,000.

Among recently incorporated telephone companies are the following-named: Havelock Mutual Telephone Company, Havelock, Iowa; Lone Wolf Telephone Company, Oklahoma City; Lamar and Barton County Telephone Company, Lamar, Mo.; Miller Independent Telephone Company, Miller, Neb.; Mutual Telephone Company, Clay Center, Neb.

The Independent Telephone Company of Syracuse, N. Y., has been organized with a capital of $1,000,000. This company will operate telephone lines around Syracuse and in Onondaga and 16 other counties in Central New York. The directors of record are Jacob Ames of Baldwinsville, A. K. Hiscock and C. M. Warner of Syracuse, and C. F. Lamb of Rochester.

Standard Telephone Operating Rules and Regulations.

At the recent convention of the National-Interstate Telephone Association in Chicago a committee composed of C. E. Tarte, chairman; W. L. Moellering, secretary, and J. P. Boylan, William Handlan, A. L. Tetu and A. B. Conklin, presented an exhaustive report of its work in preparing a set of standard operating rules and regulations for telephone companies. The rules prepared by the committee were not read at the convention, but upon recommendation by the committee a permanent committee was named to consider the report and subsequently call upon a large number of operating companies, large and small, for copies of their operating rules, both local and long-distance, and in this way gain further knowledge for embodyment in a standard set. This committee is to make such changes as suggest themselves and report at the next convention.

The general rules in the 60-page report presented to the Chicago convention are as follows:

"1. Employes shall thoroughly familiarize themselves with the following instructions. Ignorance of these instructions will not be accepted as an excuse for their non-observance.

"2. Employes shall report promptly for duty at the hour designated, and shall not absent themselves from duty without first obtaining permission from their superior officer. If unable to report for duty at the hour assigned, an employe shall report as soon as possible, preferably by telephone, the cause and probable duration of the absence.

"3. Employes shall be courteous in all their dealings with one another, and with the patrons of the company, and shall conduct themselves in a quiet and orderly manner while in the building.

"4. While on duty in the operating room employes shall hold no conversations with one another beyond that necessary in the proper performance of their work.

"5. Employes in the operating room shall speak in low and distinct tones directly into the mouthpiece of the transmitter. The receivers must be retained at the ear continuously while the employes are on duty.

"6. All employes in the operating room, except the chief operator and the assistant operator, are to be assigned personal numbers, by which they will be known in connection with the various records placed on the tickets and in their dealings with the public.

"7. No employe in the operating room other than the chief operator and assistant chief operator shall give her name to any patron. If her name is requested her number should be given.

"8. Employes shall not divulge any information obtained from listening on telephone connections. The attention of employes is called to the fact that the law makes it an offense, punishable by a fine and imprisonment, to violate the secrecy of telephonic communications.

"9. Employes are forbidden to receive from the public written or oral communications for transmission or delivery to others. This does not apply to the repeating of messages or the making of appointments.

"10. Employes are forbidden to use the circuits for connections that are not in the nature of the company's business requiring immediate attention, except when paid for. The use of the circuits for the company's business should be restricted to the smallest possible amount.

"11. Employes shall keep the switchboard apparatus which they use in a neat and orderly condition. Keyboards must be kept free from everything not required for the handling of the service. When inserting or removing a plug the employe shall not pull or push on the cord, but grasp the plug itself. When stamping a ticket on a calculagraph the levers should be handled with care and sudden and jerky movements avoided.

"12. All employes, when ringing on lines, shall be careful to give clear and distinct rings.

"13. All employes shall familiarize themselves with the code and with the signals used in the local offices for indicating "busy," "out of order," etc., where such signals are used.

"14. The force in the operating room shall consist of a chief operator, with assistant chief operators if necessary, supervisors, operators, clerks and office messengers. The chief operator shall report to and be responsible to the manager or superintendent. The supervisors shall report to the chief operator and the different operators, such as recording, line, through, desk, etc., shall report to the supervisor who has charge of that part of the work with which they are associated. The clerks and office messengers will report to the chief operator, but be under the supervision of the different supervisors as they are employed in their divisions."

Instructions to and duties of the various operators and employes are then presented, followed by instructions in the use of tickets. Three forms of tickets are recommended for use—"sent," "received" and "through" tickets. A "sent" or "received" ticket that is used for a night message shall have the word "night" endorsed across its face. Tickets are to be filled out and reported for all calls made in connection with handling the service, except between chief operators and wire chiefs and their subordinates at instruments treated as part of the switchboard. Instruments that are considered to be part of the switchboard are chief operator's, supervisors', deck operators', recording operators', line operators' and wire chief's sets.

A long set of rules for the receiving and handling of calls is recommended. All calls not completed by midnight are to be canceled and considered lost calls for that day's business. The chief operator, on the following morning, shall take out from the previous day's tickets such lost calls as she thinks there is a possibility of reviving and make every effort to complete them. A record should be kept of all lost calls of a previous day's business that on any day are revived and completed.

The rates to be charged on conversations are given in the rate book, and are for an initial period of three minutes, and for each additional minute over the initial period. Day and night rates are given in the rate book. Three and one-fourth minutes are considered the same time as the initial period. Any fraction of a minute more than one-fourth will be charged as an additional minute. Recommendations for charging in cases where messengers are required are given, with many other details coming under this head.

Among the other subjects treated in the report are such as symbols, service complaints, fire drills, emergency lights, testing of cords, team work among operators, and many others.

The committee said that in compiling the rules it considered a large exchange with a complete organization, and suggested that small exchanges having only a chief operator, or possibly a combined chief operator and toll operator, would be able to use the suggestions offered by compiling from them a different set of rules applicable to local conditions. The report says that while the rules are drafted to cover a common-battery exchange with lamp supervision, they will with few changes be applicable to a magneto system having no supervision.

Telephones for the Philippine Islands.

The Philippine commission has passed an act granting to John f. Sabin and Louis Glass of San Francisco, Cal., a franchise to construct telephone and telegraph systems throughout the Philippine Islands. Mr. Sabin is the president and Mr. Glass vice-president and general manager of the Pacific States Telephone and Telegraph Company, the head offices of which are located in San Francisco. Mr. Sabin was formerly president of the Chicago Telephone Company and the Central Union Telephone Company.

GENERAL TELEPHONE NEWS.

The Vaquina Bay Mutual Telephone Improvement Company of Newport, Ore., has been granted a franchise to build and operate a telephone system in Newport.

D. A. Mann has resigned as manager of the Mutual Telephone Company at Grundy Center, Iowa, and has accepted a similar position with the Cedar Valley Company at Clarksville.

The Southern Nevada Telephone and Telegraph Company is preparing to erect a three-story stone and brick building at Goldfield, Nev., to be used as the telephone exchange and for office purposes.

The New York and New Jersey Telephone Company has just installed at the Brooklyn "main" office two new distributing switchboards for facilitating its growing suburban and Long Island traffic.

A special meeting of the stockholders of the Home Telephone and Telegraph Company of Los Angeles, Cal., has been called for August 29th to consider increasing the capital stock of the company from $3,000,000 to $6,000,000.

A meeting of the Indiana Mutual Telephone Association was called by President Theodore Thorward of South Bend to meet at the Winona Assembly grounds at Warsaw on Wednesday of this week. The meeting was called to deal with the present situation in Indiana as brought about by the recent securing by the Bell company of controlling interests in several local Independent exchanges in different parts of the state.

The Cunard liner Lucania, arriving at New York on July 8th, was found to be fitted for the first time with a new kind of telephonic signaling apparatus by means of which during a dense fog off the coast she was able to make her way by picking up the bell signals from Nantucket, Fire Island and Sandy Hook. This apparatus, which is the invention of J. B. Millet of Boston, Mass., consists of micro-telephonic receivers attached to the bow of the ship 20 feet below the water line.

By a vote of 105 to 99 the bill in the Connecticut Legislature to admit Independent telephone companies to do business in that state was rejected in the House after much discussion. The House then took up a bill providing for a commission of two senators and four representatives to be appointed by the General Assembly to investigate the conduct and operation of telephone companies now doing business in the state and to report to the next General Assembly.

CORRESPONDENCE.

Great Britain.

London, June 28.—The views of the local authorities owning telephone services are now being heard in relation to the agreement between the postmaster-general and the National Telephone Company for the acquisition by the former of the business of the latter. There is a fear lurking in the minds of the telephone municipalists that the company will in some way evade the terms of the agreement by claiming to have the right to work, after 1911, the date of the acquisition, in those districts where its license has been extended beyond that date in view of municipal competition. It is therefore being asked that the company shall, under specific terms in the agreement, be absolutely wiped out of existence altogether. Another grievance of the municipal telephone authorities is that, apparently under the agreement as it stands, it is the intention of the postmaster-general to acquire and work all the local telephone systems, i. e., all the systems in every town as distinct from the trunk service. This is strongly protested against as contrary to the principle laid down in the Telephone Act of 1899, and also as contrary to the best interests of the telephone system of the country generally. The argument is put forward that each particular local authority should have charge of the local service and that the postoffice, as now, should restrict itself to the trunk service. To this end the municipalities now owning telephone licenses—and they number six—are asking that municipal telephone licenses should be extended and that municipalities should be encouraged by being granted licenses in larger numbers under better conditions than at present. It was also contended that, in deciding what parts of the plant of the company should be refused by reason of its being obsolete, the postmaster-general should be the sole arbiter.

Some little agitation is just now being excited both by the promoters of and the opponents to the large electric power scheme for London in view of the near approach of the second reading of the bill in the House of Commons. If the bill passes the House it will become law. The London County Council has been circularizing the members of Parliament both inside and outside London to oppose the second reading on principle. The promoters have replied with another circular asking that the second reading be allowed to pass without discussion and that the bill be discussed on its merits by a committee of the House of Commons. One or two provincial municipalities, however, have signified their intention of endeavoring to back up the efforts of the London County Council. Should the bill come before a committee there are over 50 petitioners against it, all of whom will probably be represented by counsel.

There is apparently little prospect of the London tube-railway bills being considered in this session of Parliament. There are two proposals for the construction of tube railways along the one main route not having any direct railway service; such a line being recommended by a joint committee a few years ago. There was at the beginning of the session another scheme, but this was disqualified on account of the failure of the promoters to make the necessary financial deposit in the House of Commons. The question of the deposit has a bearing upon the doings of the Royal Commission on London Traffic, for, while the two surviving schemes are hung up pending the report of the commission, the deposit in the other case was not made, owing to opinion of the promoters that the report would not be issued in time to allow of the bill being considered this year. The progress of the two other schemes has been delayed from month to month and has now been put off until July.

The tramway exhibition, which is held in London every two years, opens next week, but it is stated that several of the largest firms will not exhibit, although the exhibition generally will be a very representative one. The annual conference of the Municipal Tramways Association will be held during the exhibition. G.

Dominion of Canada.

Winnipeg, Man., July 8.—The Ontario government has appointed an electrical power commission, consisting of the Hon. Adam Beck, P. W. Ellis and George Pattinson, who are authorized to collect all the information possible in regard to waterpowers in the province suitable for the development of electrical energy that will enable the government to adopt definitely a policy in dealing with the waterpower question in relation to the development of electrical energy.

The machinery for the Edmonton (N. W. T.) electric street railway has been placed in position, and everything will soon be in good running order for a regular service with modern cars and motors.

W. H. Braim, a former official of the British Columbia electric railway, has invented and patented a switch which can be turned by the motorman without getting off the car. It has worked with perfect success, and the British Columbia Electric Railway Company has installed it on all

its cars. Mr. Braim is now forming a company to manufacture the device.

The Lulu Island electric railway, which the British Columbia electric railway recently took over, is being improved at a cost of $150,000. The contract for the wire has been given to the firm of Eugene Phillipps & Co. of Montreal, calling for 106 miles of wire. The contract for the overhead insular hangers, etc., has been let to the Canadian General Electric Company. The single-pole type of construction, with the poles set at one side of the track, will be used. The company is now building a number of cars for use on the line, to cost $9,000 each. They will be equipped with motors provided by the Canadian General Electric Company. The trucks are from the car works of J. G. Brill & Co. of Philadelphia. Each car will be provided with portable telephone instrument. Freight cars of an improved type of construction are also being built for use on the road. A contract has been let for the construction of a sub-station at Eburne of brick and concrete. The office of the company is in Vancouver.

The Winnipeg Electric Street railway Company has put on more new cars to meet the increased traffic on the line. This makes 13 new cars put on the line this summer, nine brought from the East and four built in its own shops. The number of cars now in use is 107, of which 80 are motor cars.

The Canadian General Electric Company has supplied the machinery for the electric plant now being installed at Bankhead, N. W. T.

The Cambell Electric Company of Edmonton, N. W. T., has been acquired by the Northwest Electric Company.

The electric-light plant at Windsor, Ont., will be remodeled and enlarged at a cost of $30,000.

The Ingersoll (Ont.) Waterworks Company will substitute electric for steam power at the pumping house, the current to be obtained from the Ingersoll Electric Light and Power Company. H.

New York.

New York, July 8.—At midnight tomorrow subway passenger trains will commence running for the first time from the Battery to the Bridge and from the Harlem River to West Farms. This latter line is not entirely underground. Through traffic from end to end will come later. Meanwhile a system of transfers will be operated at One Hundred and Forty-ninth Street so that passengers can either proceed downtown by the subway or by the elevated lines on Third and Second Avenues.

Justice Gildersleeve has taken the view that no harm can come if the Board of Estimate does continue to consider plans and applications for the proposed $100,000,000 subways while awaiting the decision of the Supreme Court on the constitutionality of the recent legislation which allows the Board of Estimate to deal with the matter, and which right is contested by sundry persons, including Tammany aldermen. The judge said nothing on the constitutional point, but the board will make another endeavor to obtain a full decision in its favor.

Chief Engineer George S. Rice announces the possible speedy commencement of the four-track subway under Flatbush Avenue, Brooklyn. The only obstacle in the way is to secure the consent of 50 per cent. of the property owners, which, it is to be hoped, will soon be done.

The state land board has fixed the price of a small knob of rock in the East River at $5,000. The Belmont Tunnel Company is seeking to acquire this rock for the purpose of sinking a shaft thereon for its under-river tunnel.

President E. L. Winters of the Brooklyn Rapid Transit Company, with his three leading officers, General Manager J. F. Calderwood, Surface-line Manager D. A. Smith and Chief Engineer Klapp, dined with the Improvement Association of Whitestone and Flushing, L. I., today. Mr. Winter and his staff had previously inspected a proposed route for trolley extension to Whitestone, but after the dinner Mr. Winter disappointed his hosts by saying that nothing could be done until the local people secured a right-of-way for the company. This is practically a refusal on the part of the Brooklyn Rapid Transit to build the line.

The Brooklyn Rapid Transit Company has signed a contract with the Cranford Contracting Company, Brooklyn, for the cleaning and repainting of the elevated railroad structure. The price of the contract is $250,000 and the work will occupy about 12 months.

An attempt on the part of the Brooklyn Edison Company to put up poles at Bensonhurst, L. I., has aroused spirited local resentment. Men, and even women, it is said, have conducted all-night vigils with firearms in their hands for the purpose of preventing the erection of the poles.

The Board of Estimate on Friday passed plans for the improvement of the Manhattan terminal of the Brooklyn Bridge at a cost of $3,000,000, the work to take two years. The plans now adopted after so much discussion and delay include the depression of the trolley loops to a basement, waiting rooms and crossings on the street level, a second gallery to facilitate the movement of foot passengers, and a new third floor at a considerable height above the street for the elevated tracks. These improvements are calculated to double the present traffic capacity of the terminal.

The newly formed Amalgamated Gas Fixture Company, although incorporated for the purpose implied in its title, includes also in its charter the purpose of dealing in electrical fixtures.

Edward B. Lent, writing in the Brooklyn Daily Eagle, says that "electricity is heat disguised as a commercial traveler. It goes a long distance in that form, does a big business when it arrives, and forces a customer to take the goods."

D. W. W.

Southeastern States.

Charlotte, N. C., July 8.—The Southern Power Company has been organized in New York city with a capital stock of $7,500,000 to develop large water-powers on the Catawba River in North Carolina and Upper South Carolina. The new company is organized under the laws of New Jersey. W. Gil Wylie of New York is president; B. N. Duke of Durham, N. C., first vice-president, and W. S. Lee of Charlotte second vice-president and chief engineer. The offices of the company will be in Charlotte. The first new power to be developed will be at the Great Falls of the Catawba, where a plant will be erected costing about $1,500,000.

Following upon the merger of electrical companies in Columbia, S. C., the merged concern known as the Columbia Electric Street Railway and Power Company has applied to the state for the right to increase the capital stock from $500,000 to $1,600,000. The merger is now practically completed.

The town of Spencer, N. C., has voted a bond issue of $70,000 for improvements, including electric lights.

The Asheville and Craggy Mountain Railway Company will soon change from steam to electricity on the line running out from Asheville, N. C., to a point on the French Broad River.

Murfreesboro, Tenn., has granted to the City Gas and Electric Light Company a franchise and a 10-year contract for lights for the city.

At the annual meeting of the stockholders of the Anderson (S. C.) Water, Light and Power Company Dr. S. M. Orr was re-elected president. No dividend was declared on account of the fact that profits have been largely expended in making improvements in the system.

The Greensboro (N. C.) Electric Company has placed an order for a new 750-horsepower engine which will nearly double the present capacity of the plant. L.

Ohio.

Cleveland, July 8.—There has been some discussion of late regarding changes in the Cleveland, Painesville and Eastern line that will put it on a better-paying basis. One of the first roads built about Cleveland, it cost more than many of the others because of the experiments required in securing route and in construction. It has paid the interest on its bonds, but has never yielded much for stock.

W. Kelsey Schoepf of the Cincinnati Traction Company is said to have made a proposition to the State Board of Public Works for a lease of the canal bed inside the city limits of Cincinnati, on which he wishes to build standard interurban trolley tracks to give an entrance to the Widener-Elkins roads into the city. At present the property is producing nothing for the state and the state board has the matter under consideration.

The Capitol City Savings and Trust Company of Columbus has been made fiscal agent for the Licking County Light and Power Company of Newark, incorporated recently to take over the light plant in that city. The stock and bonds have all been taken by a syndicate and there are none for sale.

The Toledo Storage Battery Company of Toledo has been incorporated with a capital stock of $50,000 by Fordyce Belford, Sarah Owens, G. C. Bryce, E. J. Marshall and C. A. Byers.

The Commercial Transit Company of Springfield has been incorporated with a capital stock of $50,000. F. P. Torrence, J. S. Harshman, T. J. McCormick, E. B. Gunn and E. B. Phelps are the incorporators. The company will operate an automobile line, it is understood.

Receivers of the Appleyard properties have received the report of the expert accountants employed to go over the books. They did not secure the books of the Northern Construction Company, however, and the report is not complete without them. Nothing will be made public regarding the report until it is filed with the court.

Half of the issue of $800,000 bonds of the Cleveland, Ashfield and Mansfield Traction Company have been taken by capitalists connected with the Mandelbaum-Pomeroy syndicate of Cleveland. Of the other half F. E. Myers & Bro. of Ashland have taken $100,000; the Ohio Farmers' Insurance Company, $135,000; people of Lodi, $40,000, and persons in various other places enough to make the amount about $300,000. This leaves but $100,000 to dispose of. The road will be 40 miles long and it will cost about $20,000 a mile to build it.

The Hocking Valley Railway Company is engaged in fighting electric-railway competition. Its line is now paralleled from Columbus to Lancaster south and from Columbus to Marion north, while the new Toledo, Fostoria and Findlay will add another 17 miles of competition on the northern end.

W. L. Ball of Galion is projecting an electric railway from that place to Fredericktown, a distance of about 25 miles.

The traction building at Cincinnati and the Mill Creek lines owned by the Cincinnati Interurban Company have been leased to the Ohio Traction Company. J. B. Foraker, Jr., and Dana Stevens have been elected first and second vice-president, respectively, of the Ohio Traction Company. At the same meeting a dividend of 1¼ per cent. on the preferred stock was declared.

Work will be begun on the new power house of the Cincinnati Northern Traction Company within a short time. It will be located at Hamilton. The machinery has been purcased for the most part. The plant will have three 1,500-kilowatt turbo-generators, one 500-kilowatt turbo-generator, three 500-kilowatt rotary converters and other machinery necessary. Four sub-stations will be built. The feed line will carry a voltage of 33,000, sufficient to operate the entire system from the one plant.

O. M. C.

Indiana.

Indianapolis, July 8.—The Muncie and Portland Traction Company has filed articles of incorporation. The object of the company is to construct systems of street and interurban railways in and connecting Muncie, Albany, Redkey, Dunkirk and Portland. The principal office will be in Portland. A. E. Smith, W. F. Richey, J. L. McPherson and L. A. Clark are the incorporators.

The Indianapolis and Southeastern Traction Company has filed articles of incorporation with a capital stock of $1,200,000. The company proposes to construct an electric railway between Shelbyville, Greensburg and Batesville, and to supply electric heat, light and power to these cities. Fletcher M. Durbin, W. J. Alford, C. C. Curtis and J. H. Smith are the incorporators.

The office of the Toledo and Chicago Interurban Railway Company has been opened in Auburn. A large force is at work grading the roadbed. The line will run from Alverdon, Ohio, to Goshen, Indiana, with several spurs. S. E. Seagraves is president of the road.

Contracts for the building of an electric railway from Covington to Rockville have been let and the work started. The line will be largely devoted to freight traffic, but passenger cars will also be operated.

In summing up reports on business of the interurban lines running into Indianapolis the officials thereof says that the Fourth of July traffic was the heaviest in the history of the traction lines in the state.

The Muncie, Hartford City and Fort Wayne Traction Company has sold its $600,000 bond issue to Rollins & Co. of New York and Chicago. The company has let the contract for the grading of the line from Bluffton to Fort Wayne and stipulated that the work is to be completed in four months.

A new through route between Fort Wayne and Indianapolis is believed to be a part of the plans of the Widener-Elkins syndicate that is buying up other interurban lines through the state. It is the purpose of the syndicate to connect the new line with the Union Traction Company at Muncie. To do this it is proposed to build through territory already occupied by the Muncie, Hartford City and Fort Wayne, which operates between Muncie and Bluffton.

The engineering corps of the Indianapolis and Western electric railroad located its line through the city of Greencastle during the week. The construction party is now at work between Danville and Greencastle and it is the intention to have the line in operation within the next six months.

The Evansville Gas and Electric Light Company is planning to erect a large plant in that city to supply electrical power to the various traction lines now operating or that may come in the future.

Plans and specifications are being made and bids will soon be asked for the installation of new machinery in the Tell City electric-light plant. Frank Hinkle is city clerk. S. S.

Michigan.

Detroit, July 8.—The Eesley Light and Power Company of Plainwell has taken over the Brownell Electric Company's plant at Plainwell and will continue it in operation until such time as the new power house can be occupied. The entire system of lines will be rebuilt and strengthened. This company will, in addition to lighting the town, private and business places, supply power to a number of mills during the day. The company is capitalized at $30,000. J. F. Eesley is president, and Detroit capital is represented on the board of directors by M. W. Hicks.

Cabs, buses and ferry boats still continue to be the principal means of transportation in Bay City, and the strike of the street-car employes is as far away from settlement as ever. The company has conceded practically all the men demanded, so far as wages and hours are concerned, but insists on individual contracts and refuses to recognize the

union, while the men insist on preserving their organization. The cars are running now without police protection, but are poorly patronized.

The Detroit, Monroe and Toledo Short Line is rushing the completion of its double tracking. The ties and the rails for the entire uncompleted distance are now on the ground and work of grading is being pushed as fast as possible.

The Du Brie Motor Company has been incorporated with a capital of $20,000 to take over the business of William E. Mageborn, S. R. Du Brie and John S. Austin. C. G. W.

Northwestern States.

Minneapolis, July 8.—The Madison (Wis.) Gas and Electric Company has installed a 400-kilowatt steam-turbine engine and boiler in its new Blount Street Station.

It is reported that the Janesville (Wis.) street-railway property is to be sold to the Rockford, Beloit and Janesville Railroad Company. Negotiations are admitted to be in progress.

Improvements will be made on the electric-light system at Spirit Lake, Iowa, at a cost of about $2,500.

O. J. Moore has been elected president of the new Sioux City and Ireton Interurban Railway Company to succeed D. Montgomery, who has resigned.

The American Electric Light Company of Minneapolis has secured the contract for the construction of an electric-light plant at Melrose, Minn.

Bids are to be received until July 18th for a new boiler for the electric-light plant at Shakopee, Minn.

The state board of education for normal schools of Nebraska has awarded the contract for lighting the Kearney Normal School to the Pomerene Company of Lincoln, Neb.

The proposition to issue bonds for an electric-light plant was voted down at Cold Spring, Minn.

The local business men at Sioux Falls, S. D., who have formed a company to erect a packing plant, have announced that they will operate it by electrical power.

The Washington (Iowa) Illuminating Company has been succeeded by the Iowa Gas and Electric Company.

Work is to be commenced immediately on the proposed trolley line in the Black Hills district of South Dakota.

Thomas R. Kimball, 503 McCague Building, Omaha, Neb., will receive bids until August 5th for the erection of a power house at the Battle Mountain Sanitarium at Hot Springs, S. D. R.

Pacific Slope.

San Francisco, July 6.—The San Francisco Board of Supervisors has directed City Engineer Stutt to prepare specifications for the reconstruction of the Geary Street railroad as an electric line.

The California Trolley Company has been incorporated in Los Angeles, Cal., with a capital stock of $250,000 by L. D. Clark, E. D. McDonald, J. L. McDonald, C. W. Jenks and M. S. Jenks.

The Merchants' Mutual Electric Lighting Company of Santa Barbara, Cal., has begun preliminary work for the construction of an electric-lighting plant at that place.

The United Light, Fuel and Power Company of San Diego, Cal., which recently purchased the electric distributing system of the San Diego Electric Railway Company, has ordered machinery and will soon begin work on some extensive enlargements of its plant on Arctic Street.

James J. Hill, president of the Great Northern Railroad Company, and his associates have sold to J. T. McChesney of Everett, Wash., and others their interests in the Everett Improvement Company, owner of the street-railway and electric-lighting systems of Everett.

The Snohomish and Cherry Valley Electric Company of Snohomish, Wash., which is planning to build an electric railway from Everett to Tolt, Wash., will reorganize with a capital stock of $1,000,000.

The Ferndale Electric Light Company of Ferndale, Cal., is preparing to make considerable extensions to its lines.

The Oroville Light and Power Company of Oroville, Cal., will install an electric power plant on West Branch near Oroville.

The Gray's Harbor Lighting Company of Gray's Harbor, Wash., has let a contract for the construction of an extension to its electric railroad from Aberdeen to Cosmopolis, Wash., to R. L. Philbrick of Hoquiam, Wash.

The Novelty Electric Works of Portland, Ore., owned by C. E. Obrist, was destroyed by fire a few days ago.

The El Pizmo Company of Santa Maria, Cal., is preparing to install a complete electric-lighting plant with a capacity of 400 lights at Pizmo Beach.

The Ocean Shore Railway Company, recently organized to build an electric railroad from San Francisco south along the ocean shore, has purchased extensive depot sites and rights-of-way in Santa Cruz County.

The Western Gas and Power Company has been incorporated in Oakland, Cal., by J. H. Becker, George P. Marcus, J. H. Eichler and others, with a capital stock of $20,000.

E. S. Babcock of San Diego, Cal., has been granted a franchise to construct and operate a street railway in San Diego.

Senator Reed Smoot and L. Holbrook of Salt Lake City, Utah, are preparing to construct a large power house on the Walker River in Mono County. The electricity generated will be used in the operation of the Syndicate mines at Bodie, Cal.

The Washington Water Power Company of Spokane, Wash., is preparing to extend its electric-light and power lines 100 miles south of Spokane to the town of Colfax.

The Clackamas Power Company has been incorporated at Salem, Ore., with a capital stock of $25,000 by J. T. Apperson, C. H. Dye, H. E. Gross and E. G. Canfield.

The city authorities of Eugene, Ore., have filed a claim for water rights adjacent to that city and will erect an electric power plant of 5,000-horsepower capacity.

The Humboldt Transit Company of Eureka, Cal., has been granted a franchise to equip and operate a single track, standard-gauge electric railway upon certain streets and highways in Humboldt County, Cal.

Chief Engineer Newell of the Jamestown and Yosemite Railway Company began work this week in locating the line of the company from Jamestown to a point five miles above Groveland. Work will begin on this section of the road as soon as the line is located.

The Sierra Nevada Water and Power Company has been incorporated in San Francisco, Cal., by W. A. Stowell, G. B. Crittendon and others, with an authorized capital stock of $5,000,000 for the purpose of developing electricity by waterpower. The company is said to be backed by the Sierra railway of San Francisco. A.

Rocky Mountain States.

Salt Lake City, July 8.—A franchise for an electric street railway has been secured at Missouli, Mont., by G. W. Dougherty of Hamilton, who states that the system will extend into the Bitter Root country and that active work will be commenced some time during the summer. It is the intention to extend the line as far as Anaconda and Butte at some later period.

Plans for the construction of an electric railway connecting Bingham Junction, Murray, Bingham and adjacent camps with Salt Lake City, Utah, are being considered by mining men of Salt Lake City. The plans as now outlined contemplate an expenditure of about $2,000,000.

Citizens of Saratoga, Wyo., are planning the construction of an electric railway from that city to a connection with the Union Pacific either at Fort Steele or Walcott.

An order for cars has been placed by Simon Bamberger of the Salt Lake and Ogden railway for the equipment of his system at Ogden, Utah.

The Northern Electric Company has filed articles of incorporation at Reno, Nev., the capital stock being placed at $3,000. The company will carry on a general electric business, including apparatus for lighting, heating, telephone and telegraph plants.

John L. Bright and others of Livingston, Mont., who have secured control of the Livingston Water Power Company, will spend between $60,000 and $100,00 this summer in the installation of new machinery and the erection of a new power house at Livingston.

J. A. Manley, chief consulting engineer, of the Lewiston and Southeastern railway, with headquarters at Lewiston, Idaho, announces that a contract has been let to Charles E. Loss of San Francisco for the construction of the road. The contract includes the construction of a power plant.

J. E. Lane and others of Boise, Idaho, are doing preliminary work for the construction of a power plant at Thousand Springs, near Hagerman, Idaho. A company will be organized under the name of the Snow Bank and Thousand Springs Power Company. A power plant of 10,000 horsepower will be erected.

Promoters of Butte, Mont., are contemplating the early construction of an electric railway between Red Lodge and the Bear Creek coal camps. G.

PERSONAL.

Prof. H. S. Carhart of the University of Michigan, who was formally invited to attend this year's convention of the British Association, which is to be held in South Africa, is on his way to England and thence to the Cape of Good Hope.

The Engineering Standards Committee of Great Britain has suffered a severe loss by the death of its chairman, Mr. James Mansergh, who had been at the head of affairs since the constitution of the committee. Sir John Wolfe Barry has been appointed as the new chairman.

Henry N. Potter, a special engineer of the Westinghouse Electric and Manufacturing Company, has received the degree of doctor of science from Amherst College. This honor was bestowed in recognition of Mr. Potter's achievements in scientific research and his contributions to practical and theoretical knowledge in the fields of electric-furnace working, electric lighting and kindred subjects. Dr. Potter is a graduate of Amherst College and was instrumental in the introduction of the Nernst lamp into this country.

S. L. F. Deyo, chief engineer of the subway division of the Interborough Rapid Transit Company of New York city, has resigned his position to take a position with the Metropolitan Street Railway Company of the same city. He is succeeded by George H. Pegram, who has hitherto been in charge of the elevated lines of the Interborough company.

Philip A. Feigin has opened an office as a consulting engineer in Evansville, Ind. Mr. Feigin is a Russian, who studied mechanical and electrical engineering at Cornell, and who has had experience with the General Electric Company and in the United States Navy. He has delivered addresses on electrical subjects in Evansville, and his work has attracted the favorable attention of the daily press.

Bryson D. Horton of Detroit, Mich., was married on June 28th to Miss Bessie R. Bouslog at the home of the latter's parents in Peru, Ind. Mr. Horton is of the Horton-Morehouse Company of Detroit, manufacturer of electrical supplies. The bride has been one of the leading society ladies of the younger set of Peru and is the daughter of R. H. Bouslog, secretary and treasurer of the Peru Electric Manufacturing Company

Samuel A. Freshney of Muskegon, Mich., general manager of the Muskegon Traction and Lighting Company, will be appointed by the city of Grand Rapids as commissioner of public works, a newly created office, which carries with it the salary of $2,000 a year. Mr. Freshney has been connected with the Muskegon street-railway system for a number of years and was at one time connected with the Brush Electric Company of Cleveland. He is 39 years of age.

Edward G. Connette, vice-president and general manager of the Syracuse Rapid Transit Railway Company, was offered the position of general manager of the Consolidated Street Railroad Company of Worcester, Mass., to succeed Frederick W. Huntress, who recently went to Rio Janeiro, Brazil, to manage a street railway and electric-light plant. Mr. Connette is one of the ablest electric-railway managers and his progressive policy has aided greatly in building up the system of the Syracuse Rapid Transit Company. He is a former president of the New York Street Railway Association. The Syracuse company refused to release Mr. Connette from his contract.

ELECTRIC LIGHTING.

The Clarendon (Texas) Water, Light and Power Company has been incorporated with a capital stock of $50,000.

The Climax Light and Power Company has succeeded to the business of the Burlington Electric Light Company in Burlington, Kan.

The Kansas City Electric Light Company is changing its first boiler so as to use oil as fuel. It is planned to use oil entirely in the near future.

At a meeting of the stockholders of the Salamanca (N. Y.) Waterworks Company recently it was voted to accept the offer of the village board to take over the waterworks and electric-light system at $85,000.

Kingsley, Mich., is preparing to light her streets with electricity. The business men of the city will install the poles and lamps and the Boardman River Electric Light and Power Company will furnish the current.

An ordinance was passed at the meeting of the Chicago City Council this week providing for a referendum at the fall election on the new city charter measures and the law for the sale of electric light by the municipality of Chicago, passed by the Legislature.

Traverse City, Mich., has entered into a two-year contract with the Boardman River Electric Light and Power Company to furnish the city with light at $70 per lamp per year. The company offered service at $65 on a five-year contract and $60 on a 10-year contract. The city uses 67 lamps. Its aldermen have been investigating municipal ownership and are not yet satisfied with a private contract.

The proposition of the Union Heat, Light and Power Company to light the city of Covington, Ky., has been accepted by the council, for one year, with the privilege of renewing annually for five years. The company is to furnish any number of 2,000-candlepower arc lights at $65 each per year, provided they are placed within 400 feet of each other, and 32-candlepower incandescent lamps for $27 a year, with the same provision.

The Elmwood Electric Light Company of Elmwood, Ill., has just secured a franchise at Brimfield, Ill., to which place it will extend its lines, a distance of eight miles. The company intends later to extend to Maquon and Douglas, Ill., making five

towns served from the Elmwood plant. The company is in the market for the immediate purchase of line material and local supplies, including 200 poles, 5,000 pounds of No. 6 bare copper wire, two transformers, cross-arms, insulators, etc.

The Electric Light Company of Yankton, S. D., has been reorganized and is now called the Yankton, Light Heat and Power Company. The directors are: William H. Edmunds, president, Yankton, S. D.; S. G. Donaldson, vice-president, Yankton, S. D.; Robert Ferris, secretary-treasurer, Monmouth, Ill.; W. J. Ferris, Chicago, Ill.; Thomas Ferris, Osage, Iowa; James W. Ferris, Eldora, Iowa. The new company will be pleased to receive catalogues or printed matter with price lists covering anything used about electric-light, gas, heat or power plants, as it intends to rebuild and to deal in supplies. Robert Ferris is the manager.

At a recent meeting of the City Council of Ashland, Ore., an ordinance was passed to install a municipal electric-light and power plant to be operated by waterpower. A city election was ordered to vote on issuing $50,000 city bonds to pay for installing the plant. On June 10th it was decided by a city election to issue $30,000 bonds for the purpose of purchasing all the water rights of Ashland Creek not now owned by the city. The laying of a complete sewer system is now well under way. The city has for years owned its own gravity waterworks. The water is supplied by a cool mountain stream which has its source in the timbered snow-capped Ashland peak, situated about seven miles distant.

ELECTRIC RAILWAYS.

The books of the South Haven (Mich.) Traction Company are open for subscriptions to the capital stock. The company is formed to build a road from Saugatuck to Watervliet.

Negotiations are under way between the Chicago and Joliet Electric railway and the Metropolitan Elevated whereby the former may secure a direct connection with the latter for bringing its passengers into Chicago.

The June meeting of the New England Street Railway Club, which is composed of practical street-railway men all over the New England states, was held at Lake Quinsigamond, near Worcester, Mass., where a party of about 200 passed the day in various pleasures.

The Lehigh Valley Traction Company on July 4th did the largest business in its history. Independent of the Allentown and Philadelphia line it carried 75,000 passengers, while 35,000 were carried on the Philadelphia line. The receipts for June amounted to $75,338, an increase of $7,915 over the corresponding month of 1904.

The Chicago, Milwaukee and St. Paul railroad ordinance, providing for the elevation of the tracks and the substituting of electricity for steam on the Evanston branch of the road north of Wilson Avenue, Chicago, was sent back to the committee at the last meeting of the Chicago City Council, and action on various amendments was postponed until fall.

Cleveland, Kansas City, St. Joseph and New York financial concerns are considering the underwriting of the electric railway to be built from Kansas City to St. Joseph, but it is thought the greater part of it will be taken in Cleveland. The road will have branches to Atchison and Leavenworth, Kan. The company will be known as the Missouri Valley Traction Company.

Henry E. Huntington, heavily interested in street and interurban railways throughout Southern California, has purchased a seaside resort 18 miles from Los Angeles, known as Redondo. The tract involved comprises 1,000 acres, almost intact. The holdings include one of the finest resort hotels in the state and various village enterprises. The consideration is said to be nearly $1,000,000.

The Quebec and Saguenay River electric railway, owned by the Quebec and Saguenay River Navigation Company, has just elected Rudolphe Forget of the Montreal street railway as president. The company will at once extend the electric road running from Quebec to Ste. Anne's down to Tadousac, a distance of 110 miles. The cost will be over a million dollars, and government aid will be sought.

The Dunkley-Williams Transportation Company has been incorporated as the Kalamazoo, Lake Shore and Chicago Traction Company, with a capital stock of $500,000. The company expects to have 30 miles of rails laid between Kalamazoo and Benton Harbor, Mich., by October 1st. The incorporators include S. J. Dunkley of Kalamazoo, A. W. Norton of Chicago, Joseph E. Lockwood of Detroit and others.

Edward M. Deane & Co. of Grand Rapids, Mich., have secured control of the Salisbury and Spencer Railway Company of Salisbury, N. C., carrying with it an electric-light plant and a gas plant. The company is capitalized at $400,000, with an authorized bond issue of $1,000,000. The franchises of the company cover gas and electric-light, street-railway, telephone and telegraph privileges in Salisbury and Spencer and Rowan County, and by a special act of the Legislature run for 60 years.

The British Columbia Electric Railway Company, which operates the electric lines in Vancouver, Victoria and New Westminster, B. C., has leased from the Canadian Pacific railway the 12 miles of track between Vancouver and Steveston. The Canadian Pacific officials will probably construct an electric road from New Westminster across Lulu Island direct to Steveston and turn it over to the electric railway company for operation.

The Metropolitan West Side elevated railway of Chicago has been granted an ordinance permitting it to carry express and freight on its system. The term of the grant was placed at 10 years instead of 37 as asked. The company must pay the city five per cent. of the gross receipts from the new business for the first five years and 10 per cent. for the last five. Arc lights are also to be placed at each street intersection by the elevated company.

As an outcome of foreclosure proceedings instituted against the New Hampshire Traction Company, which operates 11 street railways in New Hampshire and Massachusetts, and two land companies, Arthur H. Masten, special master appointed by a New York court, has been instructed to sell at auction in that city stocks, bonds and notes of the subsidiary companies having a total par or face value of more than $6,000,000. Of the amount, $3,594,900 is in stocks, $2,080,000 in notes, and $702,320 in bonds. The proposed sale is understood to be part of a plan of reorganization.

Arrangements are being made to lay out a route for a proposed 100-mile electric railway from Janesville to Waupaca, Wis. The Milwaukee Engineering Company is said to have completed profiles for the survey. The route is to be through a promising tobacco district which has been handicapped by lack of transportation facilities. The cost of construction and equipment, it is said, will be in the neighborhood of $20,000 a mile, a considerable portion of which will be represented by electric locomotives and other rolling stock. Philadelphia men are reported to be promoting the enterprise.

A unique electric railway in Germany possesses the peculiarity that its trains are operated without a motorman. It is a miniature affair used in carrying salt from the salt mines at Stassfurt. The trains consist of 30 trucks, each carrying half a ton of salt. The engines are electric, of 24 horsepower each. As a train approaches a station, of which there are five along the line, it automatically rings a bell, and the station attendant turns a switch to receive it. He is able to stop it any moment. To start it again he stands on the locomotive, switches the current and then descends before the engine has gained speed.

TELEGRAPH.

Following the recent reduction in the cable rate to Japan the Commercial Pacific Cable Company has announced that from July 1st the cable rate to Korea will be reduced by 20 cents a word. The rate of Chemulpo, Fusan and Seoul will be $1.21 a word from San Francisco, and to other places in Korea, $1.20 a word from San Francisco.

The Commercial Cable Company has agreed to lay 200 miles of deep-sea cable for the colonial government of Newfoundland to connect the island with Canso, N. S., thus giving the colonies a state-owned telegraph-service connection independent of the present cable system of the Anglo-American Cable Company with the rest of the world.

A former telegraph operator who was the engineer of the train upon which Harold Douglas, a railroad telegraph operator, and his bride were departing for their honeymoon from Hempstead, L. I., is said to have taken advantage of his knowledge of the Morse code by tooting the locomotive whistle in dots and dashes to signal each tower house that the bridal party was on board.

PUBLICATIONS.

The name of The Electric Club Journal of Pittsburg has been changed to The Electric Journal.

The Goldschmidt Thermit Company of New York city has issued, in pamphlet form, the paper read by Ernest Stütz before the meeting of the American Society for Testing Materials, which was held at Atlantic City on June 29th. The paper is entitled "The Thermit Process in American Practice" and is accompanied by numerous illustrations.

Various styles of electric grinders and buffers for shop and factory economy are described in the latest bulletin of the Northern Electrical Manufacturing Company of Madison, Wis. The bulletin is full of interesting things concerning grinding, polishing and buffing operations. The standard windings for Northern emery grinders and buffing lathes are 110, 220 and 500 volts.

Yost specialties are tastefully set forth in an attractive new booklet issued by the Yost Electric Manufacturing Company of Toledo, Ohio. The booklet illustrates and describes in an attractive way Yost key and keyless sockets, concealed bases, open bases, sign receptacles, rosettes, the Electrogrip for holding a lamp in any position over a lathe or other work, and many other specialties.

The Electric Storage Battery Company of Philadelphia has issued Bulletin 94, which is devoted to the application of Exide batteries to electric vehicles. To give an idea of the extent to which Exide batteries are used, some figures are given in the bulletin. The capacities of the plates manufactured from 1901 to 1904, inclusive, are 9,046,705, 10,795,145, 17,889,698 and 26,419,567 watt-hours, respectively.

"Direct-current Lighting and Power Generators" is the subject of a new and well-illustrated bulletin issued by the Crocker-Wheeler Company of Ampere, N. J. The generators described in this bulletin embody all the well-known features of the Crocker-Wheeler machines and are as compact as is consistent with low-temperature rise and sparkless operation. The bulletin takes up thoroughly the design of the various parts of these machines.

An attractive circular issued by the West Shore railroad describes the points of interest in the Catskill Mountains which are reached by the West Shore road and connecting lines. The circular gives a list of summer hotels and boarding houses of this district, and also a large map lettered on the margin. Opposite each name on the list are the marginal letters showing upon the map where the particular house is located. The list also gives the prices, distance from railroad station and conveyances available, making altogether a useful guide for the summer tourist.

For the concentration of ores the Allis-Chalmers Company of Milwaukee, Wis., manufactures a machine called the Overstrom concentrator. In general design the apparatus consists of a diagonal table, the top of which is placed diagonal to the line of reciprocation, the concentration of the mineral particles being performed by three forces—gravity, reciprocating motion and the action of wash water. A very comprehensive catalogue issued by the company describes in detail the concentrator, giving also instruction for its erection and operation.

The third report of the committee on current classification and nomenclature of the American Electrotherapeutic Association has been issued, and it shows the results of careful study. It contains the results of tests on electrostatic machines, the analysis of currents of high frequency, due to disruptive discharges and the mathematical formulas representing the results of these tests and analyses, applied solely, however, to the conditions of electrotherapeutic practice. The chairman of the committee is Mr. W. J. Jenks of 120 Broadway, New York.

MISCELLANEOUS.

A fall industrial exposition will be held in the Music Hall and Exposition Buildings, Cincinnati, during the two weeks beginning September 11th and ending September 23d.

During 1904 the production of tin ore in the United States was 159 short tons, containing 40 to 70 per cent. of metallic tin. During the last few years the production of tin has not been equal to the demand, and accumulated stocks in various countries have been much diminished. As a consequence processes of detinning are becoming of considerable importance in the United States. Many hundred tons of metallic tin and chemical salts of tin, chiefly chlorides, are procured each year from the chemical or electrolytic treatment of new tin scrap, which is obtained from the tin-can and fruit-can factories.

A new system of automatic block signals put into practical use for the first time last year was recently exhibited by the General Electric Company at the American Railway Appliance Exhibition in Washington, D. C. A distinctive feature of one type of the system is that the motor is geared directly to the spindle of the semaphore blade by means of an electric clutch, thus dispensing with long connections between the motor and the signal, which are necessary when the motor is placed at the bottom of the signal pole. The motor may be attached to any signal pole at the top, and when substituted for the mechanical signal supported on a wooden post it is placed by sawing off the post squarely at the top.

TRADE NEWS.

The Missouri Electric Motor Company of St. Louis has been incorporated with a capital stock of $10,000.

The Norton Electrical Manufacturing Company of Camden, N. J., has been incorporated with a capital of $100,000. The directors are Frederick G. Norton, David L. Hart and Abner Smith.

The Los Angeles (Cal.) office of the Westinghouse Electric and Manufacturing Company, which

has heretofore been in the Trust Building, has been removed to No. 527 South Main Street.

A quarterly dividend of 1½ per cent. on the preferred stock of J. G. White & Co. (Inc.), of New York, payable August 1, 1905, to stockholders of record May 31, 1905, has been declared by the board of directors.

Charles Wirt & Co., dealers in electrical and mechanical apparatus at Newark, N. J., have incorporated their interests, with a capital of $100,000. The incorporators are James F. Coleman, Arthur R. Denham and John L. Lotsch.

The Empire State Engineering Company of Rome, N. Y., has been incorporated with a capital of $1,000,000. This concern will conduct a manufacturing and electrical engineering business. Among the directors are William C. Sherwood of New York, Charles F. Davenport of Brooklyn, John T. McDonough of Albany, and Arthur Schwartzenbach of South Orange, N. J.

M. B. Daly, manager of the East Ohio Gas Company, has purchased the plant of the United States Carbon Company in Cleveland, Ohio, and announces that a new company will be formed to operate it in August. The plant is a large one, covering about four acres of ground, but it has not been in operation for a year or more. It cost originally something like $500,000. High-grade carbons and dry batteries will be manufactured by the new company.

The following are the duties prevailing on imports of electrical instruments and accessories into Ecuador during the present year: Telephone and telegraph apparatus, 0.121 cent per kilogram, gross weight; articles absolutely necessary to municipalities for lighting or any other public use, whether the work be executed under contract or directly by them, free; asbestos, free; candelabra of metal, crystal or other material for any system of lighting, 0.121 cent per kilogram gross weight; carbide of calcium, free; motor cars and bodies for same, free; railway plant and accessories of every description, free.

The Gas and Electric Development Company of No. 1328 Chestnut Street, Philadelphia, acts as a broker or agent in the purchase and sale of public-service properties, such as gas plants, electric-light and power plants, electric railways, etc. The company will make examinations and reports upon such properties, and act as consulting engineer in connection with their construction and operation. The president of the company is Harry C. Case; vice-president and engineer, A. B. Beadle; secretary and treasurer, W. W. Levering; superintendent of construction, S. S. Ingman; counsel, Roberts & Measey. While the company is a new one, the individuals interested in it have been in public-service lines for a number of years and are well known.

BUSINESS

T. P. Bradley, secretary and general manager of the Duluth Log Company, Duluth, Minn., was in Chicago last week. Mr. Bradley said that his company is having a most successful season in the pole and tie lines.

The Star Dynamo Company of Jefferson City, Mo., is offering to users a special line of small direct-current motors ranging from one-half to 15 horsepower. The company has issued a new catalogue describing its product and will be pleased to mail the publication on request.

The Chicago House Wrecking Company, Thirty-fifth and Iron streets, Chicago, has a large quantity of lead-covered cables, weatherproof and rubber-covered wire, secured from its purchase of the material used at the St. Louis World's Fair. In addition to this wire the company has a large quantity of miscellaneous electrical goods which it is willing to dispose of at a sacrifice.

Among a long list of recent sales of large and small Ideal engines, manufactured by A. L. Ide & Sons of Springfield, Ill., appear the following: Two 310-horsepower and one 150-horsepower to the Ralph J. F. Gerstle Company of New York city; one 248-horsepower and one 118-horsepower to the Wheeling and Lake Erie railroad of Cleveland; one 250-horsepower to the Stratford Hotel in Chicago; one 215-horsepower to the Utah Fuel Company of Sunnyside, Utah; one 324-horsepower to the Alhambra Theater Company of Milwaukee. Sales to Japan, Alaska, Brazil, Chile and Mexico are also included in the list.

The Electro-dynamic Company of Bayonne, N. J., will make an exhibit in space 13, department "A," during the International Electrical Exhibition to be held in Mechanics Hall, Boston, Mass., on July 15th to 22d. The exhibit will include one of the company's type 5-S four-to-one interpole variable-speed motors belted to a generator. The motor will be reversed under various conditions of load and speed, showing many remarkable results. There will also be on exhibition different sizes of motors running from one horsepower at a speed ratio of four to one up to 10 horsepower at a speed ratio of four to one. Altogether the motors exhibited by this company will cover 123 distinct varieties.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) July 4, 1905.

793,647. Capacity. Reginald A. Fessenden, Washington, D. C. Application filed December 14, 1904.

The capacity consists of a number of pieces of cable, each having its conducting core and an insulating sheath and outer conducting covering stripped successively greater distances from the end. A conducting clamp secures the inner conducting cores and electrically connects them in parallel.

793,648. Receiver for Electromagnetic Waves. Reginald A. Fessenden, Washington, D. C. Application filed December 14, 1904.

A U-tube contains a liquid, and a fine-wire terminal is immersed in the liquid in one leg of the tube. A second terminal is also immersed in the liquid, the terminals being in operative relation to an aerial and a local circuit. Means regulate the pressure in the tube due to the decomposition of the liquid by electric current.

793,649. Signaling by Electromagnetic Waves. Reginald A. Fessenden, Washington, D. C. Application filed March 30, 1905.

Signaling by electromagnetic waves is accomplished through means for the practically continuous generation of electromagnetic waves or impulses, a spark gap and means for modifying or changing the intensity of the discharge across the gap without interrupting their continuity.

793,650. Signaling by Electromagnetic Waves. Reginald A. Fessenden, Washington, D. C. Application filed March 30, 1905.

An improvement in the art of signaling by electromagnetic waves consists in the practically continuous generation of electromagnetic waves or impulses and modifying or changing the radiations without interrupting their continuity by waves or impulses.

793,651. Aerial for Wireless Signaling. Reginald A. Fessenden, Washington, D. C. Application filed March 30, 1905.

An aerial for the transmission and receipt of electromagnetic energy has a base, a cylindrical structure having a pivotal support on the base and guys for holding the structure in a vertical position, the structure forming the whole or a portion of the antenna.

793,652. Signaling by Electromagnetic Waves. Reginald A. Fessenden, Washington, D. C. Application filed April 6, 1905.

In a system of signaling by electromagnetic waves are combined an aerial, a charging circuit, a discharging circuit and means for connecting the aerial alternately to the charging and discharging circuits.

793,671. Electric Automatic Block System for Railways. George H. Lower, Robert H. Lower, Edward P. Lower, Winfrey W. Lee, William B. Lee and Herbert Walker, Hot Springs, Ark. Application filed July 23, 1904.

Signals are situated on both sides of a railway, adapted to be operated by the flange on the wheels of a moving train. Operating switches, a system of energized wires and contacts, extending from the switches, and operating signals on both sides of the track, the wires energized by an alternating current produced by parallel machines at intervals along the track, are the other features.

793,718. Wireless Telegraphy. Reginald A. Fessenden, Washington, D. C. Application filed March 30, 1905.

Signaling by electromagnetic waves is done with the combination of a transformer having its primary formed by a tubular coil provided with an outlet, means for forcing liquid through the coil and receiving apparatus operatively connected to the secondary of the transformer.

793,754. Insulation. George A. Weber, New York, N. Y., assignor to the Weber Railway Joint Manufacturing Company, New York, N. Y. Application filed February 10, 1903.

An insulating ring of suitable material is provided with metallic armor upon both the interior and exterior, the edges of both interior and exterior armor beyond the edges of the ring being turned transversely to the insulating ring.

793,760. Art of Telegraphy. Marcus O. Anthony, Barberton, Ohio. Application filed November 22, 1902.

The improvement consists in generating a primary current in the sending apparatus and producing make-and-break impulses of the current. From this current are generated two induced secondary currents of opposite rotative forces, which are combined and sent through a common service conductor.

793,768. Motor Control. Eugene R. Carichoff, East Orange, N. J., assignor to the Otis Elevator Company, East Orange, N. J. Application filed December 8, 1903.

In a motor-control system are combined a motor, a source of electrical supply, a resistance and a double-acting magnetically operated circuit closer, adapted when in one position to connect the motor to the source of electrical supply through the resistance, and when in another position to connect the motor to the resistance. Means prevent the circuit closer from connecting the motor to the electrical supply until the resistance is placed in the circuit.

793,774. Multiple Electric Lamp Holder. Elias L. Elliott, New York, N. Y., assignor to the Illuminating Engineering Company, New York, N. Y. Application filed June 5, 1903. Renewed May 23, 1905.

A receptacle adapted to hold two or more incandescent lamps is described.

793,775. Fire and Burglar Alarm. Peter M. Esser, Chicago, Ill., assignor of one-half to Julius G. Breitenstein, Chicago, Ill. Application filed August 29, 1904.

An automatic alarm comprises an alarm signal and its operating circuit. A spring-operated circuit closer is adapted to close the circuit by movement either in the direction caused or in that opposed by the spring. A cord, strained taut from the circuit closer, holds it out of circuit-closing position. A branch from the cord is connected to a closure to be guarded, the connection being such that the opening movement of the closure draws upon the taut cord.

793,777. Condenser. Reginald A. Fessenden, Washington, D. C. Application filed March 30, 1905.

Two conducting surfaces are combined with an inductance or transformer, the parts being surrounded by a gaseous dielectric under pressure.

793,802. Electric Protective Apparatus. Frederick R. Parker, Chicago, Ill., assignor to Frank B. Cook, Chicago, Ill. Application filed July 9, 1904.

Combined with a ground plate are a pair of superposed springs mounted thereon and insulated from each other, means for grounding one of the springs and a protective device adapted to disengage the outer spring and cause them to operate and thereby ground only the inner spring of the pair, under abnormal circuit conditions.

793,826. Telephone Attachment. Nebo E. Damico, Redlands, Cal. Application filed January 31, 1905.

A telephone attachment comprises an eye and companion gripping members of integral formation, the eye and gripping members being arranged about in the same plane. The eye is adapted to be fitted to the mouthpiece of the transmitter and the gripping members are adapted to receive a ticket, slip or the like containing memoranda for ready reference.

793,833. Insulating Handle Connection. John H. Gault, Philadelphia, Pa. Application filed June 8, 1904.

An insulating handle connection comprises a core of insulating material, a ring embracing one portion thereof and adapted to be secured to a section of the handle and an inwardly extending flange on the end, embedded in the body of the core.

793,845. Automatic Take-up Device for Telephone Connections. Frank B. Long, Los Angeles, Cal. Application filed October 15, 1904.

An automatic take-up for telephone connections embodies a stationary shaft having two passageways leading from each end to the outer surface, electrical contact plates on the shaft across the inner extremities of the passageways, a spring-actuated drum having its hub rotatably mounted on the shaft, and provided with rings in its bore, having electrical contact with the contact plates, line wires extending through the passageways and connected to the contact plates, and insulated electrical conductors winding and unwinding on and from the drum.

793,848. Electric Controller. Charles S. Reno, Covington, Ky. Application filed March 11, 1905.

In a rheostat having a movable arm are a main switch and means for controlling the rheostat and switch comprising a manually operated element, a cam device for operating the arm, and a cam device for operating the switch, both of the devices being controlled by the element.

793,872. Spark-tight Box for Arc Lamps. Harry Bissing, New York N. Y. Application filed May 23, 1904.

An arc lamp is situated in a spark-tight inclosing box having a movable screen, an electric switch in the arc-lamp circuit, and a lock connected to the switch for preventing the withdrawal of the screen when the switch is closed.

793,896. Submarine Signal. Arthur J. Mundy, Boston, Mass., assignor to the Submarine Signal Company of Waterville, Maine, Boston, Mass. Application filed February 14, 1903.

An electrical sound-transmitting device for receiving and transmitting submarine signals comprises an electrical transmitter provided with two diaphragms, oppositely arranged, a holder for the transmitter having a body and a hole extending transversely its body from side to side for containing the transmitter.

793,897. Electric Switch System for Blast Furnaces. Robert G. McFarland, Newcastle, Pa. Application filed November 10, 1904.

In a switch-operating device for hoists, a screw shaft and mechanisms thereon are arranged to operate a series of electric switches, each mechanism being adjustable independently of the others.

793,904. Induction Motor. William D. Pomeroy, Norwood, Ohio, assignor to the Bullock Electric Company, Cincinnati, Ohio. Application filed November 24, 1903.

Combined with a rotating element having secondary windings are means for short-circuiting the windings comprising slip rings, to which the windings are connected. A metal member is carried by the rotating element, short-circuiting switches are pivoted thereto and in electrical connection. A slidable collar, links connecting the collar and the switches, and a handle for sliding the collar are also provided. (See cut on next page.)

793,928. Telephone Transmitter. William E. Harkness, Elyria, Ohio, assignor to the Dean Electric Company, Elyria, Ohio. Application filed March 18, 1904.

A diaphragm having a central opening is associated with a cup having a flange or shoulder within the opening and resting against the diaphragm. A pair of springs normally under tension forces the cup against the diaphragm. Electrodes and granular conducting material are placed in the cup.

793,936. Electric Push Button. Henry F. Keil, Bronxville, N. Y. Application filed February 27, 1905.

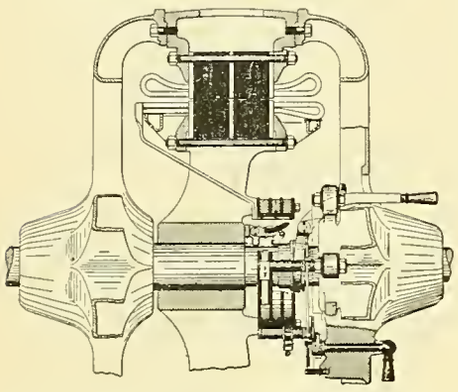
In an electric push button is a plug having longitudinal perforations for wires located away from the edge thereof and terminating in a practically horizontal face formed by an interior lateral-recessed part across which the ends of the wires may be placed.

793,941. Telephone-exchange System. Edmund Land, Grand Rapids, Mich., assignor to the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. Application filed January 23, 1903.

A telephone line extending by its limbs from a substation to an exchange is provided with cord connecting apparatus at the exchange for connecting the line with another for conversation. A cut-off relay has two differential windings normally serially included in a single limb of the line. A line signal is controlled by switching apparatus at the substation, and means whereby the connection of the cord connecting apparatus with the line causes an actuation of the relay to destroy the substation control of the line signal are provided.

793,942. Supporting Device for Electric Fans. Sidney G. Leach, Ilford, England. Application filed September 14, 1904.

A supporting device for ceiling fans is described.



NO. 793,904.—INDUCTION MOTOR.

793,952. Electrical Lamp Fixture. Benjamin W. Perrigo, Auburn, N. Y. Application filed November 3, 1904.

An electrical lamp fixture contains an insulation member, in sections, adapted to be inserted laterally in position, with their end portions overlapping each other and pinned together.

793,965. Trolley. William F. Thompson, Coraopolis, Pa. Application filed December 28, 1904.

Combined with a trolley pole are a harp, an adjustable spindle mounted in the harp, a wheel journaled upon the spindle, arms carred by the harp and adapted to overlie the wheel, means to partially rotate the arms and means to adjust the wheel.

793,969. Switch. Ferdinand Volk, Pittsburg, Pa. Application filed November 25, 1904.

Associated with a switchboard adapted to be supported above a trolley wire are revoluble contact blocks mounted upon the switchboard, means carried by the switchboard and actuated by a trolley wheel to rotate the contact blocks, means to retain the contact blocks in their moved position, until again rotated, and a hinged hood to incase the contact blocks.

793,971. Telephone-exchange System. Harry G. Webster, Chicago, Ill., assignor to the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. Application filed April 17, 1903.

A number of test thimbles for the line are normally disconnected from the circuit. Cord-connecting apparatus at the exchange connects the line with another for conversation, and means are provided whereby the connection of the cord-connecting apparatus with the line causes the test thimbles to become charged by the source. A test contact is adapted to be connected to a point in the source of current intermediate in potential between the potentials of the terminals of the source, and a signal-receiving device, upon application of the charged test contact to a charged test thimble, indicates the condition of the tested line. (See cut.)

793,972. Telephone-exchange System. Harry G. Webster, Chicago, Ill., assignor to the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. Application filed March 25, 1903.

The details of a test circuit are described.

794,012. Electric Temperature Alarm. Cowan P. Hepler, Smithton, Pa. Application filed February 6, 1905.

A temperature alarm comprises a conducting casing, an insulating receptacle for expansible material located in the casing, a series of contact blocks located adjacent to the receptacle and insulated from each other and from the casing, means for connecting each block with the interior of the receptacle, a conducting strip located adjacent to the blocks and insulated from the receptacle and means for connecting the strip with any one of the blocks.

794,016. Telephone Attachment. Frank F. Howe, Marietta, Ohio. Application filed March 2, 1905.

An attachment for holding the telephone receiver to the ear is the basis of the patent.

794,020. Trolley Head. Harry I. Jeffers, Tuscaloosa, Ala. Application filed August 20, 1903.

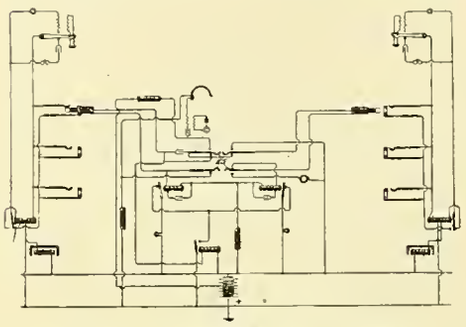
In a trolley head are a main supporting frame or casing having slotways, rack teeth secured to the casing and running parallel to the slotways and a trolley wheel having a shaft mounted within the casing with its shaft in the slotway.

794,028. Bulb for Incandescent Electric Lamps. Robert R. Kintz, Meriden, Conn., assignor to the International Silver Company, Meriden, Conn. Application filed May 15, 1905.

An ornamental bulb for incandescent lamps is described.

794,084. Meter. Frederick Darlington, Great Barrington, Mass. Application filed October 14, 1904.

In a meter is a body rotated by the energy to be measured, a registering train geared to the body, but rotated by power supplied from a spring connected to the train, the rotating body acting to control the movement of the registering train, a movable bearing for the shaft of the body and means for continuously moving the bearing, the means being actuated by power supplied by the spring. (See cut.)



NO. 793,971.—TELEPHONE-EXCHANGE SYSTEM.

794,086. Lifting Magnet. Arthur C. Eastwood, Cleveland, Ohio. Application filed December 27, 1904.

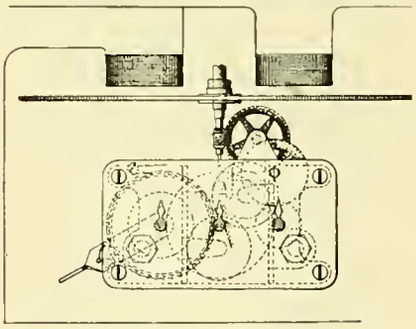
A portable lifting magnet has a magnetizing coil and a frame of magnetic material extending outside of the coil and also partly through the same, the magnetic circuit of the magnet being normally incomplete.

794,112. Service Meter for Party Telephone Lines. James L. McQuarrie, Chicago, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed January 29, 1903.

A service meter comprises a number of counting trains, an actuating magnet, intermediate actuating mechanism, a selecting magnet adapted to move the actuating mechanism into operative relation with any one of the counting trains, and means for controlling the magnets jointly or independently.

794,116. Telephone Attachment. Valentin Rebhun, Schaghticoke, N. Y., assignor of one-half to John Liddle, Hoosick Falls, N. Y. Application filed October 17, 1904.

Telephone apparatus comprises an extensible device mounted at one end to be raised and lowered at the other, which carries the receiver. Connection is placed between the switch hook and the extensible device, and a member operates to maintain the device in one position when shortened and in another position when lengthened.



NO. 794,084.—ELECTRIC METER.

794,117. Electric Spark System. Frank I. Remy and Benjamin P. Remy, Anderson, Ind., assignors to the Remy Electric Company, Anderson, Ind. Application filed November 4, 1904.

The sparking system consists of a transformer having in its primary circuit an alternating-current generator, inductance and means for breaking the circuit. The inductance and the point of break bearing such relation to the angular advancement of the generator that increase of speed will produce an increase of lag of the current of such character that less than a maximum current value is utilized at high speeds.

794,125. Service Meter for Telephone Lines. Charles E. Scribner and James L. McQuarrie, Chicago, Ill., assignors to the Western Electric Company, Chicago, Ill. Application filed July 16, 1900.

The service meter at the station is normally inoperative with respect to currents flowing over the line. Mechanism controlled by the movement of the switch hook is adapted to bring the service meter into operative connection with the line, and means made operative by the hook while in its up position are adapted to counteract the controlling mechanism, whereby the service meter is brought into operative connection with the line only when the telephone is replaced on the hook.

794,134. Telephone Switch. Klas Weman and Henry M. Bascom, New York, N. Y. Application filed October 16, 1903.

The mechanical parts of a telephone switch are described.

794,135. Induction Motor. Edwin C. Wright, Newport, Ky., assignor to the Bullock Electric Company, Cincinnati, Ohio. Application filed November 24, 1903.

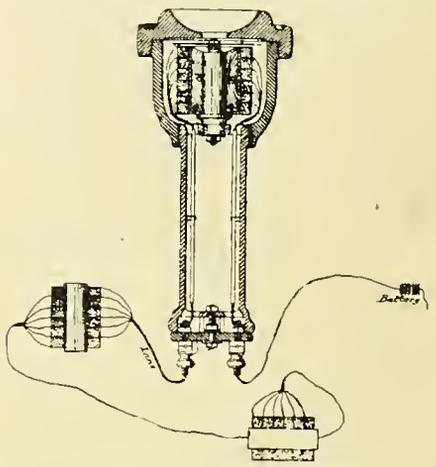
In an alternating-current machine having collector rings are studs fixed to the frame of the machine and sleeves having arms mounted on the studs. Brushes are carried on the sleeves and links connect the arms. A spring tends to keep the brushes in contact with the collector rings.

794,137. Telephone Receiver. Theodore C. Brecht, Washington, D. C. Application filed September 22, 1902. Renewed December 14, 1904.

A metal cylinder carries metal coils wound thereon. Associated with this is a wooden cylinder and a core, a diaphragm being centrally secured to the core. A spring supports the diaphragm and a series of multiple coils, whose ends are connected together at one end and to the line wire, while their opposite ends are connected to a battery. (See cut.)

794,140. Socket or Receptacle Plug. Louis J. Costa, Philadelphia, Pa., assignor of one-half to David Hall, Garrett, Philadelphia, Pa. Application filed April 16, 1904.

A socket or receptacle plug is composed of an exterior portion, an inner neck and a packing-supporting shoulder on the plug intermediate of the portion and neck.



NO. 794,137.—TELEPHONE RECEIVER.

794,142. Telephone Switchboard. Eugene Darnell, Carrollton, Mo., assignor of one-half to Harry H. Wilcoxson, Lulu Wilcoxson, Harry W. Tull and Frank E. Lovell, Carrollton, Mo. Application filed April 30, 1904.

A telephone switchboard comprises a series of individual switches, one for each subscriber, and a movable connector for each switch, each connector having two terminals arranged to be simultaneously adjusted by the switch. These are combined with a relatively stationary connecting bridge having two insulated faces adapted to connect the two terminals of one switch connector to the corresponding two of any other connector.

EXPIRING PATENTS.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on July 10, 1905:

385,727. Electric Motor for Street Cars. W. S. Salisbury, Chicago, Ill.
385,760. Electric Battery. W. P. Kookogey, Brooklyn, N. Y.
385,770. Protector for Electrical Instruments. G. W. Mingle, Philadelphia, Pa.
385,774. Device for Lighting and Heating Cars by Electricity. DeWitt C. Roberts, Chicago, Ill.
385,782. Electric Switch. S. S. Wheeler, New York, N. Y.
385,787. Electric-railway System. E. M. Bentley, New York, N. Y.
385,815. Electrical Switch. J. E. Mayo, North Manchester, Conn.
385,826. Multiple Switchboard. A. Sechrist, Greeley, Colo.
385,839. Mechanical Telephone. S. D. Brear, Winona, Minn.
385,846. Wiring Switchboards. J. A. Cook, Detroit, Mich.
385,863. Multiple Switchboard. M. G. Kellogg, Hyde Park, Ill.
385,894. Electrical Annunciator. M. M. Wood, Erie, Pa.
385,902. Electric Railway. E. M. Bentley, New York, N. Y.
385,903. Switch on Overhead Lines in Electric Railways. E. M. Bentley, New York, N. Y.
385,915. Electric Conductor. L. Daft, Plainfield, N. J.
385,927. Coin-operated Induction Coil. J. W. Hazell, Baltimore, Md.
385,928. Electric Railway. E. W. Heald, Wilmington, Del.
385,943. Commutator for Dynamo-electric Machines. F. B. Mitchell, Columbus, O.
385,956. Electric Telephone. N. Parks, Deansville, N. Y.
385,963. Railway Signal. E. A. Sharp, Rogers Park, Ill.
385,964. Electric Signal for Railways. E. A. Sharp, Rogers Park, Ill.
385,974. Telephone Central-station Apparatus. T. N. Vail, Boston, Mass.
385,975. Telephone Sub-station Apparatus. T. N. Vail, Boston, Mass.
385,976. Telephone Central-station Apparatus. T. N. Vail, Boston, Mass.
385,977. Telephone Central-station Apparatus. T. N. Vail, Boston, Mass.
386,059. Telegraphic-recording Apparatus. C. Cuttriss, New York, N. Y.
386,066. Electric Lock. F. J. Gridley, Chicago, Ill.
386,071. Magneto-electric Machine. W. Humans, Cambridge, Mass.
386,085. Electric Railway. E. E. Ries, Baltimore, Md.
386,086. Driving Mechanism for Electric-railway Cars. E. E. Ries, Baltimore, Md.
386,087. Combined Electric Railway and Wire Conduit. E. E. Ries, Baltimore, Md.
386,088. Method of Welding by Electricity. E. E. Ries, Baltimore, Md.
386,090. Electric Battery. I. L. Roberts, Brooklyn, N. Y.

WESTERN ELECTRICIAN

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LIBRARY OF ELECTRICAL ENG'G

Modern Norwegian Hydro-electric Station.

By Frank C. Perkins.

One of the finest electric-power transmission plants in Norway is that on the Glommen River, near Kykkelsrud. An exterior view of this hydro-electric plant showing the tailrace at the right and the hydraulic intake at the left is to be seen in Fig. 2. Fig. 1 shows the interior of the station. The large vertical alternators are to be noted at the right in the background, the two vertical-turbine direct-driven exciters and governors are in the foreground and the switchboard gallery and equipment are to be seen at the left.

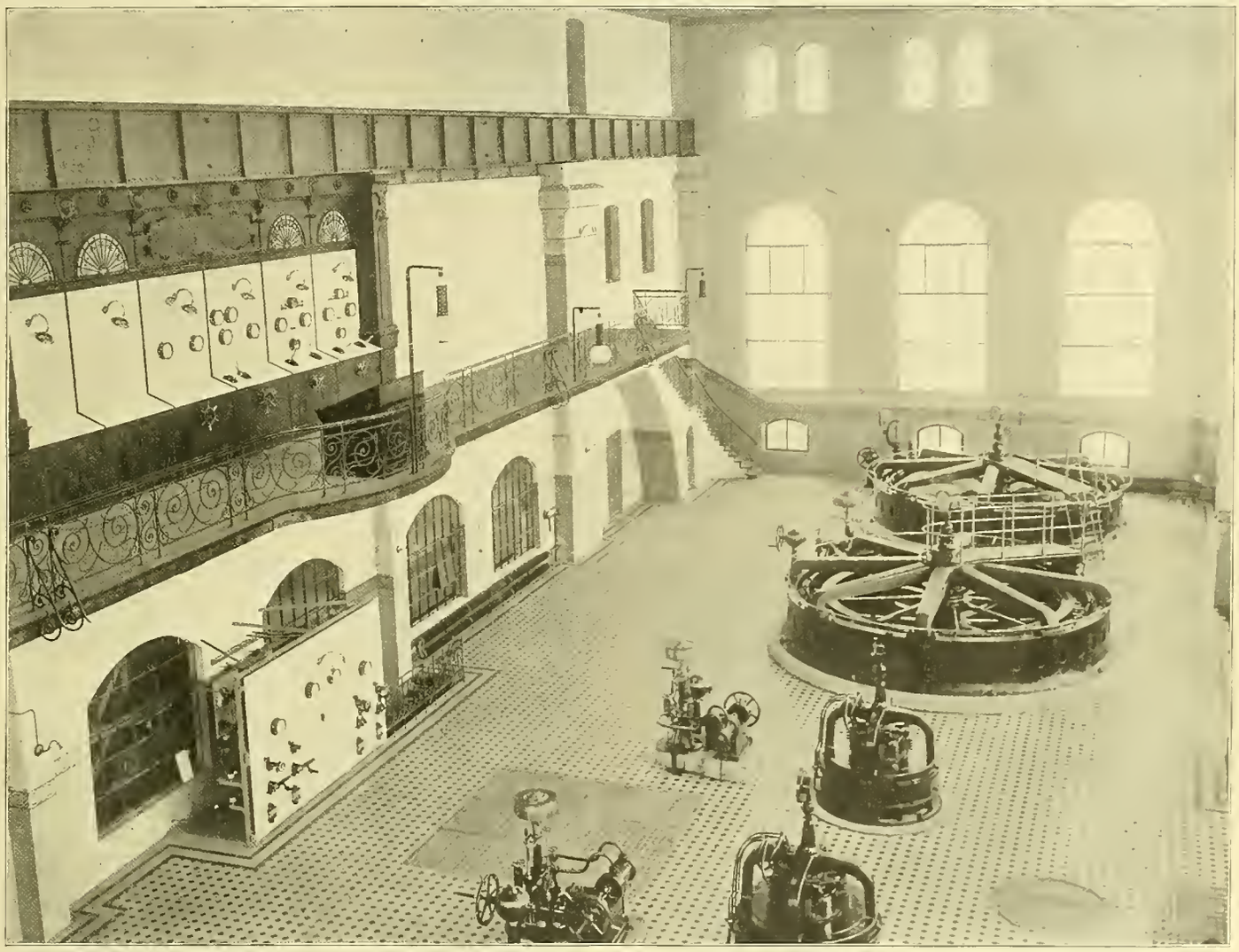


FIG. 1. MODERN NORWEGIAN HYDRO-ELECTRIC STATION.—INTERIOR OF GENERATOR ROOM IN POWER STATION NEAR KYKKELSRUD, ON THE GLOMMEN RIVER.

The rear of the switchboard, showing the rheostats above the framework, and the high-tension conductors and the oil switches are shown in Fig. 4, while Fig. 3 gives an excellent idea of the arrangement of the step-up transformers utilized for raising the pressure of the three-phase current to 20,000 volts for use on the long-distance power-transmission line. This station supplies current for the city of Christiania, Norway, and was equipped with electrical apparatus by the Siemens-Schuckert Company of Berlin, Germany.

The Glommen plant is provided with two single Francis turbines with vertical axes and cylindrical speed gates constructed at Zurich, Switzerland, by Escher, Wyss & Co. These turbines each have a capacity of 3,000 horsepower, operating under a net fall of 19.16 meters, or about 62.9 feet. The cylindrical speed gate is placed between the guide and the runner, and the weight of the revolving part of the turbine is balanced by forcing oil under pressure into the thrust bearing. The regulation as to speed is provided by an automatic oil-pressure governor. The vertical turbine shaft drives the direct-connected alternator at a speed of 150 revolutions per minute. The two small exciters shown in the foreground in Fig. 1 are directly coupled to 280-horsepower vertical turbines. These direct-current dynamos have each a capacity of 181.7 kilowatts and supply current not only for exciting the field coils of the large three-phase generators, but also for lighting the station.

The large three-phase alternators of the vertical type each have a capacity of 2,500 kilowatts and supply a three-phase alternating current having a frequency of 50 periods per second. These machines have field magnets with 40 poles, the above frequency of current being obtained by a generator speed of 150 revolutions per minute.

The switchboards are mounted partly on the floor level of the generator room and partly in the switchboard gallery five meters above. Switchboard panels are provided for four generators as well as for four long-distance transmission lines, the pressure on which is 20,000 volts. Oil switches are provided for the 5,000-volt and 20,000-volt circuit, the high-tension conductors being mounted on an iron framework with porcelain insulators back of and below the switchboard panel. The step-up transformers, shown in Fig. 3, are six in number and raise the pressure to 20,000 volts. The capacity of each transformer is 950 kilowatts.

The total number of transmission lines includes four circuits to the north and one to the south. The northern transmission lines are 63 kilometers in length, two rows of poles being provided on each of which are installed two circuits of three conductors each, the cross-section of the wires being 50 square millimeters. One of the transmission lines connects the power station with the transformer sub-station at Slemmespad, a distance of 87 kilometers, the three conductors forming the circuit having a cross-section of 35 square millimeters. On the long-distance transmission line there are altogether seven sub-stations, each equipped with oil-insulated transformers, which reduce the pressure of the current on the transmission line at 20,000 volts to 5,000 volts for the distribution circuit, smaller transformers being utilized at various points for reducing the pressure to 220 volts for operating incandescent and arc lights as well as motors.

The river Glommen is one of the largest rivers of Norway and tributary to it are a number of lakes, the largest, Lake Mjosen, having an area of 359 square kilometers. The greatest depth is 450 meters and it is situated 123 meters above the sea level. South of Lake Mjosen, a distance of about 60 kilometers, lies Lake Oieren, located 123 meters above the sea level, the latter being fed by the Glommen River and receiving also the overflow of Lake Mjosen through the Vormen River. The power house is located near Kykkelsrud, on the Glommen, about 63 kilometers from Christiania, with an available waterfall of 19 meters and a flow of 260 cubic meters per second.

The station is designed for a total capacity of 12,000 horsepower, in four large units of 3,000 horsepower each, as already mentioned. An additional 1,000 horsepower includes the three direct-current vertical units of 280 horsepower utilized for

exciters and general lighting purposes. Provision has also been made for a southern addition to the power station to contain three turbines, each having a capacity of 5,000 horsepower. This station, all in all, is one of the most unique and thoroughly up-to-date hydro-electrical power plants in Norway.

The generator room, as shown in Fig. 1, is well

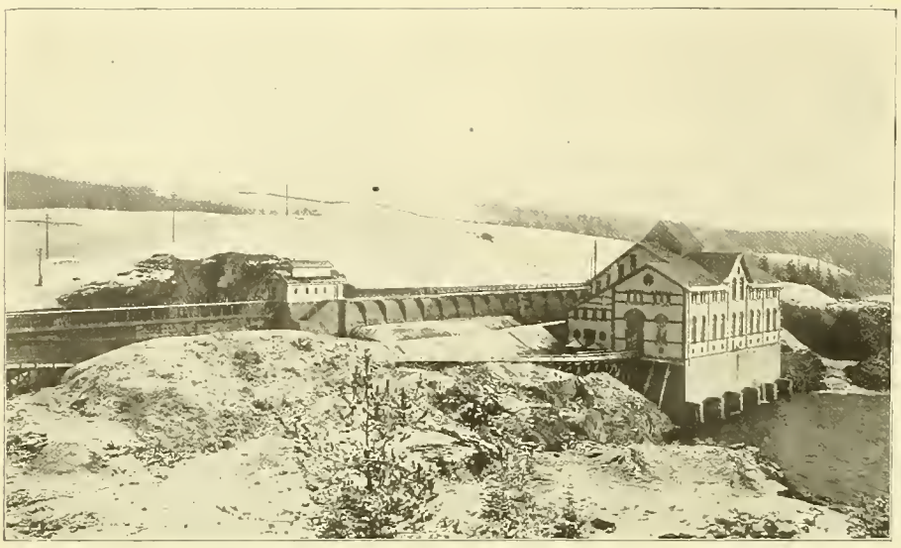


FIG. 2. EXTERIOR OF NORWEGIAN HYDRO-ELECTRIC POWER PLANT ON THE GLOMMEN.

arranged, clean and neat without excessive ornamentation, while the switchboard and high-tension apparatus, as shown by the other illustrations, is neatly and substantially installed.

Detroit Tunnel of Michigan Central Railroad.

President W. H. Newman of the Michigan Central Railroad Company announces that the construction of the Detroit tunnel from Windsor, Ont., to the west Detroit yard of the Michigan Central, including the "electrification" thereof, is placed in charge of an advisory board of engineers, consisting of Mr. William J. Wilgus, vice-president of the New York Central and Hudson River railroad, Mr. Howard Carson, consulting engineer, and Mr. W. S. Kinnear, chief engineer of the tunnel company.

The chief engineer will be in direct charge of construction, reporting to Mr. H. B. Ledyard, chairman of the board of directors, on executive and financial matters, and to the board of advisory engineers as to plans, specifications and methods of doing the work.

It is understood that the land necessary for the changes in track and for the tunnel approaches is now under option.

Submarine Signaling.

The work of Arthur J Mundy of Boston in connection with submarine signaling is well known, and a system for the transmission of articulate sounds devised by him, and using water as the medium for the transmission of the waves or impulses, was described in the Western Electrician of September 17, 1904. The waves are transmitted through the water between the signaling apparatus at the two stations and impinge on the receivers, which are similar to telephone receivers, the sounds being interpreted by the apparatus in much the same way as in the ordinary telephone. Mr. Mundy has recently taken out a patent on an improvement to this system in which the sound-transmitting portion of the apparatus or the part which takes the vibrations from the water is arranged to be dragged some distance behind the ship, somewhat after the manner of the ordinary troller for fishing. It was found that the throbbing of the machinery on the vessel disturbed the diaphragm of the transmitter in the original apparatus and interrupted the communication; therefore it is placed by the new arrangement out of reach of such vibrations.

The receiver, or the part which takes the vibrations from the diaphragm and converts them into sound electrically, is located on board and connected by a cable with the transmitter as it moves along beneath the surface of the water. The electric relation between the transmitter and the battery on the vessel is such that the electric circuit from the transmitter to the battery and receiver is automatically established upon the submerging of the holder, remains established while it is submerged, is automatically broken upon the removal of the holder from the water, and remains broken while it is so removed from the water and inactive.

In relation to the matter of submarine signaling in general, some recent developments are of interest. The shipping federation of Canada has decided not to adopt the submarine bell system, which, it was expected, would be taken up by the steamships using the St. Lawrence route. The minister of marine for Canada and a number of shipping men were greatly interested in the system and made an inspection of it during a special trip on the Atlantic last year. The company operating the system agreed to supply the apparatus to each steamer at a cost of $500 apart from the large amount which the government would have to spend in providing the system throughout the river and Gulf of St. Lawrence.

A report comes from New York to the effect that the micro-telephonic signal detectors, previously reported to have been used experimentally on certain Atlantic liners, have proved so successful that they are to be attached to all the vessels in the fleets of the Cunard and North German Lloyd companies.

Addition to Power House of South Side Elevated Railroad in Chicago.

Work is now under way upon an extension to the system of the South Side elevated railroad in Chicago, and with the completion of this work an increase to the already overloaded power plant becomes imperative. The present power plant, which is located at the corner of State and Fortieth streets, began operation May 1, 1898. It has a present normal full-load capacity of 7,700 kilowatts, all in direct-current generators, developing a pressure of 630 volts. In connection with this plant there are two storage batteries floating on the line, one at Twelfth Street and one at Sixty-third Street, each having a capacity of 750 kilowatts.

The conditions of overload are unusually severe. The 24-hour average load on November 17, 1903, as an example, was 4,981 kilowatts, with a three-hour period during which the average load was 7,578 kilowatts, and a one-hour load of 8,028 kilowatts. The maximum peak during that period was 12,500 kilowatts. Under such conditions as these it is evident that, with extensions to the line and the operation of more cars, the facilities for producing power must be greatly increased.

An extension to the power plant has therefore been planned, and work upon the building has been begun. The elevated-railway company has bought the old car barns of the Chicago City Railway Company just north of its present power plant, giving it now all the ground on State Street from Thirty-ninth Street to Fortieth Street. The addi-

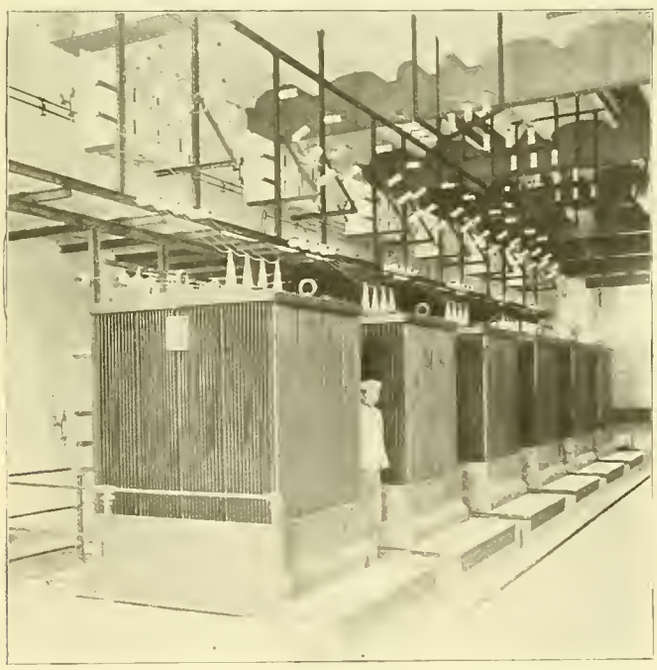


Fig. 3. 20,000-volt Transformers for Raising Potential for Transmission to Christiania.

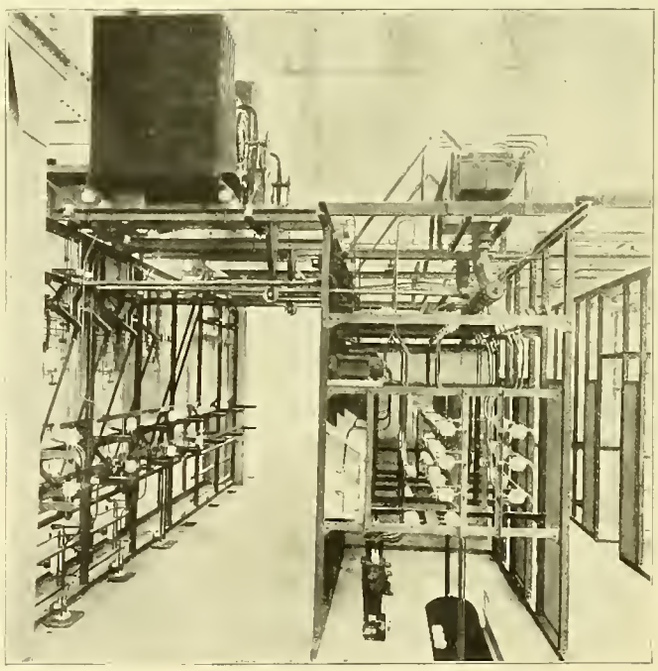


Fig. 4. High-tension Conductors and Oil Switches.

MODERN NORWEGIAN HYDRO-ELECTRIC STATION ON THE GLOMMEN RIVER.

tion to the plant is being erected on this site. Two more generators will be installed, each having a capacity of 2,000 kilowatts. A third storage battery will also be installed, at Thirteenth Street, having a capacity of 2,000 kilowatts. These additions are expected to be completed some time in November. Sargent & Lundy of Chicago are tht consulting engoneers. They have had charge of all the electrical construction undertaken by the South Side Elevated Railroad Company.

Fessenden's Latest Work In Space Telegraphy.

A number of patents dated July 4th were issued to Reginald A. Fessenden of Washington, D. C., for various improvements to space-telegraph apparatus. One of these, which is particularly interesting, consists in improvements to a system patented by Mr. Fessenden in 1902, by which it was proposed to transmit articulate speech through the ether.

Fig. 1 shows the general arrangement of the original apparatus. Direct-current generators (3) in series are driven by a suitable motor. In Fig. 1 are also shown means for the generation of

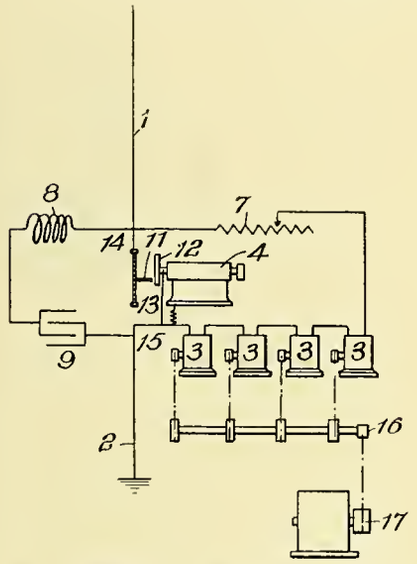


FIG. 1. FESSENDEN'S TRANSMITTER FOR ARTICULATE SPEECH.

electromagnetic waves substantially similar to those shown previously in United States letters patent No. 706,742, the continuous-current dynamos (3) (one, two, or more in number) being driven by a suitable motor (17), and having their terminals connected to the sending conductor and to ground. Suitable means are employed, as shown at (7) for regulating the flow of current from the generators. A circuit, including an inductance and a capacity, is arranged in operative relation to the sending conductor and spark-gap (which is grounded) for the purpose of maintaining sustained oscillations of practically constant frequency. One of the terminals (11) of the spark-gap is attached to a diaphragm, which, for telephoning, would form the diaphragm of a transmitter. This terminal is electrically connected to the conductor (1). The other terminal of the spark-gap is formed by a disk (12) on the shaft of a suitable motor adapted to impart a high peripheral speed, which may be as high as seven miles per second, to the disk, and so arranged that the sparking terminal (11) is eccentric to the axis of the disk. The terminals of the spark-gap may be formed of any suitable material, as platinum, iridium, aluminum, or carbon. One of the terminals is connected to the sending conductor and the other to ground through a brush bearing on the disk or its shaft. The circuit containing the condenser, inductance, spark-gap, brush and leads is preferably tuned to the period of the sending conductor. As the sparking terminal (11) moves with the diaphragm the vibration of the latter, when acted on by impulses, such as sound waves, will vary the length of the spark-gap, and the discharge of potential will be responsive to the pressure on the diaphragm. With the regulator (7) in a given position the number of discharges per second will depend upon the proximity of the discharge terminals, and this will also influence the potential at which the condenser (9) is discharged, since the potential will depend upon the length of the spark-gap. If the circuit containing the inductance and capacity is tuned to the sending conductor and the regulator (7) is adjusted to cause the number of discharges per second to be the same as the natural periodicity of the sending conductor, the number of discharges per second, and hence the resonance, will be altered by the vibration of the diaphragm. On the vibration of the diaphragm, which will respond to impulses such as sound waves, the radiation from the sending conductor will vary in response to the sound waves, and the radiated electromagnetic waves will reproduce such vibrations in a suitable receiving apparatus. The inductance and capacity may be omitted and the number of discharges per second be made as many as desired by means of the regulator, only the capacity and inductance of the sending conductor being used.

In the improved type, an apparatus shown in Fig. 2 is employed, consisting of a high-frequency generator (18), and a transformer in connection with the generator in order to raise the voltage. A double spark-gap is employed, one of the terminals (25) being connected to the transformer and the sending conductor, the latter connection being formed, if desired, by switch (24). The other outer terminal (23) is connected to ground and to the opposite terminal of the transformer. The intermediate terminal (21), which is electrically connected to the sending conductor, is attached to a diaphragm (22)—as, for example, the diaphragm of a transmitter. On exciting the transformer a discharge may be caused to pass from the terminal (25) to the terminal (21) and thence to terminal (23). The potential across the terminals (25) and (23) may be made to have any desired value by regulating the potential of the transformer (19) or the current flowing in the field circuit containing battery (26) and adjusting the resistance (28). If the switch (24) be left open the potential of the intermediate terminal (21), and therefore that of the upper portion of the sending conductor, will vary with the position of the terminal (21), and on the vibration of the diaphragm—caused by sound waves—the intensity of the radiation from the sending conductor will be caused to vary in a manner corresponding to the sound waves.

The apparatus may be used for the transmission of words, by closing the switch (24) and adjusting the terminals of the spark-gaps so that no discharge passes between terminals (25) and (21), but mainly between terminals (21) and (23). This ar-

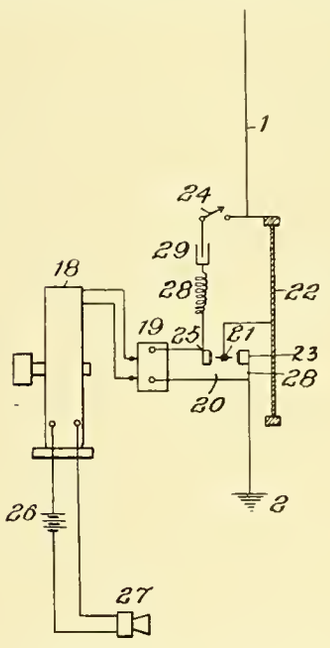


FIG. 2. FESSENDEN'S IMPROVED SPEECH TRANSMITTER.

rangement gives good results, it is said, as the radiation from the sending conductor will vary as the gap between the terminals (21) and (23) varies with the movement produced in the diaphragm by the sound waves. The resistance (28) may be so constructed as to form a flexible support for the terminal (25).

Several phenomena have been noticed in connection with methods of wireless telephony such as this, which are of interest. One is that under certain conditions, not yet fully understood, the pitch of the transmitted speech may be raised, sometimes one octave and sometimes two octaves. This only occurs, however, with certain methods or with certain adjustments, and may in most cases be obviated by altering the adjustments. It does not, however, in any case seriously affect the distinctness of the speech. A second point of interest is the extreme clearness and sharpness with which the speech is transmitted; the sound appearing at the receiving end is as if it did not come from a telephone, but from a person speaking in the room very sharply and clearly. This statement does not, however, apply to the case where a telephone transmitter is used for varying the field excitation, as here the sound seems more like that of an ordinary telephone. One cause of this clearness of articulation is found in the fact that the capacity effect, which is so prejudicial to good speech, is absent in the transmission of electromagnetic waves and the higher hamonics of the voice are transmitted without distortion.

A receiver for space-telegraph apparatus forms the basis of another of Mr. Fessenden's patents and is shown in Fig. 3. The device is in the form of a receiver called a "liquid barretter," in which both the highly oscillatory currents to be detected, and the constantly flowing current from a local source, both flow through a constricted conducting fluid path, and the highly oscillatory

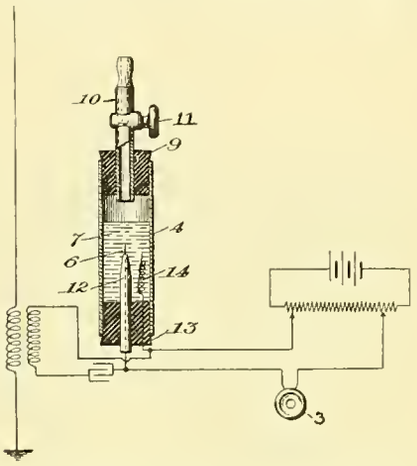


FIG. 3. FESSENDEN'S IMPROVED "LIQUID BARRETTER."

currents produce a change in the amount of current flowing through the local circuit.

A tube, preferably of glass, is closed by plugs (9) and (13), and partially or wholly filled with a suitable solution which may be nitric acid or caustic soda. The plugs are formed of a material incapable of being affected by the liquid in the tube. The fine-wire terminal (6) of the liquid barretter is preferably sealed in a glass tube (12), which is inserted through the lower plug, so that the fine-wire terminal is immersed in the solution. Through the upper plug extends a tube (10), provided with a stop-cock, and capable of being attached to a pump for varying the pressure inside of the glass tube. (14) is the other terminal of the liquid barretter, which is preferably large.

When tube (10) is connected to a pressure pump so that pressure in the tube is raised above atmospheric pressure the signals obtained in the indicating mechanism (3) are much louder and clearer, and good results have been obtained with pressures as high as 40 and 50 pounds per square inch.

Perhaps the most unusual and interesting of the series of patents relate to the aerial apparatus. It appears that almost anything which is a conductor, even to a comparatively small degree, will serve for the antenna. A column of water, therefore, is used by Mr. Fessenden for this purpose. On board ships where the masts have been shot or blown away, or in fortifications where it is desired to transmit for a considerable distance, and where a permanent mast is not practicable, the device shown in Fig. 4 is suggested. In this instance the antenna consists of a column or jet of water, preferably salt, which is forced up into the air by a pump. The most ingenious feature in this device is the coil in the pipe, which takes the place of an inductance or the primary of a transformer having a secondary as shown in the cut.

In practice this coil forms a part of a local oscillating circuit, which contains a condenser, a spark-gap and a source of voltage, preferably a transformer. For receiving, the transformer may be used in the usual manner, the primary being formed by the water coil. Also, by shifting the switches, the condenser and the receiver with its potentiometer and telephone may be connected

across the coil, which in that case forms the inductance.

The general appearance of another form of aerial is shown in Fig. 5. This aerial is formed of a number of sections connected together and provided at the top with a crown or collection of wires radiating from the aerial at points near the top and having their ends connected to a hoop, which is supported by gaffs. The sections are secured together by suitable joints with or without suitable insulation between the sections. In the former case the cylindrical sections are riveted or bolted to castings which are insulated from each other by a fiber washer. Where the sections are so insulated they may be electrically connected by a

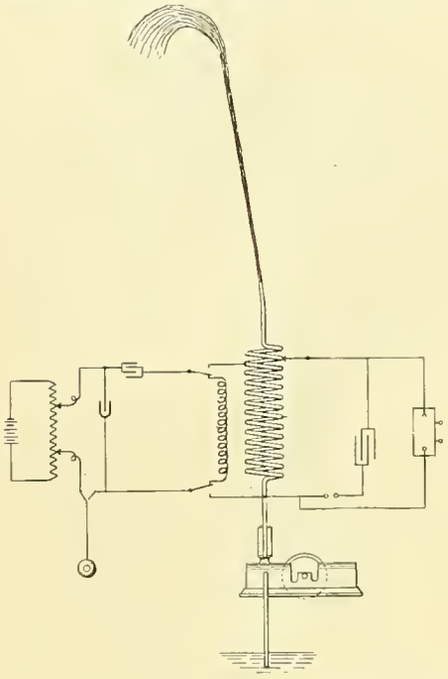


Fig. 4. Water-jet Aerial..

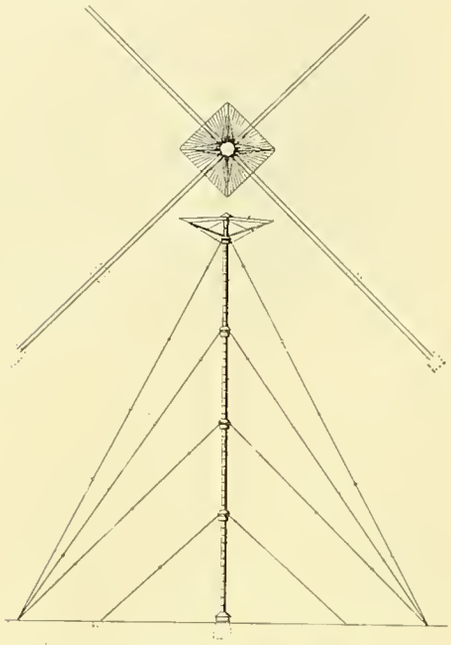


Fig. 5. Sectional Resonant Aerial

FESSENDEN'S LATEST WORK IN SPACE TELEGRAPHY.

suitable means for modifying the wave length. This means may consist of an inductance coil or a condenser, or both. By properly proportioning the inductance or capacity, or both, the antenna may be divided into a number of sections electrically, each section being resonant to any desired periodicity.

Three Concrete Examples of the Results of Municipal Ownership.

The Texas correspondent of the Western Electrician writes that Mayor W. E. Shelley of Austin, Texas, is negotiating with the representatives of Boston men for the sale of the ruins of the old dam across the Colorado River at Austin and the sale or lease of the municipal water and light plant. The dam was built about 10 years ago, at a cost of $1,000,000, but was destroyed by a flood in 1900. It afforded power for operating the waterworks and electric-light plants of the city.

Arrangements have been completed for the transfer of the municipal electric-light plant of Elgin, Ill., to the Elgin, Aurora and Southern Traction Company. The terms of the lease were printed in the Western Electrician of March 4th. The contract provides that the property be turned back to the city at the end of 10 years in as good condition as at present. For this reason the fulfillment of the agreement was delayed until a proper inventory could be made. This has been done, and the company is probably supplying street lights now.

According to the Terre Haute Star, the city of Muncie, Ind., after owning its electric-lighting plant for 15 years or more, may purchase its electricity for street lighting in the future from a private company. "A company has agreed to furnish power and light to the city for street lighting and other purposes at the rate of 3½ cents a kilowatt, and it costs about double that to manufacture electricity at the city power plant. Accordingly, a franchise probably will be given to Jerome Herff of Peru, who will obtain the power for his lighting plant by constructing a dam across Buck Creek, six miles from here, and utilizing a waterfall thus created. The machinery in the city plant is antiquated, and the operation of the concern has become very expensive since the failure of natural gas. The municipality does not feel able to install a modern power plant."

A Russian Engineer's View of Brain Work.

Philip A. Feigin, a mechanical and electrical engineer residing in Evansville, Ind., delivered an address on electricity in that city recently to local stationary engineers and electricians. In the course of his lecture Mr. Feigin, who is a native of Russia, said:

"Electricity is to have a wider field than it has today. You will find it at the bottom of mines, a thousand feet below the earth's surface; you will find it in the mills, in the workshops and on rivers. It will row, it will pump, it will excavate, it will carry, it will draw, it will lift, it will hammer, it will spin, it will print. It will wash, it will cook, it will iron, it will dry, it will sew. It will say to all men and to all artisans, 'Leave off your manual labor; give over your bodily toil; bestow but your skill and reason to the directing of my power, and I will bear the toil, with no muscle to grow weary, no nerve to relax, no breast to feel faintness.' Thus electricity will become a blessing. A man's education, no matter what his business, will not be complete unless he will understand something about this great science. To you men particularly, who have to make a living from it, this subject is of the most vital importance.

"I find that a man's work is appreciated in proportion to the amount of brain that accompanies his work. The man who is only able to dig a ditch, to carry bricks and to do work that requires no brain is placed on a lower standard, for his work is limited by his animal muscular power; but with the introduction of brain into our work, the results become multiplied. James Watt, had he worked with his frail body, would have accomplished but a very small amount of work, but when he introduced brain into his task he accomplished the invention of the steam engine, which does the work that millions of men would have had to do otherwise.

"In Russia, the country from which I came, machinery, the product of the brain, is used much less than here. There, along the banks of the beautiful Volga, hundreds of peasants, harnessed in ropes, are employed to draw piles—work which in this country is done by the little engine. For this reason it is brain against brutal force that decides the greatness of a country. Look how Russia is falling to pieces today because it has not given a chance to its people to use their brains, because it has closed all avenues of education to the enormous population, and look how the little bright Jap, because he has more brains, is able to 'lick' the big Russian bear."

Mr. Feigin has had an interesting career. He was born in Russia in 1873 and had his elementary education in the schools there. His family left the country for political reasons; his oldest brother, being a labor organizer, was in danger of exile to Siberia. At the age of 16 the boy came to this country and learned the trade of piano construction in New York city. He then started out for himself, and, supporting himself by selling and repairing pianos, he undertook the study of mechanical and electrical engineering. By evening work he prepared himself for Sibley College at Cornell, which institution he entered in 1899, graduating in 1903. Shortly after he entered the testing department of the General Electric Company at Schenectady, and later, after taking the civil-service examination, became a draftsman in the United States navy yard at Brooklyn. For the last few months Mr. Feigin has been in Evansville, connected with various local electrical enterprises.

Development of the Incandescent Lamp.

J. T. Marshall recently read a paper before the Electrical Section of the Franklin Institute upon the "Development of the Manufacture of the Edison Incandescent Lamp—1881 to 1905." The author gave in this paper a detailed account of the successive steps in the development of the Edison incandescent lamp from the period of its appearance as a commercial product in 1881 to the present time. The following general facts taken from the first part of the paper serve to show wherein lies the difference between the electric incandescent lamps of 1881 and 1905:

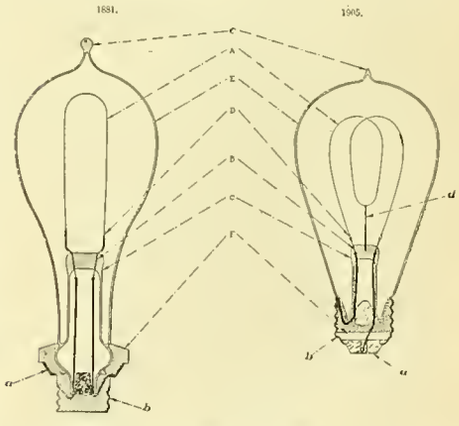
The writer of the paper has been continuously in the employ of the Edison General Electric Company and its predecessors since October, 1881. In that year there were made in the United States about 34,000 very crude-looking Edison incandescent electric lamps, the greater number of which were 16 candlepower, 100 to 110 volts, and 5.8 watts per candle, or eight lamps per horsepower. Their average life to the breaking point was about 3,000 hours, but they declined so rapidly in candlepower as to be very inefficient long before they broke. Lamps then sold for 65 cents apiece, but the cost was more than double this, so that they were manufactured at a loss.

In 1904 there were made in the United States over 45,000,000 Edison incandescent electric lamps of artistic appearance, the greater number of which were 16 candlepower, 100 to 120 watts, and 3.1 watts per candle, or 15 lamps to the candlepower. The average life to the breaking point of lamps as now manufactured is 800 hours, and until the end of their lives the candlepower is very much better maintained than it was in the 1881 lamps at 5.8 watts per candle. If the present lamps were to be burned at 5.8 watts per candle, or at the efficiency at which the old lamps were burned, the life would be 25,000 hours, or over eight times as long as that of the old lamp. Lamps are now sold for an average of 16 cents apiece. The number of lamps now made per operator in the company's factory is several times the number made per operator in 1881.

In 1881 the Edison lamp consisted of a conducting filament of carbon enclosed in a vacuous glass globe and connected through leading-in wires to a source of electric current, which caused the filament to glow. The component parts of the lamp were the filament of carbon, the leading-in wires to which the filament was attached, the glass stem into which the wires were sealed, the joint or clamp by which the filament was secured to the wires, the bulb into which the stem with the filament on it was sealed, and the base to which the exterior ends of the leading-in wires were attached and which, when screwed into the socket, connected the filament to the source of current.

The Edison lamp of today has the same component parts; not one has been added unless the anchor be considered an addition, nor has any one been taken away; all have been more or less modified and improved.

In the accompanying illustration are shown the



DEVELOPMENT OF THE INCANDESCENT LAMP.

lamp of 1881 and the lamp of 1905. (A) is the filament. In the old lamp it is hair-pin shaped and made from carbonized bamboo. In the new lamp it is coil-shaped, thinner and about twice as long as in the old lamp, and is made from carbonized artificial cellulose. (B) shows the leading-in wires of platinum. In the old lamp they are longer than in the new lamp. (C) is the stem made in both lamps from a piece of glass tubing. (D) is the joint or clamp. In the old lamp it is made of a piece of flattened copper wire folded over the shank of the filament and copper-plated to it. In the new lamp it is made of carbon paste which cements the filament direct to the platinum wire. (E) is the bulb. In the old lamp it was "free blown," so that no two bulbs were the same size and shape. In the new lamp it is molded, so that all bulbs are just alike. (F) is the base. In the old lamp it consists of a brass ring (a) and a screw (b) assembled and secured to the lamp with plaster of Paris. In the new lamp it consists of a cap (a) and a shell (b) assembled with molten glass and secured to the lamp with a spe-

cial cement. (c) is the tip left from closing the lamp after exhaustion. (d) is an iron-wire support or anchor to stiffen the filament, and is the only part in the new lamp that does not appear in the old one.

The bamboo splint from which the filaments were cut was 11 inches long, three-eighths inch wide and one-sixteenth-inch thick, with the bark or skin on. It was submitted in turn to the operations of splitting into strips, planing off first one side and then the other, shaving off the bark and cutting out between the shanks on the end. The work was done by hand on specially designed splitters, planes and molds, and, compared with recent methods, involved an enormous amount of labor. The shank left on the end of the filament gave it a broad contact with the clamp, and prevented the heating and volatilization of the copper-plated clamp, which would otherwise have occurred.

Ontario Hydro-electric Power Commission.

Evidently it is the intention of the government of the province of Ontario to make a thorough inquiry into the question of power development, the cost, possibilities, etc., for it has appointed a commission to be known as the Hydro-electric power Commission, which body is composed of Hon. Adam Beck, London, Ont.; Mr. George Pattinson, M. P. P., Prescott, Ont., and Mr. P. W. Ellis of Toronto. Mr. Beck has been selected as chairman, and Mr. Cecil B. Smith is to be engineer to the commission.

HON. ADAM BECK.

The order in council giving the commission instructions for its inquiries reads as follows:

"The present and probable demand for hydraulic and electric power in the various districts capable of being supplied from the different waterpowers within the legislative jurisdiction of the province of Ontario.

"The location, capacity and capital cost of development of the various waterpowers within the legislative jurisdiction of the province of Ontario at present developed, but whose development is required to supply the present and probable needs of the surrounding district, and to ascertain the probable cost of the attendant transmission plants necessary to the utilization of electric or hydraulic power to be derived from the aforesaid waterpowers within the respective surrounding districts.

"To ascertain the rates or prices that would require to be charged the various classes of consumers of hydraulic or electrical power within the respective districts, in order to meet all expenditure of maintenance and operation.

"To inquire into and ascertain the annual savings accruing to the consumers in the various districts aforesaid by the substitution of the rates or prices to be ascertained under the next preceding paragraph, for the rates paid at present in the said district, so far as the commissioners may be able to ascertain or estimate them.

"To inquire into and ascertain the cash capital cost of the hydraulic and electrical power undertakings of existing companies located within the province of Ontario; the capacity and state of development thereof, and to ascertain further:

"(a) The quantities of power supplied and contracted for and the rates charged, and to be charged, under such contracts by these companies for hydraulic or electric power.

"(b) The actual present value of the said undertakings, after making such fair and reasonable allowance for existing conditions as in the judgment of the commissioners seems necessary or expedient.

"(c) The estimated capital outlay, if any, necessary to complete these undertakings."

It is said that the commission proposes to divide the province into four electrical districts, the idea being to select a waterpower in each district from which electrical power may be produced and transmitted to all other points in the district. The four great waterpowers named to supply the respective districts are Niagara Falls, the Chaudiere Falls at Ottawa, St. Mary's Rapids at the Soo, and Kakabeka Falls near Fort William. It is thought by some that power from these centers can be transmitted for 200 miles and still be less expensive than steam power. The object of the commission's report will be to supply information on which the government will base its policy with regard to power development. It is said that the government does not propose to go in for power development itself except as a last resort, but will endeavor to govern and restrict the operations of private corporations, particularly in the matter of rates.

Electrical Features of the Elks' Carnival at Buffalo.

The entire business portion of Buffalo was in gala attire in honor of the nineteenth reunion of Elks, held the week beginning July 10th. Bunting of many colors—purple, the Elks' color, predominating—was draped everywhere in profusion. But if the daylight scene was gorgeous, it was far excelled at night by the electrical decorations which literally turned the night into day.

Through the energy and resourcefulness of General Manager Charles R. Huntley of the Buffalo General Electric Company, the city streets presented a night scene of great brilliance. Niagara electric power had been freely drawn upon, and was used to operate incandescent lamps festooned across the fronts of buildings in "Welcome" signs and in elaborate special designs embodying the characteristic Elk emblem.

The unique feature of this festival of light was a "Mercury-arc Tower" located in Shelton Square. This was a fluted column of staff 75 feet high, studded with 100 mercury-arc lamps. Standing alone, the tower produced a startling effect, due largely to the characteristic greenish light of the mercury-arc lamps. It stood out conspicuously in the mass of many-colored incandescents covering the fronts of the buildings on the square and the radiating streets. The natural curiosity of the people regarding its peculiar color caused a constant jam about its base. Inasmuch as the tower was visible for a long distance up the streets leading from the square, it received a great deal of attention and was freely spoken of as the most original feature of the carnival.

The mercury-arc lamps were operated in two series of 50 lights each, from four-ampere Brush arc machines located in the Wilkison Street station. As each lamp consumes only 160 watts, the operating expense was extremely low for so brilliant a spectacle. They are of the standard type for outdoor lighting, as developed under the direction of Dr. C. P. Steinmetz, and manufactured by the General Electric Company.

The new use of the mercury-arc lamp on a large scale marks a step in electric lighting for decorative purposes. The incandescent lamp is thought by some to have reached its climax for general illumination and for decorative effects at the Pan-American Exposition four years ago in Buffalo, and it is interesting to note that the latest development in this branch of the art should be successfully tried in the same city, and using also Niagara power.

The luminous tower was a special contribution to the carnival by the Niagara Power Company, the Cataract Power and Conduit Company, and the Buffalo General Electric Company. Mr. Huntley conceived the idea, and designs were prepared by the illuminating engineers of the General Electric Company and this company furnished the material and superintended the installation. The most elaborate decorative feature of the carnival utilizing incandescent lamps was located at the corner of Main and Seneca streets. This was a regular cobweb of wires studded with incandescent lamps of various candlepowers, the whole structure being crowned with four massive Elks facing the different quarters of the globe. It is stated that 4,000 lamps were used in this one feature. Many of the business houses of Buffalo employed experts to decorate the fronts of their buildings, and the results were decidedly pleasing. On account of the carnival, many stores increased their window lighting or added new signs which will remain permanently. Thus, the celebration not only increased to a very large extent the temporary lighting of the local company, but has added not a little to its permanent load.

The electric power plant of the Delaware and Hudson Coal Company, Wilkesbarre, Pa., is being enlarged, and within the next few weeks the company will operate and illuminate all its collieries in the vicinity by electricity. The small locomotive will give way to the motor cars, and the mine mules will be a thing of the past. The company in a small way gave the electric devices a systematic trial, which proved more successful than was at first hoped for.

Boston Electrical Exhibition Opened.

Boston, July 15.—The electrical exposition held here in connection with the annual convention of the National Electrical Contractors' Association and the Electrical Contractors' Association of Massachusetts was opened this evening with a large attendance. There were no formal exercises, that feature being reserved for the convention days next week. The exhibition hall was crowded with spectators, however, and the large variety of scientific exhibits gave undoubted satisfaction to those present. Wireless telegraphy, the X-ray, imitation lightning and motor applications of many kinds were the chief attractions. The exhibition was witnessed by thousands of people from Boston and the surrounding places. B.

Chicago Street-railway Situation.

According to information gained at the city comptroller's office, A. B. Dupont, the street-railway man of Detroit whom Mayor Dunne asked to come here and assist him in his municipal street-railway project, will arrive in Chicago this week. It is given out that Mayor Dunne considers B. J. Arnold's plans for the proposed new street railway too elaborate and expensive for the city to take up at this time. He believes that Mr. Dupont can devise a less expensive system and still supply the city's needs. This is given as the mayor's reason for employing the Detroit expert.

It has been announced that the Union Traction interests are to join with the Chicago City Railway Company to negotiate anew with the city for the sale of their lines.

"MERCURY-ARC TOWER" AT ELKS' CARNIVAL, BUFFALO.

James Hamilton Lewis, the new corporation counsel, has taken his office. According to published interviews, Mr. Lewis is not fully in accord with the mayor's traction ideas. He evidently believes in instituting condemnation proceedings against the traction companies and put an end to "dilly-dallying." Speaking of the referendum, Mr. Lewis is quoted as saying: "I believe the people are too busy to know what ought to be done in public matters. They are seldom capable of judging for themselves about public matters."

The report of James Dalrymple of Glasgow, giving his ideas of Chicago as a field for municipal ownership, has not yet been made public by Mayor Dunne. Horace Andrews, president of the Cleveland electric railway, is said to have received a letter from Mr. Dalrymple in which the Scotch municipal-ownership expert declares that in his belief it would be a mistake on the part of the company to lower the fare in Cleveland under five cents and give universal transfers. He argues that a five-cent fare with a transfer yields about the same revenue as a graded fare without a transfer.

The Smith Light and Power Company of Bolivar, Mo., has secured a franchise at Cottonwood Falls, Kan., and will put in a new electric-light plant.

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DATES AHEAD.

Ohio Electric Light Association (annual convention), Hotel Victory, Put-in-Bay, August 16th to 18th.

International Association of Municipal Electricians (annual convention), Erie, Pa., August 23d, 24th and 25th.

Old Time Telegraphers' and Historical Association (annual meeting), New York city, August 29th to September 1st.

American Electrochemical Society (general meeting), Bethlehem, Pa., September 18th, 19th and 20th.

American Electrotherapeutic Association (annual meeting), Academy of Medicine, New York city, September 19th, 20th and 21st.

American Street Railway Association (annual convention), Bellevue-Stratford Hotel, Philadelphia, September 25th to 29th.

AS SHOWN by the account of the electrical features of the Portland Exposition given in the Western Electrician of last week, the electrical visitor will find not a few things of especial interest to him, both in the pleasing illumination of the grounds and buildings (including the ingenious under-water lighting) and among the exhibits in Electricity Building. In the latter display there are shown several novelties that are sure to attract attention. The exposition is also noteworthy in having no generating plant, current being taken from a central-station company well equipped to supply it. This arrangement is no doubt a very sensible one. Electrically considered, the Lewis and Clark Exposition appears to have been wrought with intelligence and good taste—a result that was to be apprehended from the fact that an electrical man is at the head of it.

ELECTRIC-FAN weather brings gratefully to the attention of many who work in offices and shops the comforts of this bit of ministering mechanism. There are some captious persons who declare that the revolving fan merely agitates the air and does not cool it, but even if it is admitted that the apparatus as commonly employed has no refrigerating attachment, the breeze is certainly an amelioration when the thermometer is in the 90's, to say nothing of the soothing murmur (good fans do not hum, nowadays) that tells of sturdy and unceasing effort at alleviation. The man who invented the electric fan may not have inscribed his name on the roll of fame with those of Morse, Bell and Edison, but he certainly contributed in no small degree to the hot-weather comfort of his fellow-men, while at the same time he brought the electric motor to the notice of many thousands who would not otherwise appreciate its advantages.

STEAM-RAILROAD noises, such as the blowing of whistles, the sound of escaping steam, the ringing of bells, etc., are the cause of much complaint in cities where the lines run through residence districts, and particularly in Chicago, from the business center of which railroads diverge in many directions. A number of letters on this subject have lately appeared in the Chicago daily papers, the writers asserting, and with perfect truth, that the railroad noises are a nightly nuisance, disturbing the rest of the sick and of light sleepers. In summer, when windows are widely opened, the annoyance is most noticeable. It may be remarked that most of these noises would be obviated by the electrical operation of the trains; and as it is only a question of time, it is hoped, when all railroad terminals in large cities will be "electrified," the noises of railroad operation, so unpleasant to many persons, should before many years be a thing of the past—a reminiscence of a less enlightened age—in all thickly settled communities.

APARTMENT HOUSES of the better class are now provided with gas stoves, refrigerators, sideboards, bookcases and many other conveniences which in older days the householder supplied for himself. In only a few cases, however, does this equipment include a telephone, although many apartment buildings are provided with telephones accessible to the various tenants. However, as the tenant would pay for the maintenance of the telephone, just as he does for the gas which he burns in the stove provided as a part of the permanent equipment, it is not unlikely that before long it will be expected that all high-grade apartments shall be furnished with telephones as a matter of course. The instrument might be as much a part of the permanent furnishing as the speaking-tube, having, however, a vastly greater range of usefulness. It is possible that in case of a tenant desiring the apartment without the telephone service the company might find it expedient, if the instrument was of the popular prepayment type, simply to allow it to remain in its place, considering that in the vicissitudes of apartment-house changes the next man would be glad to have the telephone. Indeed the whole arrangement would be between the telephone company and the tenants, as in the case of the gas supply, the landlord simply arranging to have the instruments installed in the first place, with perhaps a clause in the lease stipulating that they should remain undisturbed in case of non-use.

COLUMBUS, Ohio, is the latest city which, having tried municipal ownership of an electric-lighting plant, finds it unsatisfactory. Mr. A. W. Fields and Councilman M. A. Williams have completed the report of their investigation of the municipal lighting plant in that city for a period covering four years, and they find that it is a failure in the essential matter of furnishing lights cheaper than they could be procured from a private company. For the period covered by the report it is shown that the cost of maintenance was $75,360.52; interest on bonds, $18,171.13, and the estimated depreciation $40,000, making total expenditures of $133,531.65. The cost per light at that rate is $98.91 a year. This report does not cover the new plant that has recently been installed, but this will be watched closely to ascertain if there is really any gain in the operation of a plant by the municipality. If the examination of the record of the new plant is as honestly and thoroughly made as that of the old system appears to have been, there is little doubt that it, too, will show to disadvantage in comparison with the economies of private operation.

IT IS interesting and somewhat surprising to note the great variety of means applied successfully in making the aerial or antenna of a space-telegraph set. The experiments performed by Major Squier, using trees for antennæ, were described in the Western Electrician a short time ago. These experiments aroused much interest not only from their novelty, but from the practical applications which they promised. Another example of a unique antenna is described in a patent recently issued to Reginald A. Fessenden of Washington, D. C., and described elsewhere in this issue. The aerial specified by Mr. Fessenden consists of a jet of water, preferably salt, pumped up into the air, the transmitting and receiving apparatus being connected to the metallic pipe through which the water is forced. A novel feature is the forming of a coil in the pipe which acts either as an inductance or the primary of the induction coil. In practice this coil forms part of a local oscillating circuit, which contains a condenser, a spark-gap and a source of voltage, preferably a transformer. The system is proposed for use on board vessels where the masts have been shot or blown away, or else in land fortifications where a permanent antenna is not desirable.

A SENSIBLE move has been made by the government in the direction of improving our export trade. Electrical manufacturers and exporters, among others, will be interested to learn that the secretary of commerce and labor has just appointed five trade commissioners, two of whom will visit the Orient, while the other three will go to Central and South America and the West Indies for the purpose of investigating trade conditions in those countries with the object of promoting our foreign commerce. During the last session of Congress an appropriation of $30,000 was made for this purpose. After going over the situation very carefully with the chief of the Bureau of Manufactures and other government officials charged with the duty of promoting the foreign trade of the United States, Secretary of Commerce and Labor Metcalf decided that the trade commissioners could do more effective work in the Latin-American countries than they could in the great commercial countries of Europe, in view of the limited appropriation. It is hoped that Congress will increase this appropriation materially during the next session in order that trade agents may be sent to Europe and Africa. There is no doubt that much good could be done by the collection of definite, accurate data as to the channels through which American electrical machinery and appliances may be exported, and especially in the markets south of us, the trade of which legitimately belongs to us. The commissioners who are now en route to their respective destinations have been instructed to report upon transportation routes, docking and warehouse facilities, banking systems and other matters of importance to exporters.

Wiring and Other Electrical Regulations for Chicago Theaters.

In the Iroquois Theater fire of December, 1903, Chicago had such a terrible experience that it revised its wiring regulations for theaters. That fire, although originating in a spark from an arc lamp used on the stage, was not due so much to deficiency in existing requirements as to laxity in their enforcement. And if there had not been further laxity in relation to exits, stage flues, fire-fighting apparatus, etc., there would probably have been no loss of life after the fire started. Nevertheless, in the light of that terrible calamity, the specifications for arc lamps in theaters, for theater wiring and for the control of stage flues have been entirely revised and are now considered to afford effective protection. Herewith are given, for the benefit of all interested in the subject, the present rules and regulations of the Department of Electricity of the city of Chicago relating to spread and lens lamps, as they are called, to the control of stage flues and to the wiring of theaters.

Spread Lamps.

Frame.—The frame of lamp must be made entirely of metal, and no wood used in connection with it. The metal frame to be made of galvanized steel of a thickness equivalent to No. 24 U. S. standard gauge.

Bottom.—Must be made of two thicknesses of metal for strength and be entirely closed, except that the extending rod controlling carbon holders may enter through the bottom, but must be bushed in such a manner that no opening can exist.

Sides.—Must be ribbed or fluted for strength and be entirely inclosed; colored glass or the like may be inserted in the sides, provided it is held in place both inside and outside by a metal washer riveted tightly to the frame.

Back.—Must be entirely enclosed, except that the leading-in asbestos covered conductors are to enter here, protected with porcelain bushings; wires must be sealed inside of bushings with asbestos. Short porcelain bushings having the heads inside of lamp are to be provided and held in place by a suitable flanged ferrule riveted to metal frame.

Top.—Must be ribbed or fluted for strength and be suitably ventilated with a sufficient number of one-half-inch openings and provided with a substantially raised hood having openings at sides; approved gauze wire to be provided outside of casing to cover openings, and substantially and tightly riveted to metal frame to prevent sparks being emitted from the lamp.

Front Opening.—Must be provided with a hinged frame in which ground glass or other glass must be inserted; color holder to be a part of this hinged frame, and frame must be so arranged that it cannot open wider than 60 degrees; the frame of opening must close in an approved manner, and when closed must effectually prevent any spark from getting out of lamp.

Guard.—Must be provided with a one-sixteenth-inch iron or steel guard having a mesh not larger than one inch, and be substantially placed over top and upper half of sides and back of lamp frame; this guard to be substantially riveted to frame of lamp and to be placed at a distance of two inches from the lamp frame.

Lamp Insulation.—Fiber or rubber will not be approved as insulation for metal parts, but mica of suitable thickness and size will be required.

Lamps on Single Standard.—Not more than one arc lamp will be permitted to be supported on a standard.

Switch on Standard.—Knife switches controlling lamps must be encased in one-sixteenth-inch sheet steel box, and arranged in such a manner that the opening or closing of the cover of box will open or close the switch.

Lugs.—All stranded connections in arc lamps and at switch and rheostat must be soldered into lugs having ample contact surface.

Carbon Holders.—Carbon holders which will grip the carbons in a circular manner and cover at least one square inch of carbon surface will be required.

Rheostat.—The rheostat, if mounted on standard, must be raised to a height of at least three inches above floor line, and in addition to being properly inclosed must be surrounded with a substantially attached metal guard having a mesh not larger than one square inch, which guard is to be kept at least one inch from outside frame of rheostat.

Operation.—It will be absolutely necessary to provide a competent man for each lamp, whether "hand-feed" or "automatic," and for the operator to remain at each lamp until the connections leading to lamp have been cut off. It will be necessary in operating lamps to have them so placed that the operator's head will be slightly elevated above the lamp frame, as the safe and proper care of lamps requires looking down rather than up at the lamp.

In case of any improper operation of arc lamps by incompetent operators, this department will reserve the right to order the discontinuance of the use of arc lamps in theaters.

Lens Lamps.

Lens lamps are to be the same as spread lamps, except that the front may be made stationary and door provided on back or side; said door to be provided with spring hinge so as to close properly, and with a rabbet so set that it will positively close opening.

Control for Stage Flues.

Flues or vents over stages in all Class V theaters shall be provided with metal dampers, and shall be operated by a closed-circuit battery or closed lighting circuit.

Magnet operating damper to be wound to take full voltage of circuit it is supplied with, using no resistance device, and must not heat more than normal for apparatus of like construction. Magnet must be located in loft above scenery and be installed in an iron box with tight-closing door.

Such dampers are to be controlled by two switches, one at electrician's station on the stage, and the other at the city fireman's station on opposite side of stage. Said switches are to be standard single-pole switches mounted in substantial iron boxes.

Wiring between switches, magnet, batteries, etc., to be standard No. 14 rubber-covered wire installed in iron conduit. Conduit must properly enter all boxes and be provided with lock nuts and smooth bushings on end.

The above apparatus must be independent of all other devices or apparatus used to control these dampers and its operation must not be interfered with in any way.

Theater Wiring.

1. All fuses used in connection with lights illuminating parts of the house used by the audience, such as auditorium, halls, corridors, lobbies, stairways, etc., and also supplementary lights on the stage, must be enclosed in double fireproof enclosures with a half-inch air space between materials, and be so constructed that there will be six inches between the fuses and the sides and face of enclosure if open fuses are used, and three inches for cartridge fuses. When iron or steel are used the materials will have to be of a thickness of at least one-sixteenth inch.

2. Switchboards accessible from stage level must be protected by an approved guard rail to prevent accidental contact with live parts on board.

3. Approved stage cables will be allowed to connect stage pockets to strip lights and bunch lights, and to extend from border lights to fly gallery panel boxes, but no other exposed wiring will be allowed on any stage or in any dressing rooms, except by special permission.

4. All wires, whether exposed or concealed, except those classed in the above paragraph, must be encased in approved iron conduits continuous from outlet to outlet.

5. Flexible cord will not be allowed in any dressing room, scene room, property room, or on any stage or working portion of any of the above-mentioned houses.

6. Molding will not be permitted to be used.

7. Approved lugs must be sweated to the ends of all stage cables.

8. The use of calcium lights in theaters is strictly prohibited.

All arc lamps used in the building must meet specifications of this department, and are not to be used until stamped "approved" by the city electrician.

9. A competent attendant must be constantly kept in charge of each arc lamp during the entire time such lamp is in use or connected to the live circuits.

10. Pockets for receptacles must contain no gas piping, and must be rendered absolutely fireproof, and must be kept open at the bottom so that no accumulation of rubbish or dust will collect therein. Pockets must be so constructed that live parts of plug will be protected by floor ledge and must be cleaned out before every performance.

11. Pocket receptacles, when permitted, must be wired for a capacity of at least 15 amperes.

12. All stage borders must be constructed of galvanized or enameled iron having a thickness of not less than No. 20 gauge, and must be constructed so that the flanges of reflectors will protect the lamps. Borders must be suspended by wire rope. Fuses must not be placed on borders.

13. Strips are to be constructed the same as the border lights above, except that in the proscenium strips a wire mesh will be required to keep the curtains and scenery from coming in contact with lamps. Other strips are to have iron bands so constructed that they will protect the lamps.

14. Footlights are to be mounted in an iron trough constructed of galvanized or enameled iron not less than No. 20 gauge.

15. General lamps about the stage and dressing rooms must be provided with approved guards. Sockets or lamps will not be permitted on a canvas or other cloth setting.

16. Plugging boxes must be of an approved type.

17. Drop chandeliers will not be allowed in scene setting unless a special permit has been obtained for use in each setting.

18. The use of any special electrical effect, such as lightning, etc., must be approved before being used.

19. All lights in halls, corridors, lobby, or any other part of the building used by the audience, except the auditorium, shall be controlled by a separate shut-off located in the lobby, and controlled only in that particular place.

20. Every portion of the building devoted to the use or accommodation of the public, also all outlets leading to the streets and including all open courts, corridors, stairways, exits and emergency exit stairways shall be well and properly lighted during every performance, and the same shall remain lighted until the entire audience has left the premises. One 16-candlepower incandescent lamp for every 400 square feet of floor space will be considered sufficient for illumination.

21. All stairways and corridors shall be supplied with a supplementary lighting system of electricity, gas or sperm oil, and such system shall be independent of all other lights in such building, and shall be in operation during the entire period such theater is open to the public and until the audience has left the building.

22. All alterations to electrical equipment, and all new work to be installed or used on each attraction must be reported by manager of house and permits be secured before any work is done. (This to include sign work.)

A Denial from Mr. Westinghouse.

The New York World printed a story last week to the effect that George Westinghouse was the originator of a big financial scheme to build electric railways to parallel steam roads all over the country wherever there seemed a chance for profitable competition. A denial of this statement, published in the New York Times, is as follows:

"Mr. Westinghouse's attention having been called to an article in one of the morning papers, he said that he deemed it important to at once deny the statement that there was any Westinghouse scheme to go into the business of building electric railways parallel to or in opposition to steam railways, which statement he characterized as an attempt of unfriendly interests to prejudice the managers of railways against the Westinghouse interests. As to the other statements in the article in question, Mr. Westinghouse sees no occasion to comment on them."

The "other statements" have reference to the report that John F. Wallace had been induced by Mr. Westinghouse to resign as chief engineer of the Panama Canal to take charge of the new electric-railway scheme. No comment would be made on this statement by Mr. Westinghouse, it is said, but a friend of his is quoted in the Times as saying: "Mr. Wallace has been named for almost everything, and it isn't strange that they are coupling him up with Mr. Westinghouse now. Mr. Westinghouse could deny it, but he won't. He prefers not to say anything on the subject."

Electricity on a Duck Farm.

That electricity may be utilized to advantage even in the raising of ducks is demonstrated in a large farm in New Jersey devoted to the raising of these fowls. Current is furnished to this farm by the Public Service Corporation of New Jersey and is used in a great variety of ways. First of all, the eggs are examined in an electric egg tester. Then the incubators are ventilated by electrically driven exhaust fans and it is said that since this application healthier and livelier ducklings are hatched than before. An electric motor mixes the feed (somewhere more than a ton a day) for the full-grown fowls. Electricity also assists in a novel way in the fattening of the ducks for market. In the words of the owner: "Frequently during the night one duck would become frightened at something and set up a quack. Before long the whole 5,000 would be at it and keep on scurrying about in their coops all night. This would materially reduce their weight, even in one night, and was also decidedly unpleasant. I put a small electric light in each coop and kept it burning all night. Ever since then the ducks have been getting a good night's rest, and their market value has been considerably increased."

Report on London Transportation Problem.

The royal commission appointed in February, 1903, to inquire into the means of locomotion and transport in London has issued its report. One of the most striking points of the report is the recommendation of the construction of two great avenues, one, running east and west, to be 4¾ miles long, the other, running north and south, to be 4¾ miles long. Each avenue is to be 140 feet wide with four tramway tracks on the surface and four electric-railway tracks underground. The estimated cost is from $125,000,000 to $150,000,000.

More railways also are needed, and the report says they should be aided by the local authorities if necessary. Shallow subways are regarded as preferable to deep-laid tubes, although the former in some cases are admitted to be impracticable. The opinion is expressed that motor omnibuses never will take the place of the tramways.

The commissioners urge the creation of a permanent body to deal with the question.

Cutler-Hammer Radial-arm Crane Controller.

The illustrations herewith show a new type of crane controller, known as the radial arm, which is placed upon the market by the Cutler-Hammer Manufacturing Company of Milwaukee. In designing these controllers the purpose was to overcome the difficulties met with in former types and to attain, with the most simple construction possible, proper control with the minimum number of points at which arcing could occur as the controller deteriorated in service, and to make certain that when arcing did occur it would be under predetermined conditions and with ample protection. In addition, provision was made for ease of operation, adaptability to all conditions of service, ease of renewals and interchangeability of parts.

In types B and C, the latter shown in Fig. 2 and the former similar, only smaller, these ends were achieved by mounting the front above the resistance, thus giving free accessibility to the connections on the back of the slate. The front itself consists of four sets of segments, the connections of which are so arranged that no reversing sector is necessary. The resistance is also arranged in four sections, each connected to its respective set of segments, making the wiring simple, and eliminating all crowding.

The lever is in three pieces, insulated from each other by large pieces of insulating material, sufficiently massive to withstand any mechanical strain to which they may be subjected in use. Before being separated, this lever is cast in one piece, and all work on it is done with jigs, which insures positive interchangeability.

The blow-out consists of a coil surrounding and embracing the controller shaft on the front of the controller, and the iron of the framework is so disposed as to complete the magnetic circuit and give a powerful blow-out action at each of the four points at which the circuit is broken. The provision of a multiple-protected break for the circuit reduces destructive arcing to a minimum.

A reliable center-indicating device is provided at the "off" position, which enables the operator to feel the central or "off" position, but which will in no way prevent his reversing quickly.

The type A controller (Fig. 1) differs from the above only in the mounting of the resistance, which is of iron-enclosed-tube porcelain insulated construction, and is carried directly by the front. The type A controller and resistance may therefore be removed from the enclosing case and mounted directly in a recess provided, should this be desirable, as is frequently the case in applying it to small trolley-hoist work, etc. Or it may be rotated within the case, so as to permit it being placed in any desired position, as on the sides or top of crane cab. It may also be arranged for rope operation from the floor, in which case a centering spring is provided.

Types B, C and D may be provided with bell crank and link to permit of installation at the back of the cab by levers at the front. Resistance is provided which will give a speed reduction of 50 per cent. under the average load conditions on the crane.

All contacts are of hard-drawn copper, and may be readily renewed from the front of the controller without disturbing any connections at the rear. All brushes are of drop-forged copper, easily renewable and interchangeable, and are so shaped as to ride over the contacts and give a good working contact, even when the contacts have become considerably roughened.

A large number of contacts is used, providing for gradual speed changes, and practically eliminating all sparking between segments.

The controllers are designed to occupy the minimum space consistent with the duty they are required to perform, and their arrangement is such that the operator's view is practically unobstructed.

Arrangements for slow-speed control may be obtained in types B and C. This feature has not been fully developed as yet, but bulletins will shortly be issued covering this feature.

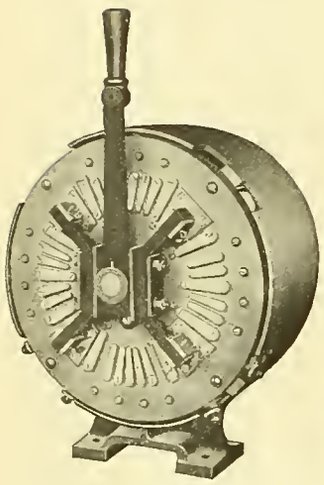


FIG. 1. TYPE A CUTLER-HAMMER CRANE CONTROLLER.

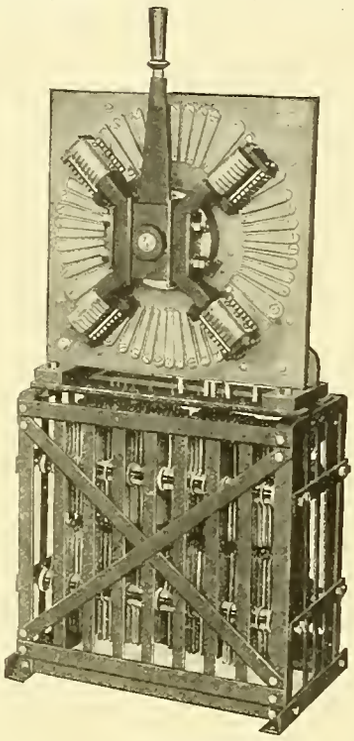


FIG. 2. TYPE C CUTLER-HAMMER CRANE CONTROLLER.

Peru Tie Buttons.

One of the National Code Standard specialties that has been recently developed by the Peru Electric Manufacturing Company of Peru, Ind., is the line of Peru tie buttons, illustrated herewith.

Fig. 1 shows the Peru cleat tie button, which is in reality a cleat and tie button combined. There is a cavity in the cap which accommodates a knot in the cord, relieving the main wires from all strain. Contractors will appreciate the saving feature in this specialty. The manufacturer says that a cleat, two screws and half the time in wiring are saved every time a Peru tie button is installed. Not only is this saving effected, but the result is said to be neater and more workmanlike.

Figs. 2 and 3 show, respectively, the concealed and molding designs of this tie button. The illustrations are self-explanatory and show at a glance the features of value to construction men that are embodied in these specialties. A peculiar feature of the tie buttons will be found in the washer collars that surround the screws and keep them from falling out of the cap. This little feature will be valuable to the practical wireman.

Peru tie buttons are designed for use when soldering the lamp cord to the main wires, and are safe and substantial devices for wiring factories, cellars and all damp places. It will be noted that there are no terminals exposed, and the caps will accommodate a knot in the cord, taking all strain off the main wires.

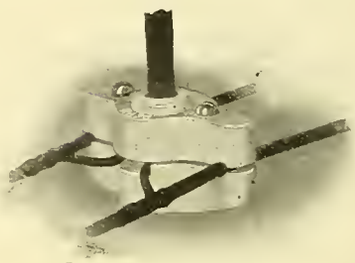


FIG. 1. PERU CLEAT TIE BUTTON.

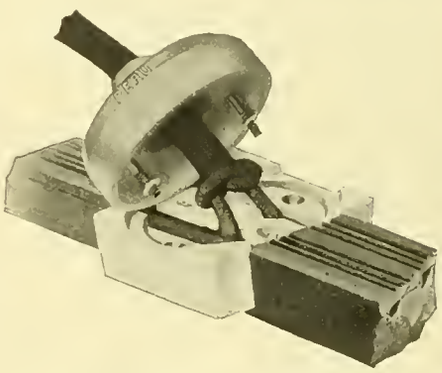


FIG 3. PERU MOLDING TIE BUTTON.

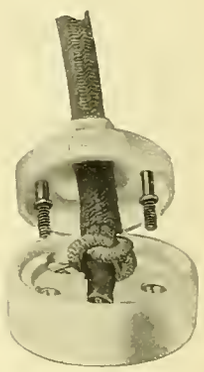


FIG. 2. PERU CONCEALED TIE BUTTON.

Electric Freight Service for Cincinnati.

A plan has been formulated for using seven miles of the Miami and Erie Canal in the city of Cincinnati for a system of tracks to be used to transfer freight cars for the principal railroads entering the city and also to give an entrance to the Cincinnati, Dayton and Toledo branch of the Widener-Elkins electric lines. The tracks for heavy work would be located in the bed of the canal so that cars could pass under all the bridges, while other tracks could be built on the towpath and on the other portions of the property. There would probably be four tracks altogether.

Engineers have completed preliminary estimates for this work, and it is said that $3,000,000 is ready for investment as soon as the plans are ready for execution. The cars are to be hauled by electric motors and many plants will be furnished good shipping service that have heretofore been unable to get it. A committee consisting of Leo Cleybolte, W. H. Alams, W. H. Stewart, Robert R. Reynolds, Walter Arnleide, William Woodal, George Hawley, James J. Hooker and Frederick Tuke is in charge of the matter.

Defendants in Chicago Tunnel Case Discharged.

Albert G. Wheeler, president of the Illinois Tunnel Company, and his fellow defendants charged with forgery in the City Council records relative to the tunnel ordinance, were discharged by Judge Chetlain on technical grounds. "The indictment fails to aver that others relied on the forged record and purchased securities of the tunnel company, and that moneys were invested on the strength of the forged document," held Judge Chetlain. However, the judge says: "It appears from the evidence, which for the purposes of this motion the court must assume to be true, that the tunnel company, knowingly intending to defraud the city, in plain violation of the letter and the spirit of the ordinance, prepared and filed plans with the commissioner of public works for constructing a tunnel of extensive dimensions 30 feet below the street level in all the streets, avenues, alleys and public places in the business district of the city and obtained permits for tunnel construction."

There was talk of instituting quo warranto proceedings to oust the company from the streets, but State's Attorney Healy is quoted as saying that there is little hope of finding grounds for a successful attack on the ordinance under which the tunnel company is operating.

The committee appointed to investigate the relation of the tunnels to the recent sinking of streets in several localities has not yet finished its work. The tunnels were found to be too near the surface in several places, but these portions of the bore were constructed under the ordinance of 1899, which did not specify a depth, leaving that to the commissioner of public works. The ordinance of 1903 fixed the depth at 29 feet, and all work since is said to have been done in strict accordance with this provision.

National Electrical Code.

The National Electrical Code for 1905 is out. This little book gives the rules and requirements of the National Board of Fire Underwriters for the installation of electric wiring and apparatus. The Code was originally drawn in 1897 as the result of the united efforts of the various insurance, electrical, architectural and allied interests, which, through the National Conference on Standard Electrical Rules, composed of delegates from various national associations, unanimously voted to recommend it to their respective associations for approval or adoption. The latest edition appears with the various amendments and additions which have been made since that time.

The following is a list of the associations composing the National Conference on Standard Electrical Rules: American Institute of Architects, American Institute of Electrical Engineers, American Society of Mechanical Engineers, American Institute of Mining Engineers, American Street Railway Association, Associated Factory Mutual

Fire Insurance Companies, Association of Edison Illuminating Companies, International Association of Fire Engineers, International Association of Municipal Electricians, National Board of Fire Underwriters, National Electric Light Association, National Electrical Contractors' Association, Underwriters' National Electric Association.

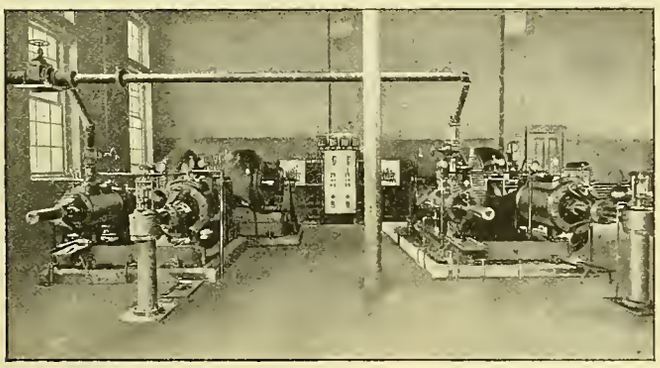
The 1905 edition consists of a book of 139 pages, of pocket size. Further information in relation to it may be obtained from William H. Merrill, Jr., Underwriters' Laboratories, Chicago.

Electrical Compressor Plant of Chicago and Northwestern Railway Terminal in Chicago.

The air-power plant at the terminal station of the Chicago and Northwestern railway in Chicago is an example of the best modern practice in the application of electric power to the compression of air for the many purposes characteristic of railway-yard work. The plant is located in a small brick building in the rear of the main terminal station, close to the Chicago River and adjacent to the extensive passenger yards of the company. This building comprises two rooms, in one of which are the steam boilers for the heating system of the station. In the other section are located the electrical and pneumatic apparatus.

Alternating current is taken from the city mains of the Chicago Edison Company and passed through transformers, reducing it to the working voltage. Part of it is used directly on low-voltage alternating circuits. The remainder is passed through rotary converters or motor-generators and delivered as direct current for power purposes.

The air-compressor plant is made up of two Ingersoll-Sergeant standard power-driven compressors, of the type designated by the makers as class JC. They are duplex two-stage machines, with air cylinders, frames and bearings, mounted on a solid cast-iron bed-plate, which encloses the horizontal intercooler between the cylinders. Both high and low-pressure cylinders are fitted with standard piston inlet valves, and regulation is secured by a standard choking controller on the low-pressure intake. This device, acting to throttle the air-intake passage, is controlled by receiver pressure and automatically regulates the volume of air compressed, and consequently the amount of power consumed, to the demand for air from the power system. The compressors run at constant speed, the controller simply varying the effective piston displacement with varying load. The machines have a stroke of 12 inches, with air cylinders 12¼ and 18¼ inches in diameter. At their speed of 130 revolutions per minute, the free air capacity of each unit is 455 cubic feet per minute. The pressure used in this plant is 70 to 80 pounds gauge.



ELECTRICAL AIR-COMPRESSING PLANT OF THE CHICAGO AND NORTHWESTERN RAILWAY TERMINAL, CHICAGO.

The sub-base is extended in each compressor to support the driving motors, which are General Electric direct-current machines, rated at 80 horsepower and 510 revolutions per minute, on 220 volts. A pinion on the motor shaft gears directly with the teeth on the compressor flywheel, which is of standard weight for machines of this capacity. The gears are protected by proper guards. The units run with a remarkable freedom from vibration and noise.

Independent concrete foundations are used. Each unit has its own automatic oiling system on all bearings, fed from a central tank. The drip is recovered and filtered. Sight-feed oilers care for cylinder lubrication. The illustration shows the arrangement of the air plant. The machines are side by side, the switchboard, rheostats, meters, etc., mounted in front of and between them. An intake duct, supplying both compressors, leads under the floor to the open air and rises beside the power house, terminating in a screen cover for the exclusion of dust and cinders from the yards.

The discharge pipes from the two units in an air main leading to the primary receiver outside the plant. Provision is made for draining this receiver. From this point the line leads to a system of cooling tubes to the west of the power house, made up of a large upper and lower horizontal header, connected by a number of small vertical pipes. This arrangement, freely exposed to the air, precipitates whatever moisture may remain in the air after leaving the primary receiver; and this water is withdrawn from the lower header. From this cooler, air lines radiate throughout the yard, supplying power to the pneumatic switch and signal system controlling the movement of trains in the terminal-track system. Secondary air receivers are also located at suitable places. The air is used almost entirely in this system of switches and signals. But a small portion is diverted to the boiler room, where it is applied in a small air-lift pumping outfit, which supplies water to the terminal.

The New York Central's Electrical Plans.

Contracts for electrical power recently let by the New York Central railroad indicate that the Vanderbilt system is preparing the way a long time ahead for the development of the electric lines along its own steam road. In fact the amount of electric power already contracted for suggests the possibility that something more is in contemplation than the operation by electricity of tributary traction lines. Whether or not arrangements are now being made for electrical power with a view to the possible electrification of a large part of the main line has not yet been divulged by the Central's management, but apparently the road will be in an advantageous position to adopt such a plan should it be found expedient in the near future to do so.

Among the contracts that the New York Central has already entered into for electrical power is one with the Ontario Power Company for all the electrical power that the New York Central requires for the operation of its traction lines from Syracuse west to Buffalo. Another contract has been made with the Hudson River Electric Power Company, under which 4,500 horsepower is now being delivered to the Central lines in Utica and which in its entirety calls for the increase of this power up to 25,000 horsepower as it may be needed. Plans are now under way for the electrification of the main line of the West Shore road between Utica and Syracuse.

The company's own power house at Yonkers, under construction in connection with the terminal improvements now in progress at the Grand Central Station and northward, will be really the nucleus of the first stage of the main line's electrification, and while the matter is necessarily more or less problematical the electrification of the New York section of the New York Central line may in the not distant future prove to have been the entering wedge for the electrification of a much longer section of the road.

Within the last two years the policy adopted by several important systems, including the New York Central and the New York, New Haven and Hartford, of bringing under their control the electric traction lines competing with them between local points along their lines has led to much more extensive purchases of electric traction properties than seemed at all probable when the movement began.

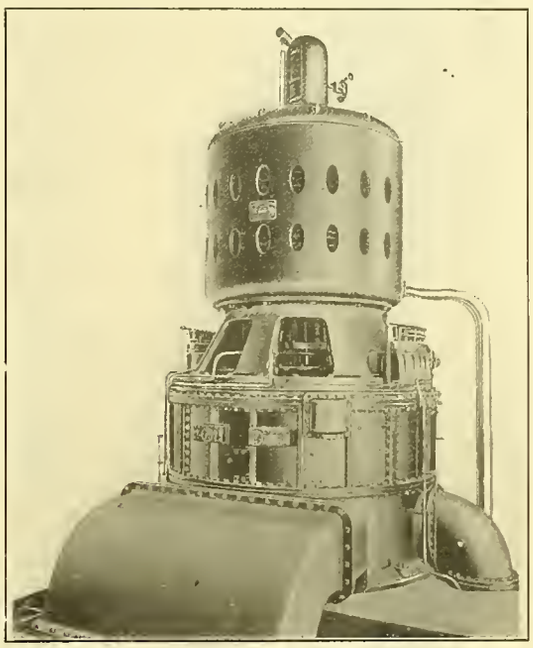
The experience of the roads running from Boston to Worcester in their competition with the electric line between those cities indicates the effectiveness of the competition of electricity against steam, for passenger traffic at least, and this and other similar experiences doubtless amply justify the acquisition by the steam roads of the electric traction lines that are evidently in a position to draw away a very large part of the local traffic of steam roads.

The fact that the New York Central now has along its lines at intervals all the way from New York to Buffalo sources of electrical power the area of effectiveness of which overlaps in most instances, making it possible to secure electrical power at practically any point along the line, shows conclusively that the difficulties in the direction of far transmission of electric power has been overcome, at least to a very large extent, and brings within reach what a short time ago, although admittedly desirable from many points of view, was regarded as impossible of accomplishment in the near future—the electrification of trunk-line railroads.

In pursuance of its plan for the extension of auxiliary electric traction lines the New York Central management some time since created a special department for the direction of these lines. William K. Vanderbilt, Jr., is now in charge of this department.—New York Times, July 16th.

Test of 2,000-kilowatt Curtis Steam Turbine.

A test was made on May 3d in Schenectady, N. Y., by Louis A. Ferguson, second vice-president of the Commonwealth Electric Company, and Frederick Sargent of Sargent & Lundy, Chicago, upon a 2,000-kilowatt Curtis turbo-generator. This machine is of the four-stage type designed in 1903, and recently changed in a few particulars as a result of experiments conducted during the last year. The machine as tested conforms as nearly as possible to the standard four-stage type now being produced, but is less efficient, since the changes made have been confined to the buckets, while several other important changes, which are known to be desirable, could not be made without entirely rebuilding the machine.



2,000-KILOWATT CURTIS STEAM TURBINE RECENTLY TESTED.

Mr. Ferguson and Mr. Sargent sent their assistants, Messrs. Clark and Eastman, to prepare the apparatus, and several preliminary tests were made before the two gentlemen first named arrived, the results of which trials very closely approximated the results of the official tests.

All instruments were very carefully tested and standardized during the trials, the electrical instruments being tested by the New York Testing Laboratory in the presence of Mr. Eastman. The surface condenser showed practically no leakage. The results of the tests were as follows:

FULL-LOAD TESTS.

Duration of test	1.25 hour
Steam pressure (gauge)	166.30 pounds
Back pressure (absolute)	1.40 inches of mercury
Superheat	207 degrees F.
Load in kilowatts	2,023.70
Steam consumption per kilowatt-hour	15.02 pounds

HALF-LOAD TESTS.

Duration of test	0.916 hour
Steam pressure (gauge)	170.2 pounds
Back pressure (absolute)	1.40 inches of mercury
Superheat	120 degrees F.
Load in kilowatts	1,066.70
Steam consumption per kilowatt-hour	16.31 pounds

QUARTER-LOAD TESTS.

Duration of test	1 hour
Steam pressure (gauge)	155.50 pounds
Back pressure (absolute)	1.45 inches of mercury
Superheat	204 degrees F.
Load in kilowatts	555
Steam consumption per kilowatt-hour	18. 9

ZERO LOAD.

Duration of test	1.33 hour
Steam pressure	154.50 pounds
Back pressure (absolute)	1.85 inches of mercury
Superheat	156 degrees F.
Steam consumption per hour	1,510.50 pounds

The Application of Electric Motors to Gate Valves.

Hand, hydraulic, pneumatic and steam-operated valves have been by experience proved inadequate for some purposes and pressures, and with the steadily increasing application of electricity to all kinds of machinery, a large demand has arisen for valves to be operated by the electric motor.

In designing electrically operated valves the conditions governing the application of the electric motor to the valve have been found to differ entirely from their application to all other machinery, inasmuch as the travel is, of course, limited to the size of the valve opening.

The ease with which the Chapman valves can be operated, making them particularly adapted to

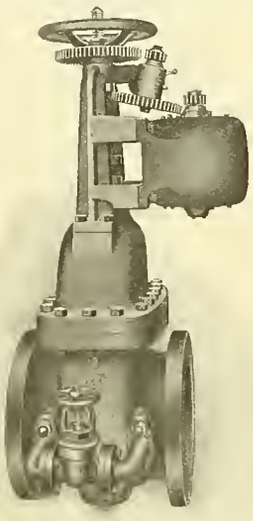


FIG. 1. MOTOR-OPERATED VALVE WITH GEARING DISCONNECTED.

operation with the electric motor, has led the Chapman Valve Manufacturing Company to adopt this method of operating valves and sluice gates. This development practically solves the problem of the rapid handling of large gate valves, under ordinary conditions, and especially in cases of emergency.

The Chapman gate valves are of the double-faced, solid-wedge, plug type, and have a straight-way

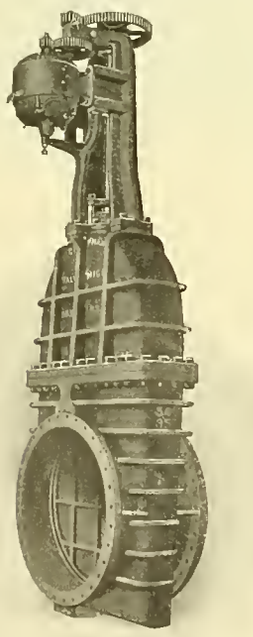


FIG. 2. TEN-TON VALVE ELECTRICALLY OPERATED.

passage the full diameter of the connecting pipe. This is the simplest and strongest design for the purpose. It requires the smallest number of working parts and offers the least resistance to the passage of the fluid. Valves of this class are especially suited for water, steam and oil lines, and for low-pressure work, such as exhaust and condenser piping, pump suctions and discharge sewage, irrigation systems, blast furnaces, etc. They are also extensively used on the receiver piping of compound and triple-expansion engines, and are rapidly coming into use as throttle valves on steam-turbine units.

The problem of motor operation of these valves was rather difficult, but was overcome by a direct-current motor especially designed for the purpose by the General Electric Company, a lost-motion device in the connection gear enabling it to attain a high speed in starting, as it is series wound, before the work of starting the valve plug was thrown on. On account of its peculiar winding, the motor exerts a very large torque at starting, and at the same time strikes a hammer blow, which is bound to unseat the valve, no matter how tightly closed.

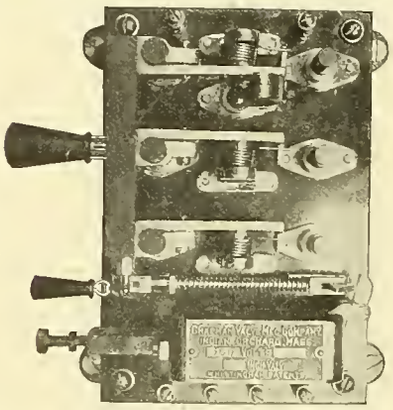


FIG. 3. AUTOMATIC STARTING SWITCH FOR ELECTRICALLY OPERATED VALVES.

Fig. 1 shows a 12-inch Chapman valve, with one-horsepower, two-phase, 60-cycle General Electric induction motor, with gearing disconnected when valve is to be hand-operated.

An example of the effective results obtained by electric-motor operation of large valves is shown in Fig. 2. This is a 54-inch Chapman valve with a five-horsepower General Electric CE motor. The valve weighs approximately 10 tons. In a test it required four men nearly 30 minutes to open it, while, motor-operated, it required less than four

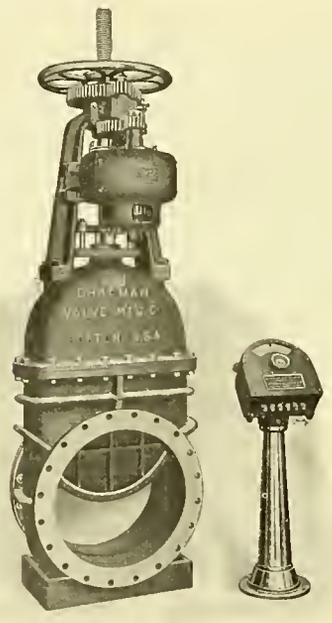


FIG. 4 MOTOR-OPERATED VALVE WITH INDICATOR.

minutes, at a current consumption of only two amperes at 500 volts. This valve is installed as the main exhaust at one of the stations of the International Street Railway Company, Buffalo, N. Y.

A special 14-inch Chapman valve is constructed with a three-fourths-horsepower General Electric CA motor, arranged for use in a vertical pipe line as a throttle valve for Curtis steam turbines, with clutch mechanism for disconnecting the motor when hand-operated.

These valves may be opened and closed at any reasonable distance from the point where they are located, it being only necessary to connect the valve with the operating stations by a two-wire circuit. The automatic switch (shown in Fig. 3) is furnished with all standard equipments. In operating these valves it requires considerable more current to start them from their seat than for the actual operation, and it is, therefore, necessary that some "fool-proof" device be used for the operation of them. By reference to the cut, it will be noticed that a secondary contact is used under the left-hand lever, cutting in or out the circuit breaker, according to the position of the switch blades. When a valve is to be started, the lever is depressed only until the contatc is made, the circuit-breaker not being in circuit during these conditions. But should the operator desire to leave the switch in and go about other duties, the locking automatically cuts in the circuit-breaker, which affords protection to the motor during the remainder of the run, the idea of the device being that the operator has all the current available that the motor will pass, during the unseating, but is protected by a circuit-breaker, as soon as the switch is locked in.

Motors used on Chapman electrically operated valves are made by the General Electric Company of Schenectady, N. Y. These motors are special series wound, having high starting torque with very low speed, and are guaranteed to withstand the rush of current which will ensue should the motor be stalled, or should the circuit-breaker fail to act, for a period of from 15 to 30 minutes, without injury to the windings.

A method of operating the valve through incremental steps of opening and closing, with visual indication of the position of the valve plug or gate at the point of operation, is being developed, and a valve and controller-indicator of this type is shown in Fig. 4.

An Epoch in the Turbine Art.

With the successful closing of recent negotiations for two 7,500-kilowatt Westinghouse turbine-type generating units, the New York Edison Company has inaugurated an important epoch in the history of metropolitan electric lighting in this country by adopting generating units of such large size. The importance of this step is enhanced by the fact that these turbine units will be installed in one of the finest and largest of American central stations, Waterside station No. 2, that ultimately will contain 10 units of the same size. Waterside station No. 1 is equipped with Westinghouse vertical three-cylinder compound reciprocating engines, which, although installed only a few years ago, and then representing perhaps the highest type of large-engine construction, have been outclassed through the rapid advance of the steam-turbine system. No less than 11 of these large engine-type units are now in service in this station, each rated at about 6,500 horsepower capacity and direct-connected to a 3,500-kilowatt generator. The next step in the acquisition of larger units resulted in the installation of 5,000-kilowatt turbine units of the Curtis type.

In the equipment of the new Waterside station with Westinghouse turbine units of still greater capacity, over twice that of the original engine-type units, there will here exist a striking example of the extremely rapid development in power-station construction that has taken place since 1900.

The extreme compactness of the new generating unit is shown by the small space it requires in the new power-station arrangement. Its over-all dimensions are approximately as follows: Length 50 feet, width 17 feet, height 15 feet; floor space 850 square feet per unit net, or 0.113 square foot per kilowatt capacity. This is less than one-half the space occupied by the engine-type units, which were considered the most compact type yet built for central-station work.

A condenser of the surface type will be located beneath the turbine in the foundations proper. This arrangement is in all respects equivalent, according to the makers of the Westinghouse turbine, to that claimed to be incidental only to the vertical type of turbine, which, according to the same authority, requires much extra space for condenser and turbine auxiliaries. The new turbines will operate under 175 pounds steam pressure, approximately 28-inch vacuum and 100 degrees superheat, the normal speed of the unit being 750 revolutions per minute. Under these conditions the economy of the complete unit will be in the neighborhood of 16 pounds per kilowatt-hour at full rated load.

Each unit will have an overload capacity of at least 50 per cent., or will be capable of developing full rated load without the use of a condenser. A distinctive feature of this design is that the turbine gives its best economy around full rated load, although a large overload capacity is at all times instantly available when required without material sacrifice of efficiency. At this maximum load each turbine will be developing over 15,000 horsepower at the shaft, which is believed to be the greatest amount of power ever developed in a single prime mover in stationary service.

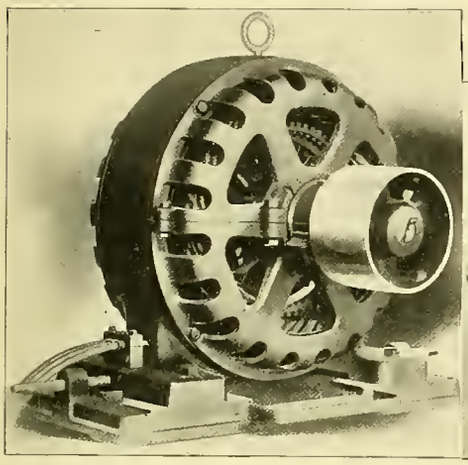
The direct-connected turbo-generators will be of standard Westinghouse construction, delivering 6,600-volt three-phase current to the high-tension network at a frequency of 25 cycles per second. The generators will embody the new enclosed construction which constitutes an important advantage in the entire elimination of the hum peculiar to high-speed turbine generators. They will have an efficiency approximating 97½ per cent. at full rated load. Each generator will be able to sustain for several hours an overload of 50 per cent. within reasonable temperature rise.

It is of interest, in connection with this important installation, that almost simultaneously three Westinghouse turbine units of the same size have been adopted by two large Brooklyn power stations, one for railway and the other for lighting service, making a total of over 50,000 horsepower in turbine machinery of this size. Two units will go to the Brooklyn Heights Railway Company and the third to the Brooklyn Edison Company.

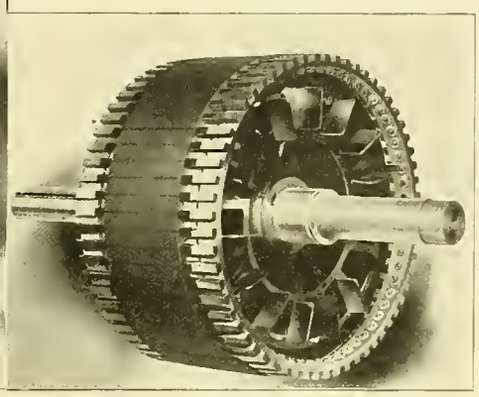
Westinghouse Polyphase Induction Motor.

A new type of polyphase induction motor has recently been placed on the market by the Westinghouse Electric and Manufacturing Company, which is designated as type CCL. These motors are manufactured in sizes from one-half to 75 horsepower and are wound for operation on two or three-phase circuits at voltages of 200 and 400 for all sizes, except the one-half-horsepower. The sizes from one-half to five horsepower, inclusive, are also wound for 100 volts. The accompanying illustrations show a 15-horsepower size of the motor, and also the general appearance of the rotor of this type of machine.

The frame of the motor consists of a solid, cylindrical cast-iron yoke, to the ends of which are bolted brackets which carry the bearings. These brackets are open, so as to provide good ventilation, and may be fastened to the frame in any of four different positions, making the motor suitable for floor, wall or ceiling mounting. Motors up to and including the five horsepower have solid brackets and bearings, with slotted holes in the feet for adjusting the tension of the belt. Larger machines have the brackets and the bearings split horizontally, greatly facilitating the removal of the bearings, should this become necessary. Belt adjustment on these motors is made by tension screws which shift the motor on a cast-iron bed-plate. There are no wearing parts on the machine except the bearings, and as these are of ample dimensions with a light rotor, and flooded lubrication



FIFTEEN-HORSEPOWER THREE-PHASE INDUCTION MOTOR.



ROTOR OF POLYPHASE INDUCTION MOTOR.

is maintained at all times by means of oil rings, the wear is exceedingly slight.

The stationary part of the motor is the primary, or element, which is connected to the source of current. The magnetic circuit consists of circular laminations of sheet steel, securely keyed into the cast-iron frame. Terminal leads are brought out at the base of the frame, held in a cast-iron cleat. Hand connectors or knuckle joints, such as are supplied with railway motors, are used to connect the motor to the supply circuit.

The secondaries of all these motors are of the squirrel-cage type, a construction which is extremely simple, rigid and durable, and which has given universal satisfaction. The winding consists of square copper bars lying in partially closed slots and bolted at the ends to metallic rings of ample cross-section to dissipate the heat generated in them. For the one-half-horsepower motor round bars are used and are riveted to brass or copper rings at each end.

The design and principles governing the construction of these motors are particularly favorable to maintaining good efficiencies at low loads, which insure a high all-day efficiency, as in general service motors may operate at light loads much of the time.

Water Level of the Great Lakes.

Electrical engineers who have inspected the power development at Niagara Falls will watch with much interest the proceedings of the International Waterways Commission, which is holding sessions in various cities along the Canadian border, and which recently met in Montreal. The members of the commission are James P. Mabee, K. C., of Toronto, chairman; W. F. King and Louis Coste; Col. O. H. Ernst of Washington, D. C.; George Clinto of Buffalo, and Prof. G. Y. Wisner of Detroit, Mich. At the Montreal meeting the principal discussion was in regard to the St. Lawrence River and its protetcion, but James Wilson, superintendent of Victoria Park, Niagara Falls, Ont.; Banker R. Paine of the Ontario Power Company; Mr. A. Monroe Grier, representing the Canadian Niagara Power Company, and Mr. H. H. MacRae, representing the Electrical Development Company of Ontario, Ltd., appeared before the board in regard to Niagara interests and solicited a session of the commission at Niagara Falls. To this the commissioners agreed.

No definite plan has been adopted by the commission, which is only now getting the sentiment of all parties whose interests are likely to be affected by any work that will have a tendency to increase the level of Lake Erie for the benefit of the vessel interests.

Physiological Effects of High Frequency.[1]

Assuming that the rapidity of the cycles or frequency of oscillatory currents has a vital bearing upon the therapeutic value of such currents, it becomes most important that the physician should know at what frequency, or between what limits of frequency, the best curative effects are to be obtained.

That the therapeutic effect of an oscillatory current may be closely related to its frequency is perhaps indicated by the differences between the physiological effects produced by a continuous current, or by an alternating current of the comparatively low frequency of 25 to 60 cycles per second, such as the frequency of the current from the ordinary alternating generator used in electric-light and power-transmission plants, and the effects of a current of the undoubtedly high frequency of several thousands or even millions of cycles per second, such as the oscillatory current that can be produced by the apparatus of D'Arsonval, Tesla and Dr. Morton, all of which were described in the report of last year; also by the apparatus of Prof. Elihu Thomson of this committee, described by him in a paper entitled "Notes on the Effects of High Frequency Electrical Discharges Passed Through the Body," and read before this association 10 years ago.

D'Arsonval passed through two persons a high-frequency current of sufficient strength to bring a one-ampere incandescent lamp in series with them up to a white heat, and through his own body a high-frequency current of "more than three amperes" without any other effect than a sensation of heat in the hands.

In the experiments by Prof. Thomson, described in his paper above referred to, the current passing through his body from hand to hand had at times a mean effective strength as great as 1.5 amperes, as gauged by its heating effect upon an incandescent lamp, and produced no other physiological effect than the sensation of warmth at the wrists, which was felt because of the noteworthy generation of heat due to the comparatively high resistance localized at these points of the electric circuit. Physiological tetanus of the muscles was altogether absent. The reason for the absence of physiological tetanus with high-frequency oscillatory currents and its presence with continuous currents, or electric-light and power-alternating currents of the comparatively low frequency of 25 to 60 cycles per second is not at present known with certainty. Some authorities hold that this absence is due to the fact that because of the high frequency such currents are compelled to flow practically on or so near the surface of the body that they do not penetrate to the nervous and muscular systems as would a low-frequency or a continuous current, and therefore have no effect upon them. On the contrary, other authorities believe that the circulatory and nerve channels, compared with the tissues at or near the surface, constitute such superior conductors of electricity that the high-frequency currents flow therein to a large degree in spite of the tendency of the high frequency to force them to the surface, and that the presence or absence of tetanus is governed by the degree of frequency.

And it is this absence of tetanus and the resulting harm that constitutes the most obvious difference between the effects produced upon the living subject by high-frequency currents and those resulting from low-frequency or continuous currents.

The line of demarcation between high-frequency and low-frequency currents, or the frequency at which tetanus begins to stop and immunity from tetanus commences, has not been clearly defined. Experiment has shown that at a frequency of about 10,000 cycles per second tetanus does not take place.

1. From the third report of the committee on current classification and nomenclature read before the American Electrotherapeutic Association at St. Louis, September 15, 1904. W. J. Jenks of New York is chairman of the committee.

Government Relation to Public Franchises.

In an address before the Atlanta convention of the National Association of Manufacturers Mr. Ludwig Nissen of New York spoke of government relation to public franchises, and his remarks were strongly in opposition to municipal, state or government ownership of public utilities. "Our system of government," said Mr. Nissen, "contemplates as little governmental interference with commerce and industries as it is possible to get along with. But that very system of freedom of individual action has fostered into being an evil which now has to be taken cognizance of and curbed in order to preserve the spirit of our constitutional liberties and keep the control and management of all public utilities out of the hands of the very few aggressive and avaricious individuals, which as a finality would perhaps be the only result that could be worse than to lodge such control in the hands of government itself."

Mr. Nissen spoke of the evils of monopoly and the injustices frequently inflicted upon the public by public-service corporations. "The present trend of public opinion in the effort to check the evils of control by monopoly is toward the other extreme —municipal or state ownership. The realization of that principle would mean state socialism. Nothing could be more foreign to the spirit in which the establishment of our government was conceived. It is absolutely un-American, because it is undemocratic. * * * The result would be the destruction of our liberty and our progress. We would go from wealth to poverty, from progress to lethargy, and from liberty to slavery, because we should live in a state of socialism, which aims at equality with the lowest instead of teaching to aspire to the highest. You would crush individuality. Take away the individual initiative and individual incentive to work for personal betterment of conditions, and you will stop the progress of the world."

Because of a desire to help avert a clash between the people and the monopolies, Mr. Nissen wants the law to control the acts of the monopolies as it does control the acts of the people. With that end in view, he offers the following suggestions in the way of remedies:

"First—All public-service corporations should be under strict surveillance of the authority that creates them. They should not be allowed to issue obligations for more than the capital actually paid in. They should be subject to regular examinations by the authority creating them. They should not be allowed to pay any dividends upon stock until they have rendered such service to the public as it is entitled to."

"Second—Whenever a charter or franchise is granted to a public-service corporation it should be granted only on condition that the service rendered by such corporation shall be adequate to the public needs. Such charter or franchise shall be forfeited to the authority that grants it, unless the conditions of service shall be strictly adhered to. Such charter or franchise should not be allowed to be given away, sold, leased or merged with that of any other corporation, except under terms carefully specified by law, which would absolutely protect the people, but should revert to the authority that grants it, when for any reason whatever the corporation having received it does not elect to exercise its privileges, and all public-service corporations doing an interstate business, should be under supervision and control of the national government."

Communication Between Moving Electric Cars and the Train Dispatcher.

At a test made on July 11th on the Indiana Northern Traction Company's line between Marion and Wabash, Ind., Edward McClintock demonstrated that while traveling at a high speed operators of motor cars could talk from one car to another and to the trainmaster in the office of the company in Marion. A small steel rail placed between the rails on which the cars are operated is touched by the metallic brushes extending from the bottom of the cars, and in this way communication is maintained. Three systems of signals are used—by telephone, by telegraph and by electric-light bulbs. Cars equipped for the tests were run over the line and the test was made by Mr. McClintock, J. A. Barry, general manager, and E. L. Smock, auditor of the Northern Traction Company. The officials are highly pleased with the test and are convinced of the practicability of the patent. Mr. McClintock will soon make another test and invite a large number of interurban and steam-railroad men to witness it. He asserts that his invention will eliminate all possibility of collisions.

Invention as a Business.

The typical modern inventor is a different man from the inventor of popular imagination, who is generally regarded as a man who works years by himself upon some idea which may either lead him to poverty or to fame and riches. In reality he is usually a capable business man, although the one-idea enthusiast has not entirely disappeared from the earth. In many cases he sells his inventive abilities for a specified sum and works with hundreds of others in the "inventions departments" of the great manufacturing establishments. An article in The World's Work contains some interesting paragraphs on this subject. The author of the article says:

"The great majority of practical inventions are made by a group of men of whom the public never hears. These men are members of one of the most complicated and highly organized of the modern professions. Every great manufacturing concern maintains under one name or another an 'inventions department' employing men who are paid various salaries simply to develop inventions. They are supplied with every mechanical appliance to facilitate their work, the bills are paid by the company and every invention they make is assigned to the company in consideration of salary and $1."

"The General Electric Company offers a typical example of the use of the inventions department. In an establishment employing 20,000 men, a round $2,500,000 is spent each year in developing patentable inventions. There are about 50 engineers at the head of various departments, and each of them is expected, as part of his routine duty, to develop such improvements as are suggested by the needs of his department to keep it in a position to meet competition. Last year 1,412 ideas were carried to the management by 300 men as patentable inventions. Of these 797 were found to be either impracticable or not new. The remaining 615 were developed by the company to such a degree of perfection that applications for patents were filed with the Patent Office at Washington. In round numbers an average of 500 patents a year are taken out by the company, every one of them for a device of immediate commercial value. To handle the legal end of the company's patent business, drawing up applications for patents, carrying them through the Patent Office, and conducting suits for infringement, a corps of 12 lawyers and 28 assistants is maintained at Schenectady, besides two lawyers in Washington and one in Europe. These figures give some idea of the dignified proportions of the profession of inventing; for this company is only one of scores which carry on similar work on a greater or lesser scale. Follow one of the 615 inventions patented last year through all the stages of its development and consider what an inventions department means when that work is multiplied by 615."

Reciprocity in Foreign Trade.

The Merchants' Association of New York has adopted the following self-explanatory resolutions:

Whereas, The principal nations of Continental Europe, following the example of the United States, have adopted, or are about to adopt, high tariff rates of duty on many products of the soil and of manufacture, the imposition of which on the products of the United States cannot fail to most injuriously affect the welfare of the varied interests of this country; and

Whereas, These European countries have also adopted, or have in contemplation, a system of preferential tariff rates of duty to be accorded to those nations that are willing to offer similar reciprocal reductions in their rates of duty which would enable countries so favored to underbid our products in European markets; now, therefore, be it

Resolved, That The Merchants' Association of New York heartily favors the conclusion of reciprocal treaties of commerce between the United States and these European countries by which an enlarged trade and extended markets for our products may be secured; and be it further

Resolved, That a committee of five be appointed by the president, which committee shall urge upon the government of the United States, and upon the Congress of the United States, the importance of the adoption of such reciprocity treaties, and shall place itself in communication with all commercial and agricultural associations or bodies throughout the United States for the purpose of soliciting their co-operation in securing the conclusion and ratification of such commercial treaties of reciprocity.

The association's committee on reciprocity treaties consists of John C. Eames (chairman), Gustav H. Schwab, Edward D. Page, Daniel P. Morse and E. H. Outerbridge.

Unidirectional Wireless Transmission.

An important improvement in space telegraphy is announced by Professor Braun of Strassburg, Germany, the inventor of the system which bears his name. The professor has succeeded, it is said, in sending wireless electrical waves in a single direction. Up to now it has been possible only to transmit waves in all directions. Much energy will be saved by the new invention, if it proves successful in practice.

It is intimated that the Lake Shore and Michigan Southern railroad may meet the competition of the electric line between Detroit and Toledo by the introduction of gasoline motors to operate passenger cars over its own tracks on a suburban schedule.

A New Indiana Telephone Association.

Pursuant to a call by Theodore Thorward, president of the Indiana Mutual Telephone Association, an important meeting of telephone men representing the Independent telephone interests of Indiana, was held at Winona on June 12th. A new association was formed to be known as the Independent Telephone Association of Indiana. There were present about 75 telephone men, who represented over 40,000 telephones. President Thorward, in opening the meeting, said that it was called for the purpose of solving the question as to what is best to do to protect the Independent properties against the encroachments of the Bell company. He suggested closer organization. The needs of the hour necessitate close district organization all over the state that will combine all the companies in the districts with contracts that will protect large and small companies against the common competitor, as well as again each other. Mr. Thorward also suggested the formation of a strong financial state institution to be used for the purpose of gathering in money to be put into the telephone business and properties in the state.

A committee on organization was appointed and reported back a preamble, constitution and by-laws, which were adopted. Those who join agree to support and abide by the articles of association; to encourage development, foster and stimulate growth, protect the mutual interests, promote and systemize uniformity of accounting, operation, maintenance and construction of Independent non-Bell telephone interests, and to defend them from unfair encroachment or competition by co-operation and by such other available means as may, from time to time, seem advisable.

The plan of the new state organization includes the formation of 11 districts, which are to be represented in state meetings by delegates. Each district also has a president, who in the state organization is a vice-president.

The state officers elected were: President, George W. Beers of Fort Wayne; secretary and treasurer, Charles S. Norton of Indianapolis. These are the district vice-presidents:

First district—Theodore F. Thorward, South Bend.
Second district—W. L. Moellering, Fort Wayne.
Third District—Walter J. Uhl, Logansport.
Fourth district—Oliver P. Freiburg, Lafayette.
Fifth district—Thomas A. Bromley Jr., Muncie.
Sixth district—Charles R. Duffin, Terre Haute.
Seventh district—W. W. Mendenhall, Indianapolis.
Eighth district—A. C. Lindemuth, Richmond.
Ninth district—W. C. Curil, Petersburg.
Tenth district—C. D. Knoefel, New Albany.
Eleventh district—W. R. Swarthout, Rising Sun.

The discussion extended over a wide range of subjects, but the central idea was for a closer compact. It was asserted that Independent telephony was never more prosperous or progressive in Indiana than at present; that companies were put to the test to supply the demand, and that they were in favor everywhere.

J. B. Hoge of Cleveland, president of the National association, was present and addressed the meeting. He was gratified with the decision of the Indiana men to join hands with the Independent associations of Ohio, Michigan, Wisconsin and other states, as well as to get into closer relations with the national association. It means uniform methods of conducting operations and accounting, and the working out of all the little details in the large exchanges.

A warm discussion arose over the eligibility of a company to membership which has contracts with both the New Long-distance Telephone Company and the Bell telephone company for toll-line long-distance service, and also companies having established long-distance service arrangements with the Bell company. President Thorward insisted that such companies should not be admitted to membership, but the matter was left in the hands of the executive committee.

The delegates to the meeting said their business is growing, in most instances, faster than they can keep up with it. They believe that the new association means still greater expansion. The district officers are to keep in close touch with the local companies and are to make regular reports to the state president. S.

Practicable Distance for Telephone Communication.

Talking about the system of the American Telephone and Telegraph Company, while in Salt Lake City recently, Mr. F. P. Fish, president of the company, is quoted as saying:

"There is now a gap of about 170 miles in the Bell lines from coast to coast. However, even if that gap were built over, I do not believe it would be commercially practicable for telephone communications. Improvements must be made before the voice can be carried so far.

"There is one very long line in constant daily use now. I refer to the line between Omaha and Boston. The Cudahys have houses in both cities, and every day they talk from one to the other over our lines. Conversations between Boston and Milwaukee and between Boston and Atlanta, Ga., are quite frequent."

The distance between Omaha and Boston is about 1,300 miles in an air line and 1,500 miles by railroad, but by telephone line is said to be over 1,900 miles.

Telephone Extensions in Mexico.

Governor Enrique Creel of the state of Chihuahua has granted a concession for the construction and operation of an extensive system of telephone lines in the central part of the state. The system will radiate from the city of Chihuahua to Santa Eulala, Aldana and other towns.

The work of constructing the new telephone system in the City of Mexico by La Nueva Compania de Telefonos, which is backed by L. M. Ericsson & Co. of Stockholm, Sweden, is in progress. The concession for this system was obtained from the municipal and federal governments by Engineer Jose Sitzenstatter, who transferred the concession to the Ericsson company. The conduits for the underground system are now being laid. The system will be completed and ready for operation in about 12 months, according to present plans. The Mexican Telephone Company is also making extensive improvements to its system, including the placing of its wires underground.

Oton Sartorius, general manager of the Mexican General Supply Company of the city of Chihuahua, has obtained a concession from the state government for the construction and operation of a new telephone system in Chihuahua. He contemplates building long-distance lines to Parral and Jiminez.

A telephone line is to be constructed from Compostela, Territory of Tepic, to El Rosario, state of Sinaloa. The line is to be built under the direction of the government of the Territory of Tepic. It will be used principally for the dispatch of public business relating to affairs of the territorial government.

A new telephone system has been built out of Villa Aldama. The principal town reached by it is Santa Fe.

Antonio Calero has obtained a concession from the government of the state of Chihuahua for the construction of a new telephone system for Santa Rosalia. Carlos C. Leal, federal inspector of telegraphs, is associated with him in the enterprise.

La Compania Noruega Mexicana, with headquarters in the City of Mexico, has obtained a concession from the government of the state of Guanajuato to establish systems of telephones throughout the state. Christian Schjetman is manager of the company.

The new telephone line which was recently completed between San Luis Potosi and Villa de Armadillo has been placed in operation. The inauguration of the line was made an event of much ceremony, the governor of the state being present. It is said to be one of the best-constructed lines in Mexico.

The government of the state of Sonora has granted a concession to E. W. Bristol for the construction and operation of a telephone line from Hermosillo, the capital, to La Colorado. H.

Telephone News from the Northwest.

The Edgemont (S. D.) Telephone Company has been incorporated with $5,000 capital stock.

W. H. Crumb & Co. of Chicago have been awarded a contract for the construction of a telephone line in connection with the government irrigation project at Belle Fourche, S .D., to cost $4,150.

The Tri-state Telephone Company has started work on an extension of its toll-line system from Grand Forks to Petersburg, N. D., nearly 50 miles.

The Pierce County Telephone Company of New Richmond, Wis., seeks a new franchise at New Richmond.

The Northwestern Telephone Exchange Company has ordered a total of 200,000 feet of cable for use in improving and extending the Minneapolis system. The company will also set 40,000 poles this season through the Northwest. The company has plans which call for about doubling the capacity of the Minneapolis system, and will have the largest and most complete exchange west of Chicago.

The Comfrey Rural Telephone Company of Comfrey, Minn., has about completed the local exchange there, as well as several rural lines.

The People's Telephone Company of Superior, Wis., will construct a new building for its local exchange. A new switchboard will be installed and a number of improvements made.

The Farmers and Merchants' Co-operative Local Telephone Company of Garfield, Minn., has been incorporated with $10,000 capital.

The Cannon Valley Telephone Company at Janesville, Minn., is replacing its street wires with cable work.

The Albert Lea (Minn.) Telephone Company will have a new building erected for its exchange.

The Wisconsin Telephone Company will extend

its system at Oshkosh, Wis., about $35,000 to be expended.

The Union Telephone Company has moved its exchange at Birmingham, Iowa, and will put in a new switchboard.

The new automatic telephone system at Sioux Falls, S. D., is expected to be in operation by August 1st. The company has already secured nearly 2,000 subscribers.

Broders & Voss have sold the telephone exchange at Hartley, Iowa, to George Coleman.

The Earling Telephone and Telegraph Company has been incorporated at Earling, Iowa, by P. J. Korth and others. The capital is placed at $10,000.

R.

Ohio Telephone Notes.

A new directory will be issued soon by the City and Suburban Telephone Company of Cincinnati. Two lines will be used for each address hereafter instead of one, so that the number and the name will stand out distinctly on the page. Some other improvements have also been made in it.

For the month of May the United States Telephone Company made a gain of nearly $1,200 in surplus earnings, which is about 20 per cent.

A restraining order has been issued by the Circuit Court against the Home Telephone Company, Sol P. Kineon and others to prevent them from erecting poles and stringing wires in the city of Newport, Ky.

The Home Telephone Company of Toledo has purchased a lot in the rear of its building, a portion of which will be used for warehouse purposes, and a small building will perhaps be erected on the Erie Street front.

Bookkeepers are working on the distribution of profits to the employes of the Cuyahoga Telephone Company for the first six months of the year. The amount will be quite a little more than $8,000, which is an increase over last year. This is due to the increased business done by the company.

President J. B. Hoge of the National-Interstate Telephone Association will have considerable of his time for a few weeks taken up with meetings of associations over the country. A meeting will be held soon at Ottawa, Canada, looking to the introduction of Independent telephones in competition with the Bell, with perhaps a proposition to substitute them for the government-owned lines.

C.

Texas Telephone Progress.

The Grayson County Telephone Company of Sherman will extend its long-distance lines to a number of towns, among them being Howe, Van Alstyne and McKinney.

The Texas Consolidated Long-distance Telephone Company, which was recently granted a franchise by the City Council of Dallas for the use of streets, will build a line between Dallas and Fort Worth and will tap a number of towns between the two cities. Other important extensions and improvements are contemplated.

It is announced at the general offices of the Southwestern Telegraph and Telephone Company in Dallas that it has purchased the property of the Granbury Telephone Company, which includes the exchanges at Granbury and Glenrose and 140 miles of toll line which reaches all of the towns in the counties of Hood and Somerville. The company is now building long-distance lines from Fort Worth to Stephenville.

Rust Bros. of San Angelo have installed a new telephone exchange at Robert Lee. The town is connected with San Angelo by long-distance lines.

A new telephone exchange has been installed at Ozona by J. J. Shepperd.

The Texas Telephone and Telegraph Company, which has its principal office at Austin, is now extending its toll lines to Brady and Georgetown. It recently completed the construction of lines to Castell and other places. Its lines now aggregate 700 miles. C. C. Gibbs of San Antonio is president; W. R. Hamby of Austin, vice-president, and A. G. Miller of Llano, superintendent.

The People's Telephone Company has been organized at Tehuacana with a capital stock of $2,000 for the purpose of installing and operating a local telephone exchange. A. L. Collins is one of the incorporators.

W. D. H.

Indiana Telephone Items.

The Rosedale and Fontanet Farmers' Telephone Company of Parke and Vigo counties has filed articles of incorporation. The capital stock is $3,000. The company will build an exchange at Rosedale and extend the lines into Parke and Vigo counties. Thomas M. Patterson and William Stuthard are among the directors.

The City Council of Cannelton has granted a franchise to the Ekerty, Branchville and Cannelton Telephone Company, a farmers' co-operative company, with lines running through Dubois and Perry counties, and seeking an outlet to the Ohio River.

The Central Union Telephone Company has begun the work of placing its wires underground in Lafayette.

An early morning fire on July 14th almost destroyed the mechanical apparatus in the Central Union Telephone Company's building at Columbus, and the entire service has been suspended. The financial loss will exceed $25,000. The fire started in the main terminal box on the third floor of the building and was under good headway when discovered. The operators escaped uninjured. Many cables and the distributing racks were more or less damaged.

The Parke County Telephone Company is establishing a new modern exchange in the Union Block in Rockville. The second floor is given up to the main switchboard and toll desk. On the floor directly underneath is the wire chief's desk, lightning arresters and distributing frames, with the workshop and supply rooms in the rear. The local or main switchboard is a four-position cabinet, wired for an ultimate capacity of 500 lines, with 310 connected. These 310 lines now accommodate 450 subscribers, who have Rockville for central. The floor space is ample to take on 500 additional lines, making 1,000 lines in all. The board was built by the Kellogg Switchboard and Supply Company of Chicago. The toll-board, which is also new and built by the same firm, occupies a position directly in front of the main board. It is a two-position desk, accommodating both the toll operator and the chief operator. It has an ultimate capacity of 20 toll lines, with 11 installed complete. The company was incorporated in 1899 and is now operating over 400 miles of wire and 200 miles of poles, which includes 125 miles of toll lines. The exchanges of Montezuma, Rosedale, Mecca, Bellmore, Bridgeton and West Union are a part of the system. The company has recently established traffic relations with the Central Union Telephone Company, thereby affording connections with every large city in the state and adjoining states. Frank M. Boyed is general manager.

S.

Automatic Telephone System for Havana.

Havana, Cuba, is to have a new 15,000-line automatic telephone system which is to displace the old "Red Telefonica" system of Havana, formerly owned by a Spanish company, but now a part of the properties of the Cuban Telephone and Telegraph Company. The company at the same time contracted for a 600-line automatic system for the town of Marianao, Cuba, a suburb of Havana. The initial installation at Havana will be 5,000 lines.

The Cuban Telephone and Telegraph Company will soon erect a new building and lay a new conduit and cable system for the new plant, and within a year Havana will have a more perfect and modern telephone system than many American cities possess. The officials of the Cuban Telephone and Telegraph Company who came to Chicago late in June to close the contract for the apparatus with the Automatic Electric Company of this city were President Roland R. Conklin, Vice-president S. L. Jarvis and General Manager W. M. Talbott. The cosmopolitan character of Havana's population makes the automatic the logical system to use, for it would be necessary for human telephone operators to be linguists in a city of so many nationalities.

TELEPHONE MEN.

Max von Schlegell, who has been with the Brainerd (Minn.) Telephone Company for several months, has taken a position with the Chesapeake and Potomac Telephone Company at Baltimore, Md.

J. A. Werner of Lake City, Minn., has become local manager for the Minnesota Central Telephone Company at Redwood Falls, Minn., succeeding J. Ambaugh, who has gone to Browns Valley, Minn., to take charge of that division.

MANUFACTURERS AND DEALERS.

The Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y., reports having closed contracts for switchboards for Auburn, N. Y.; Bird City, Kan.; McDonald, Kan.; Coldwater, Mich.; Hannah City, Ill.; Pitman, N. J.; Lewisport, Ky.; Huntersburg, Ind.; Seattle, Wash.; Arcadia, Mich.; Mulkeystown, Ill.; Lostant, Ill.; Sinclair, Tex.; Center, Kan., and Mexico, Mex.

Two contracts recently granted the Automatic Electric Company of Chicago were for a 250-line exchange at Miamisburg, Ohio, for the Montgomery County Telephone Company, and a 1,200-line exchange for the Dakota Central Telephone Company at Aberdeen, South Dakota. These two exchanges will be the first to have the new automatic four-party lines with selective ringing and lockout recently worked out by the Automatic Electric Company's engineers. This new development of the automatic system attracted much attention at the recent Independent telephone convention in Chicago, where it was exhibited for the first time. Only a portion of the Miamisburg and Aberdeen plants will be for party-line service.

The Menard County Telephone Company of Athens, Ill., has been incorporated by Lee Kincaid, W. C. Scott and T. W. Kenyon. The capital is $5,000.

GENERAL TELEPHONE NEWS.

The Mt. Pleasant Telephone Company has sustained a severe fire loss at Mt. Pleasant, Iowa.

The Nebraska Telephone Company is installing a large telephone exchange at University Place, Neb.

The City Council at Caldwell, Ida., has granted a franchise to the Independent Telephone Company.

Arnet & Hobart have sold their telephone exchange in Iola, Kan., to the Missouri and Kansas Telephone Company.

The City Council of Boise, Ida., has granted to the Independent Long-distance Telephone Company a franchise to operate in that city.

The Farmers' Telephone Company of Hallam, Neb., has been incorporated by Ed. Lauterbach and others, with a capital stock of $25,000.

The Independent telephone companies of Salt Lake City and Los Angeles are co-operating in the construction of a line which will connect the two cities.

The Kernersville (N. C.) Telephone Company has just had a new exchange installed with a 160-drop switchboard. George Fulp is president of the company.

The Citizens' Telephone Company of Battle Creek, Mich., is installing a line to Gull Lake and Augusta. Residents of the island in the lake will be connected with the mainland by a cable.

At a special election recently held at Hamilton, Mont., the citizens approved the granting of franchises to the Rocky Mountain Bell Telephone Company and the Bitter Root Telephone Company.

The Co-operative Telephone Company of Detroit has filed a quit-claim deed of its property to the city in the event of its consolidation with any other company. A former deed was not approved by the corporation counsel.

The Rocky Mountain Bell Telephone Company has purchased the franchise recently obtained at Pocatello, Ida., by E. C. Manson and G. D. Aiken of that city; also the system of the Twin Falls (Idaho) Telephone Company.

The new metallic-circuit system now being installed by the Bell telephone company in the city of Kingston, Ont., will be ready by September, and a general advance of $5 each will be made, both in business and residence telephones.

An effort to consolidate the Independent telephone companies in Washington and other Pacific states is in progress, with A. L. Black of Bellingham at the head of the movement. This is taken to mean the inauguration of more extensive Independent service.

In the barber shop in the Romaine Building in Paterson, N. J., it is possible for a business man, while sitting in a chair being shaved, to talk with his office and direct his business without interruption. The enterprising barber put in telephones as an experiment and he says they are a great help to some of his busy customers.

A number of the directors and officials of the Michigan Telephone Company went on a trip to Mackinaw and the Upper Peninsula recently. W. C. McMillian, chairman of the board, was of the party and states that the company will spend a good deal of money in the Upper Peninsula, and among other things will build a new cable across the Straits of Mackinaw.

The Connecticut state Senate has rejected, in concurrence with the lower branch of the Legislature, mentioned last week, a bill designed to allow the incorporation of Independent telephone companies in the state; also the bill introduced some time ago to investigate the conduct of telephone companies now doing business in the state. Both these measures were opposed by the New England (Bell) Telephone Company.

J. B. Ware, managing director of the Citizens' Telephone Company of Grand Rapids, Mich., gave evidence before the telephone committee of the Dominion House of Commons of Canada regarding the operation of Independent companies in the state of Michigan. Mr. Ware's evidence indicated that the Independent movement in the United States is spreading very rapidly. He thought it would be all right for the government to control the long-distance telephones, but not the local exchanges.

A statement of the earnings of the Michigan State Telephone Company for the year ended April 30th, the first year under the reorganization, has been issued by N. W. Harris & Co., leading spirits in the reorganization. A surplus of $224,051 is shown after paying six per cent. dividends on the preferred stock. The gross earnings for the year ended April 30, 1905, were $2,089,701; this is compared in the statement with $2,008,000 for the calendar year 1904. The operating expenses, taxes and maintenance for the two periods mentioned are given as $1,492,657 and $1,456,000, respectively. Since the present management took possession in February, 1904, the number of telephones in use is said to have increased from 48,778 to 70,832.

CORRESPONDENCE.

New York.

New York, July 15.—At 12:01 a. m. on Monday the subway trains commenced to run between the Battery and Brooklyn Bridge and from One-hundred-and-forty-ninth Street to West Farms in the Bronx. Passengers desiring to travel the whole distance change cars at One-hundred-and-forty-ninth Street from the subway proper to the Bronx extension, which is mainly overhead. For 48 hours a double fare was charged, but public dissatisfaction at this arrangement was so emphatic that free-transfer privileges were granted on Thursday not only to and from the subway but also to and from the Third Avenue elevated line. The opening of these lines has been long expected, and although they mark the completion, or practically the completion, of perhaps the most important subsurface traction system in the world, the event has not been marked with any demonstration or ceremonies.

Three powerful exhaust fans, each capable of moving hot air from the subway at the rate of from 40,000 to 60,000 cubic feet per minute, were started at different points in the subway this week, and more fans are to be installed within the next few days. The car windows are also to be altered to open from the bottom, and in one or two other details a strenuous effort is to be made to solve the problem of ventilating the subway. There was a slight improvement in the atmosphere of the tunnel, but this might have been due to an amelioration of the street conditions.

The sum of over $42,000 has been appropriated for measures designed to prevent the recurrence of a flood in the subway. A force of inspectors is to be organized in order to watch the water mains adjacent to the subway.

Justice Gildersleeve has made a further modification of the order which was designed to prevent the Board of Estimates acting upon subway routes; and the board is now at liberty to consider and adopt any route it thinks fit. All the routes previously considered and reported on have therefore been officially approved, and it appears that the board may proceed with the plans to any extent short of actually letting out the contracts.

Definite plans for dealing with the elevated and surface traffic at the Manhattan terminal of the Williamsburg Bridge have been accepted. The elevated tracks over the bridge are to be lowered and eight separate loops provided for the surface cars. This will involve important structural alterations on the bridge and will cost about $1,000,000.

Construction work has been commenced at Mineola, L. I., on the Jericho Turnpike line of the New York and Long Island Traction Company, for the completion of which an extension of time was recently granted. It is expected that the work will be finished by the end of October.

The press agent at "Paul Smith's" gives the news of the formation of the Paul Smith's Electric Light and Power Company, the directorate of which concern includes three members of the family, and has a capital of $100,000. Paul Smith's is a summer resort in the Adirondack Mountains, where there is an electric transit line up the steep mountain side.

Complaints are being made that difficulties are put in the way of persons who have occasion to use the telephones installed at several municipal courts in this city. It is asserted that the numbers of these telephones are not published in the directory, notwithstanding that they are maintained at the public expense.

The Commonwealth Telephone Company has been incorporated in Brooklyn with a capital of $200,000. The directors are E. M. Brooks and Daniel Bohre, Brooklyn, and J. A. Crawford, Montclair, N. J.

Chief Engineer Lewis of the Board of Estimates yesterday reported favorably on the plans of the Hutchinson commission for a municipal electric-light plant. The board approved the report and authorized the engineer to prepare specifications. The work of erecting the plant probably will be authorized by the board in the fall. The plant recommended by the commission would cost about $7,500,000.

Yale Kneeland and others have formed the Electric Elevator and Milling Company with a capital of $25,000. They will conduct business in this city.

D. W. W.

Dominion of Canada.

Winnipeg, Man., July 15.—Winnipeg is to have Sunday street cars within two weeks. The city will release the company from carrying the postmen free after August 12th and the company makes some concessions in fares during certain hours. The employes are to work only 60 hours a week.

Messrs. Royce and Henderson, solicitors for the Toronto and Hamilton Electric Railway Company at Toronto are applying to the Parliament of Canada for an act to sanction an arrangement with the Toronto and Niagara Power Company for the use of the right-of-way of the power company for the purposes of its railway and to increase its capital stock.

The statistical statement of the Toronto Street Railway Company shows that in the first year of its operations, 1893, the gross earnings were $900,232, while last year they were $2,444,534. The passengers carried in 1893 numbered 21,215,010, and in 1904 they were 59,737,460. The net earnings in 1893 were $362,635, and in 1904, $1,020,354. With all this rapid increase the mileage practically remains the same, but negotiations are pending with the City Council of Toronto to extend the area.

It is reported that the Electrical Development Company has entered into a contract to supply the Toronto Electric Light Company with power from Niagara Falls at $35 per horsepower a year. It is understood that the latter company will practically have control of the distribution in Toronto of all power transmitted to that city by the Development company, except what is required by the railway company. The Toronto Electric Light Company is constructing large sub-stations on Terauley and Scott streets, which are connected with the main receiving station on Davenport Road by underground conduits containing eight insulated copper cables, four to each station, having a carrying capacity of 10,000 horsepower.

H.

New England.

Boston, July 15.—One of the largest damage suits against the Boston Elevated Street Railway Company was brought to trial last week. The Hotel Essex proprietors are the plaintiffs, and they place the amount of their claim at $300,000. Noise from the running of the elevated trains and lack of privacy in the rooms on the level of the tracks are given as the causes.

George S. Taft, receiver for the Hampshire and Worcester Street Railway Company, has petitioned for authority to sell the property.

The formal opening of the Nahant and Lynn street railway will take place shortly. The road has cost about $150,000. Recently the company asked for authority to issue 50,000 additional stock, and a bond issue of $50,000 is also in contemplation.

An important step was taken within a few days by the New York, New Haven and Hartford Railroad Company. A third-rail electric system has been in operation for some time between Hartford and Bristol, for local traffic, but President Mellen has sent a communication to the city authorities announcing the company's intention to replace this arrangement with an overhead trolley. The same tracks are to be utilized, the cars being of standard steam-traffic gauge, and adapted for use for both steam and electric traction.

Costello Lippitt, Edwin W. Higgins and Lewellyn J. Storrs of Norwich, with Charles W. Comstock of Montville, who control a charter for a street railway from Norwich, Conn., to Westerly, R. I., have incorporated with an authorized capital of $700,000 to build a railway to be known as the Willimantic and Stafford Springs street railway. The company is also empowered to acquire and utilize abandoned waterpower plants in Tolland County. The New Canaan Street Railway Company has also been incorporated, capitalized at $500,000, to operate a railway in New Canaan and Norwalk, in Connecticut, and Pound Ridge and Lewisboro in New York state. The incorporators are William Wardwell, John E. Bliss, Charles B. Keeler, Frederick A. Palmer, Junius Benedict, C. N. Scoville, J. F. Silliman and T. Roberts of New Canaan; Lester Hyatt, Frank H. Merrill, Reed G. Haviland and W. F. Acton of Norwalk.

The Connecticut Legislature has authorized the New Milford Power Company, which furnishes power to various divisions of the Connecticut Railway and Lighting Company's road, to issue bonds to the amount of $2,000,000, secured by a mortgage on the company's property and franchise.

B.

Texas.

Austin, July 13.—The promoters of the project to build a number of interurban electric railways to radiate out of Dallas to important towns of that section have organized the Texas Traction Company with the following-named officers: President, J. F. Strickland of Dallas; first vice-president, Jesse Shain of McKinney; second vice-president, Captain William H. Bean of Howe; treasurer, W. R. Brents of Sherman. The company contemplates building one line to Sherman, another to Terrell, and a third to Waxahachie.

Steps have been taken looking to the construction of an interurban electric railway from Fort Worth to Azle, a distance of 17 miles. Sterling P. Clark is interested.

The Clarendon Water, Light and Power Company has been organized at Clarendon with a capital stock of $50,000. L. W. Chase is one of the incorporators.

The Columbus Light Company has been organized at Columbus for the purpose of operating an electric-light and power plant. The company has a capital stock of $10,000.

J. D. Beardsley of Gibsland, La., is promoting the project of building an interurban electric railway between Fort Worth and Mineral Wells. Mr. Beardsley was formerly general manager of the Louisiana and Northwestern railroad.

A number of Cincinnati (Ohio) men have taken preliminary steps toward the construction of an interurban electric railway between Corsicana and Fairfield, a distance of 25 miles. R. E. Prince of Corsicana is interested in the project.

Col. W. C. Greene of New York, who obtained a franchise from the city of El Paso for the construction of an electric street-railway system in that city, has abandoned the enterprise. Several miles of track which had been laid have been torn up and the rails removed.

J. A. Jones and E. E. Hull, who recently purchased the plant of the Gainesville Light and Fuel Company in Gainesville, will expend about $25,000 in making improvements.

The city of Denton has taken possession of the water and light plant which it recently purchased from T. J. Oliver and R. C. Storey of Dallas and A. F. Evers of Denton.

It is announced that application will be made to the City Council of Greenville for a franchise to build and operate a system of electric railways there. The secretary of the Greenville Commercial Club can give information in regard to the project.

The Gainesville, Whitesboro and Sherman Electric Railway Company, just incorporated, has a capital stock of $500,000 and principal office at Gainesville. It will build an interurban electric railway between Gainesville and Sherman by way of Whitesboro, a distance of 32 miles. The incorporators of the company are G. A. Hassinger and H. L. Lazzarus of New Orleans and H. G. Stinnett and John King of Sherman. The Gainesville Electric Railway and Light Company will also build and operate a new electric street-railway system in Gainesville. The company has been reorganized and has increased its capital. E. J. O'Bierne is secretary and general manager and will do the engineering work of the new railway.

C. A. Zilker, vice-president of the Southern Ice and Cold Storage Company of San Antonio, is promoting the organization of a company to install an independent electric-light and power plant for San Antonio. It is stated that eastern capitalists are interested in the enterprise.

The Del Rio Electric Light and Ice Company has been organized at Del Rio with a capital stock of $200,000 for the purpose of installing and operating an electric-light and power plant, among other things. John M. Gray of Del Rio is one of the incorporators.

The Bonham Gas and Electric Light Company has been organized with a capital stock of $100,000 for the purpose of installing an electric-light and power plant at Bonham. J. F. Strickland is one of the incorporators.

W. D. H.

Mexico.

City of Mexico, July 12.—It is announced that the recent flood disaster in the city of Guanajuato will not interfere with the plans for the construction of an electric railway between that place and the city of Irapuato. The governor of the state of Guanajuato, who is actively interested in the project, says that all arrangements for building the road have been made and that tentative orders have been placed for modern equipment for the line. It is proposed that the road shall do a freight as well as passenger business.

It is stated that the electric power plant which will be erected near Tepic for D. Aguirre & Co. will cost about $75,000. It will supply the city of Tepic with lights and power and will afford power for operating the Aguirre cotton factory and other industrial concerns of that section.

The Mexican government has declared forfeited the concession which it granted three years ago to Jose Garcia and Ernesto Diaz Rugama for the construction and operation of an electric belt railway in the City of Mexico. The promoters organized a company and built a small piece of track, but in no other respect were the terms of the concession complied with. The guaranty deposit is also forfeited.

The state government has signed the contract whereby G. A. Waddil will install a new electric-light plant in the city of San Luis Potosi.

An American syndicate with a capital stock of $500,000 has acquired the waterfalls in the San Pedro River near Sombrete, and is preparing to construct a large electric power plant on the site.

The Mexican government has granted a concession to Manuel Gonzalez to establish an electric power plant on the Abra de Caballeros River, in the state of San Luis Potosi.

H.

Ohio.

Cleveland, July 15.—Some of the steam roads about Lima have started cheap week-day excursions to various places, including Cincinnati, Dayton, Toledo and Detroit, with the hope of drawing considerable of the trade that is now going to the electric railways. Little difference is reported in the patronage of the trolleys so far.

The Toledo Gas, Electric and Heating Company, organized with a capital stock of $2,500,000, and authorized to issue the same amount of bonds, has taken over the Toledo Gas Light and Coke Company and the Toledo Heating and Lighting Company, the latter familiarly known as the Yaryan company. It is the intention to spend $250,000 at

once in improvements, these to include a modern lighting plant, it is said, so that business may be done in the business section of the city which has heretofore been in control of the Toledo Railways and Light Company. The new company has leased space on the Home Telephone Company's poles for lines and will use the conduits for heating pipes also. This gives it an opportunity of extending its lines over the entire city. J. K. Secor, James S. Brailey, Jr., Thomas H. Tracy and W. F. Robinson of Toledo and Lawrence B. Pierce of St. Louis are interested.

The United Power, Light, Fuel and Supply Company of Bedford has been incorporated with a capital stock of $10,000 by Albert Cappelle, Ernest Greiss and others.

The light and power plant in the new office building of the Columbus Savings and Trust Company, has been tested and is about ready for use. The electric plant consists of two 150-kilowatt generators and one 62½-kilowatt generator, with sufficient power to operate them and the pumps that operate the water and elevator systems.

Completing the reorganization of the Columbus, Delaware and Marion Electric Railroad Company deeds have been filed transferring all the property, including power property, to the Columbus, Delaware and Marion Railway Company. The officials will be the same as those of the old company.

The large storage battery of the Columbus Railway and Light Company will be completed and in operation within two or three weeks. This will be a great aid in the operation of the road and will prevent the blockades with which the road has sometimes had to contend from breakdowns at the power house.

Robert L. Walker of Poland and Horace E. Smith of Youngstown are projecting an electric railway from the latter place to Poland. They have most of the right-of-way.

A mortgage given by the Cincinnati, Milford and Loveland Traction Company to secure a bond issue of $1,000,000, July 1, 1903, has been canceled.

O. M. C.

Indiana.

Indianapolis, July 15.—A traction line from Madison to Greensburg to connect at the latter city with the extension of the Shelbyville branch of the Indianapolis and Cincinnati Traction Company for Indianapolis is now being promoted.

A franchise has been granted to the Indiana Northern Traction Company to enter Warsaw. The speed limit of 20 miles per hour within the city limits was granted and this is being criticised.

Charles Murdock, general manager of the Indianapolis and Eastern Traction Company and the Richmond Interurban Company, recently merged, has been granted some valuable concessions in New Castle. Mr. Murdock has inaugurated a through service between Indianapolis and New Castle and Indianapolis and Richmond.

Contracts were let on Tuesday for the rails, overhead work, ties and the sub-stations for the Fort Wayne, Bluffton and Marion electric road, on which grading and abutment work for the bridges is now in progress. The sub-stations are to be located at Sheldon and Kingsland. The Fort Wayne and Wabash Valley company has adopted the line as part of its system.

Passengers must now purchase tickets at stations or pay a straight one-way cash fare, costing slightly more, on the Indiana Union Traction lines. Over 50 stations have been established in all the towns and cities on the system, and more than 1,000,000 tickets were required to stock all the stations.

The Indiana Northern Traction Company, operating between Wabash and Marion, three weeks ago made an order abolishing tickets and requiring all passengers to pay full fare each way. As a result the road's traffic was diverted to the Big Four steam road, which has a rate about the same as the traction line. The falling off moved the officials to restore the round-trip tickets, which are now being sold at the old discount. J. J. Coleman of New York, president of the Indiana Northern, is giving his personal supervision to the extension of the line from Wabash to Warsaw, and says actual construction will be begun August 1st.

Hugh J. McGowan, president of the Indianapolis Terminal and Traction Company, asserted before the State Tax Board that 3.2 cents a single trip was the fare derived from citizens of Indianapolis. He said that last year 31 per cent. of the total number of passengers recorded rode on transfers. Taking this into account the price of a single ride, without transfers, would be reduced to 3.2 cents.

The Oliver Plow Works and the Oliver Hotel plant of South Bend have been connected with the Great River generating power plant, which the Olivers have been nearly two years building, at a cost of $500,000. The results far exceed the companies' expectations.

S. S.

Michigan.

Detroit, July 15.—The Public Lighting Commission of Detroit in its annual financial report for the year ended June 30th asserts that the cost of operating an arc lamp for that period was $34.99. This is a reduction over the figure given for the previous year of $5.17. During the year 408 additional arc lights were installed.

The Murphy Heating Company, which has been furnishing steam heat throughout a restricted business section of Detroit, has been granted a large extension of territory by the council through an amendment of its 1903 franchise.

The Lansing and Suburban Traction Company has purchased a large tract of land near its lines from the Lansing Iron and Engine Works, on which the traction company proposes to erect car barns.

It is stated by authority of the president of the Detroit, Monroe and Toledo Short Line that the extension of that road from Monroe to Dundee will be built this summer and that the road will ultimately be extended to Tecumseh and Adrian.

The car barn of the Rapid railway at Marine City was struck by lightning on Monday last and burned to the ground. The loss is about $11,000. The station near it was saved.

The street-car strike at Saginaw and Bay City is still unsettled. The Citizens' Alliance has offered a reward for information leading to the conviction of persons who have been dynamiting the tracks and wrecking cars. It is stated that W. D. Mahon, president of the International Street Railway Employes' Association, has made arrangements with one of the largest automobile companies for a sufficient number of large touring cars to be placed on the streets of Saginaw by the strikers to compete with the street-railway company for public patronage. It is expected that an adjustment of the strike will be effected soon, as the company has offered to treat with the men as individuals and give them some concessions.

Alex Dow, general manager of the Detroit Edison Illuminating Company, has made the announcement that his company has reduced the rate for electrical current to consumers by one-third, as was agreed to some time ago. He asks that the council return the two checks for $500 which he deposited as a guaranty of good faith in his statements as to the public lighting.

C. G. W.

Pacific Slope.

San Francisco, July 13.—The Board of Supervisors of Monterey, Cal., has awarded a franchise for an electric railway along the county roads of Monterey County to F. M. Hildy of Salines, Cal.

William Ellery of San Francisco has purchased from the trustees all of the property and machinery of the bankrupt McCloud River Power Company.

The United Railroads of San Francisco have applied to the city authorities for permission to lay an underground conduit on Mission Street for the purpose of carrying a feed wire supplying current for the operation of the Mission Street electric lines. The conduit will be of vitrified clay.

The Century Electric Company of San Francisco has just secured a contract for the electric wiring in the new Martin block at San Jose, Cal. The value of the contract is $1,405.

The Board of Supervisors of San Francisco has called on the city engineer to prepare plans so that bids for the reconstruction of the Gear Street railway as a municipal electric line may be advertised.

Albert N. New, general manager of the Pacific Wireless Telegraphy Company, who is now in San Francisco, states that his company will have its service in operation between San Francisco and Tonopah within four months and that he hopes to have it working across the Pacific within one year. The company is building a station on the Mount Tamalpais Range.

H. E. Huntington of Los Angeles, Cal., has purchased all of the capital stock of the Los Angeles and Redondo Railway Company of Los Angeles. The stock was heretofore controlled by R. R. Thompson of San Francisco and the Ainsworth Company of Los Angeles.

The John Klein Electrical Company has been incorporated with a capital stock of $250,000 to succeed to the electrical-supply business heretofore conducted under the same name. The incorporators are J. W. Morgan, A. G. Stoll and H. A. Sayles.

A.

PERSONAL.

Professor Curie, the distinguished discoverer of radium, has been elevated to the dingity of member of the Academy of Sciences of France.

F. H. Shepard, who is identified with the railway work of the Westinghouse Electric and Manufacturing Company, was recently married and is now on a trip through England and the Continent.

Patrick McDermott, a trusted employe of the Chicago Edison Company since its beginning in 1885, has been retired on a pension as an act of gratitude on the part of the company for his long and faithful service.

M. W. Thomas has been appointed manager of the Allis-Chalmers Company's district office at Atlanta, Ga. Mr. Thomas is widely known in the South, where he has been identified for years with electrical and machinery interests. He was until recently manager of the Westinghouse office in New Orleans, and brings to the Allis-Chalmers Company the advantages of a very large and valuable acquaintance.

A. H. Whiteside, who for a considerable time has been manager of the Allis-Chalmers Company's district office at Atlanta, Ga., was transferred on July 15th to the Philadelphia district office, where he succeeds as manager W. A. Wood, resigned.

Henry E. Reynolds has been appointed assistant general manager of the Boston and Northern and Old Colony street railways in Massachusetts, a position just established. He has been connected with the Brockton railway system and the Boston and Northern for 20 years.

In connection with the celebration of the king's birthday in London the honor of knighthood was conferred upon Prof. A. B. W. Kennedy, Mr. J. Clifton Robinson and Mr. J. C. Lamb, all prominent in the electrical field. Lord Rayleigh, the scientist, was made a privy councillor.

S. F. Angus of Detroit, vice-president of the Detroit, Ypsilanti, Ann Arbor and Jackson electric railway, is again able to be about on crutches, having been confined to his home for over a month as the result of a broken ankle sustained while alighting from a street car in Detroit.

William F. Duncan has been appointed general superintendent of all the divisions of the New Jersey and Pennsylvania Traction Company operating between Trenton, N. J., Philadelphia, Lambertville, Newton and other points. Mr. Duncan has been with the Brooklyn Rapid Transit Company for the last 25 years.

In the mention last week of the appointment of Samuel A. Freshney as commissioner of public works of Grand Rapids, Mich., the salary attached to the position should have been given as $4,000 a year instead of $2,000, as printed. Mr. Freshney has been general manager of the Muskegon Traction and Lighting Company.

J. B. Ingersoll, for several years one of the leading construction engineers of the Westinghouse Electric and Manufacturing Company, has just been made assistant manager and chief engineer of the Spokane and Inland Railway Company and will have supervision of the construction of the electric road extending 120 miles south of Spokane.

Charles T. Yerkes is reported to be seriously ill in London, suffering from kidney trouble, although his friends say his condition is not alarming. Since leaving Chicago Mr. Yerkes has taken up the work of building an underground electric railway in London, and it is suggested that the worry and labor incident to his connection with this big project may have undermined his health.

The funeral of William E. Matson, electrical engineer at the head of the stationary-motor division of the General Electric works at Lynn, Mass., who died on July 6th, was attended by upward of 1,000 employes of the company, services being held at the Unitarian Church in Lynn prior to the taking of the remains to Columbus, Ohio, for burial. Mr. Matson was 31 years of age and was very popular at Lynn. He was a graduate of the Ohio State University.

Chief Engineer Isham Randolph of the Drainage Canal of Chicago was granted a three months' leave of absence on July 13th to accept membership on the board of consulting engineers of the Panama Canal. Mr. Randolph's appointment comes from President Roosevelt. The board of trustees granted the leave unanimously. Arrangements will be made, however, by which Mr. Randolph will be able to keep in touch with the work of the Sanitary District during his absence from Chicago.

W. J. Buckley, well known to the electrical fraternity, who has earned a widespread reputation as a successful salesman of power and electrical machinery in the Southwest, has been appointed manager of the Allis-Chalmers Company's district office at St. Louis. H. P. Hill, whom he succeeds, goes to the Salt Lake City district office, where he will devote himself to his specialty, the electrical features of the company's business. The Allis-Chalmers Company has never before had its electrical department's products directly represented in that district.

George B. Tripp, general manager of the Colorado Springs Electric Company, has assumed the management also of the Colorado Springs Light and Power Company. There will be no consolidation, and neither company will lose its identity. Large interests in both companies are held by the same men, and the Light and Power company—the gas company—was placed under Mr. Tripp's management as a matter of economy. Mr. Tripp has been general manager of the electric company for four years, succeeding Henry Hine, who resigned to devote his time to the Guanajuato Power and Electric Company in Mexico. As manager of the gas company, he succeeds Ira Miller, who will continue in the position of superintendent of the gas company.

ELECTRIC LIGHTING.

The Homer (Ill.) Electric Light Company is considering a proposition to furnish light in Fairmount, Ill.

The Texarkana (Texas) Gas and Electric Light Company has been succeeded by the Texarkana Gas and Electric Company.

The city of Peru, Ind., is contemplating the reconstruction of its electric-light plant, and would consider propositions for the completion of the project, both financially and mechanically. William O'Hara is the city clerk.

The electric fountain in Lincoln Park, Chicago, has been repaired with new pipes and new apparatus. The fountain was put in operation for the season last week and will be operated on Tuesday and Friday evenings during the summer.

The Nevada Power, Mining and Milling Company of Tonopah, Nev., has acquired the interests of the Tonopah Light and Power Company of Tonopah. C. M. Hobbs, president and general manager of the purchasing company, states that new machinery will be installed at once.

The Chicago Edison Company, about August 1st, will institute a free-delivery lamp-renewal system. All that will be necessary to obtain new lamps will be to call up, by telephone, the office at 139 Adams Street, when the lamps will be delivered. Heretofore customers have been obliged to send old lamps to one of the company's stations to get the renewals.

The Canadian government has appropriated $40,000 for electric lighting and power on the Welland Canal. This amount is in addition to $100,000 already voted and is rendered necessary by a change of plans. The government obtains power from the Cataract Power Company of Hamilton, Ont., and pays $14 per horsepower up to 500 horsepower.

The electric-lighting plant of the Odell Electric Company of Odell, Ill., which was described in the Western Electrician of May 13th last, was recently sold to local people for over $20,000 in cash. The buyers have already taken possession. Considering that the plant is located in a town of only 1,200 inhabitants, the price paid indicates that its previous manager, Mr. W. M. Buchanan, had built it up to a high state of efficiency, and placed it upon a good paying basis.

According to an official statement, the Montreal Light, Heat and Power Company has decided to have all its stations rendered absolutely fireproof. The new sub-station which is being erected on Montana Street, and which will be in operation by September 1st, is being built of concrete, no wood or other inflammable material entering into its construction. The big Chambly power station will also be rendered fireproof, and when this work is completed the company will not carry any insurance on its buildings, effecting a saving of $10,000 a year.

ELECTRIC RAILWAYS

The net earnings of the Chicago and Milwaukee Electric Railroad Company for the month of June, 1905, were $107,956, as against $90,663 for the corresponding month of last year, representing a gain of $17,293.

A. H. Rogers of the Southwest Missouri Electric Railway Company of Joplin, Mo., says an extension is to be built from Webb City, Mo., through Oronogo, Neck City, Purcell and Alba, and connecting with the eastern end of the old line at Carthage. The bridge contracts have been let.

A movement is on foot to construct an electric railway from Brookings to Egan, S. D., and thence on to Sioux City via Sioux Falls. At a mass meeting in Egan a committee of five was appointed to solicit subscriptions and secure the right-of-way. A survey of the proposed route will be made soon.

The electric-railway franchise of the Kohala Railway Company, permitting it to construct an electric railway between Hilo and Kohala in Hawaiian Islands, has been canceled by the superintendent of public works on account of the failure of the company to comply with the terms on which the franchise was granted.

The Indianapolis Northern Traction Company and the Fort Wayne and Wabash Valley Traction Company have entered into an agreement whereby a union ticket office has been established at Logansport, Ind., where both lines have their terminal, and tickets will be sold to all points on either of the roads and their connecting lines by a single ticket agent, Mr. G. W. Beal.

J. J. Wright, general manager of the Toronto Electric Light Company, is quoted as saying: "It is probable that in the near future all the railways on the Niagara Peninsula will be operated electrically, for the railway locomotive is the most uneconomical form of steam engine there is. There is absolutely no reason why all the trains within at least 40 or 50 miles of the Falls of Niagara should not be operated by electricity. Eventually, no doubt, all the railways in southwestern Ontario from Toronto westward will be run in that way."

Horace E. Andrews of Cleveland has formed what will be known as the Central syndicate to take over the remainder of the holdings of the Utica (N. Y.) syndicate which built the Utica and Mohawk Valley electric railway, and combined a number of others with it. The Vanderbilts took 51 per cent. of the holdings and will probably take an equal portion with Mr. Andrews in the new syndicate. The underwriting has been largely taken in Cleveland, it is said.

SOCIETIES AND SCHOOLS.

It is understood that the City Council of Winnipeg, Man., will invite the British Association for the Advancement of Science to hold its 1907 meeting in Winnipeg under the auspices of the Royal Society of Canada.

The committee on the United Engineering Building recently awarded the contract for the construction of the new building to the Wells Bros. Company of New York city, the contract being for the sum of $795,000. This relates simply to the construction work on the building.

The eighth general meeting of the American Electrochemical Society will be held at Bethlehem, Pa., on September 18th, 19th and 20th, in response to an invitation from Lehigh University. A communication was received by the board of directors in reference to the Frenzel prize, and at this meeting applications for the prize will be considered. A good programme is being prepared and Bethlehem has many points of interest for the entertainment of those who attend.

William H. Blood, the new president of the National Electric Light Association, was in New York last week consulting with several of the officers of the association regarding the policy to be pursued during the coming year. President Blood intends to make several appointments of committees, etc., soon, with a view to having active work taken up at once and continued throughout the year in addition to the routine work of the secretary's office. A number of new members were added to the different classes at the Colorado meeting, and interest in the association was never so keen as at the present time.

The Department of Agriculture and Technical Instruction for Ireland was created by Parliament in 1899. The annual report of the board for the fiscal year 1903-4 shows great progress in technical instruction in cities and towns. There were 40,000 pupils in attendance during the year 1903-4. In addition, 8,600 pupils received instruction in experimental science, etc., in secondary day schools supported by the science and art grants. In centers where three or four years ago no instruction of the kind existed, there are now largely and regularly attended schools. The attendance has been maintained and the character of the work improved. Difficulties confronting technical instruction are the lack of suitable buildings and the insufficient preliminary education of the students. Other than local taxation, there is no provision for securing the necessary means with which to build, and the report suggests that Parliament should provide a portion of the funds needed.

PUBLICATIONS.

The Allis-Chalmers Company of Milwaukee has issued a pamphlet upon "Gold Milling in the Black Hills," describing its apparatus and giving interesting details concerning gold-milling processes.

Two little folders which will attract attention are issued by the Standard Electrical Manufacturing Company of Niles, Ohio, and are devoted to the Star lamp. The two are appropriately entitled "Starlight" and "Seeing Stars."

A well-printed and tastefully arranged bulletin, issued by the De Laval Steam Turbine Company of Trenton, N. J., describes the company's works and product. The bulletin is well supplied with fine half-tone cuts showing views in the interior of the factory and also the turbines themselves.

The Peru Electric Manufacturing Company of Peru, Ind., has issued an attractive bulletin on its new line of National Code Standard specialties, including tie buttons, fuseless rosettes, weatherproof sockets and attachment plugs. The company will be pleased to mail this to anyone interested in these specialties.

It is a genuine pleasure to look through the pages of the new bulletin of J. G. White & Co. of New York, which gives a few glimpses of the work that this company is doing in the line of electric interurban-railway construction. The bulletin is really a portfolio of handsome views taken of various interurban lines, power houses, car barns, etc., in the construction of which the company has been identified.

The Star Dynamo Company of Jefferson City, Mo., manufactures a motor which is especially adapted to the driving of linotype machines. This motor has a speed of 350 revolutions per minute and belts direct to the pulley of the machine. Now that scorching weather is here the same company is pushing harder than ever its electric ventilating fans, designed to be placed in a hole in the wall and remove the air from the room. These fans are of one-half and one horsepower.

MISCELLANEOUS.

Harlan W. Brush, United States consul at Milan, Italy, reports that the Federal Council at Berne has communicated to the Italian government that the official inauguration of the Simplon railroad will take place on October 10th. The king of Italy and the president of the federation will be present.

M. H. Maxwell, city clerk of Marinette, Wis., will receive bids on or before August 10th stating what percentage of the gross receipts will be offered for a 25-year franchise to operate a messenger and combination fire-alarm, night-watch and patrol system in that city. The successful applicant will be allowed to erect poles and an overhead system of wires.

TRADE NEWS.

The Central Electric Lamp Company of St. Louis has been incorporated with a capital stock of $6,000.

John I. Beggs has been made trustee of the National Electric Company. This action was taken at a meeting of creditors held in Milwaukee on Friday of last week.

Henry Bentley, representing Mrs. L. K. Behrens, C. H. Laddrell, Edward Shideler and E. L. Laralde, purchased the plant of the Barriett Electric Company of Cincinnati, Ohio, at a bankrupt sale a few days ago for $5,300. A new company will be organized, it is said, to operate the plant.

Persistent reports of late that the large car manufacturers of the country are about to combine have been denied by prominent men in the business. The latest denial is that of C. A. Ricks, secretary of the G. C. Kuhlman Car Company of Cleveland, Ohio, who states that if a combination of the car manufacturing companies has been formed, as reported in the daily press, he does not know anything of it.

The first annual conference of the Franklin Electric Manufacturing Company's selling organization was held at the home office in Hartford, Conn., on June 27th to 30th. The programme included conferences at the factory and social diversions at nearby resorts of interest. On June 29th the salesmen went to Deep River, where sailing, fishing and athletic sports were the order of the day. The annual dinner was given on June 30th.

The Electric Bond and Share Company is a holding corporation, organized under the laws of the state of New York, with power to purchase bonds, stock or other forms of securities resulting from electrical developments, such as street railways and electric-light and power plants. The corporation has issued $2,000,000 of preferred stock and $2,000,000 of common stock. All of the common stock is reported to be owned by the General Electric Company.

A. C. Garrison, president of the Columbia Incandescent Lamp Company, St. Louis, passed through Chicago last week on his return from a short vacation spent in the North. Mr. Garrison seemed greatly benefited by his vacation, and imbued with new vigor to carry out his extensive campaign for fall business. The Columbia company recently closed a contract for 100,000 lamps with a prominent eastern lighting company. The good points of the Columbia lamp are known far and wide, and under the skillful and energetic management of Mr. Garrison the demand for the Columbia is ever on the increase.

The officers of the Crocker-Wheeler Company of Ampere, N. J., have been re-elected for the ensuing year. The regular quarterly dividend of 1½ per cent. has been declared and the affairs of the company are in a flourishing condition. The officers are: President, Schuyler Skaats Wheeler; vice-president and chief engineer, Gano S. Dunn; treasurer, W. L. Brownell; assistant treasurer, G. W. Bower. The directors are Prof. Francis B. Crocker of Columbia University, Dr. Wheeler, Messrs. Dunn and Doremus, A. Foster Higgins, Herbert Noble, Thomas Ewing, Jr., F. L. Eldridge and C. A. Spofford.

Smiley & Gleeson is the name of a new firm of electrical manufacturers' agents that has recently started business in St. Louis, with offices at 407 Security Building. The members of the new firm are Frank B. Smiley and T. P. Gleeson. Mr. Smiley is well known in St. Louis business circles and has had experience in the electrical business. Until recently he held the position of secretary of the Barth-Rose Coal Company of St. Louis. Mr. Gleeson is already well known in the electrical trade by his energetic and aggressive work for the American Carbon and Battery Company. Mr. Gleeson was treasurer of this company and also was active as manager of sales in placing the factory's output. He was also for a time salesman for the Ewing-Merkle Electric Company. Smiley & Gleeson will make a specialty of only about

a half dozen electrical lines, and devote themselves exclusively to placing these specialties. Incandescent lamps will be handled; also telephones, motors, generators and batteries. This firm has already been appointed exclusive agent in Missouri and the southern half of Illinois for the Shelby Electric Company of Shelby, Ohio. The Green Telephone and Electric Manufacturing Company of Milwaukee has likewise appointed the firm as its agent in the same territory. Already the new firm has succeeded in making itself felt in the trade.

An association of British manufacturers and traders interested in the export business is reported to be in course of formation. The new organization will be known as the Manufacturers' Association of Great Britain, and its specific object will be similar to that of the Canadian Manufacturers' Association and the National Association of Manufacturers of the United States—that is, to promote and expand trade in foreign markets. The means by which these objects will be obtained include the appointment of correspondents in all parts of the world to report on openings for trade and local changes and conditions within their respective spheres, and the distribution of such information among firms whom it will most benefit.

BUSINESS.

The Electric Appliance Company of Chicago and San Francisco is sending out data descriptive of the Sangamo direct-current wattmeter, for which it is distributing agent. It reports that extensive additions to the factory are keeping pace with the growing demand for this wattmeter.

At the last Chicago telephone convention one of the most tasteful and popular souvenirs was the scarfpin representing the trademark of the F. Bissell Company of Toledo. As the company wishes to send pins to those who have not received them, it will mail them on request without charge. The pins are worth writing for. The method of advertising this house, already well known, will be appreciated.

The Belden Manufacturing Company of 194 Michigan Street, Chicago, reports a steadily increasing business with its magnet-winding machines and automatic counters from operating companies which are making their own repairs as well as from the telephone manufacturers. The counting machine is mounted on an adjustable base so that it can be connected to any magnet winder. It is connected to the winding machine by a flexible shaft and automatically records the number of turns of wire wound on the coils. It is understood that the Belden Manufacturing Company makes the only machine for this purpose on the market.

The Chicago Commercial Association has secured reduced rates to Chicago for its members and merchants and manufacturers who are patrons of its members. These rates are secured on certain dates and cover the Western Passenger Association territory, Central Passenger Association territory and southwestern territory. Special rates will also be given by the Illinois Central to southern points and by the Southern Pacific for a round trip from San Francisco and other points in California to Chicago.

That the use of the electrolytic process for the treating of ores is constantly increasing is shown by an order just placed with the Crocker-Wheeler Company of Ampere, N. J., through its New York branch. The order calls for two-size 898 Crocker-Wheeler engine-type direct-current generators, with a capacity of 10,000 amperes and 105 volts. These will be special machines with 22 poles. The speed will be 100 revolutions per minute. They will be installed at Cartaret, N. J., in a plant where there are at present four Crocker-Wheeler generators of varying capacity up to 750 kilowatts.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) July 11, 1905.

794,161. Medical-battery Electrode. Kittie L. Van Guylder Curry, Chicago, Ill. Application filed April 26, 1905.

A closed metallic shell is provided with an opening for the admission of an electrical conductor. A plate is arranged within the shell opposite the opening and at substantially right angles. Means connect a conductor to the plate.

794,194. Electric Circuits for Railway Signaling. Henry W. Spang, New York, N. Y., assignor to Charles H. Ketcham, Yonkers, N. Y. Application filed July 30, 1902.

A track circuit is formed over the two lines of rails constituting a section of railway track. Ground circuits, each include one side of the track circuit, and suitable ground connections are situated at opposite ends of the section. Control magnet coils are included in the track and ground circuits.

794,195. Electric Circuits for Railway Signaling. Henry W. Spang, New York, N. Y., assignor to Charles H. Ketcham, Yonkers, N. Y. Application filed September 30, 1902.

Combined with a guard or metallic circuit having a sectional generator and two controlling magnet coils at opposite ends are two conductors extending along the circuit and connected therewith at points between the coils and sections of the generator. This affords two additional metallic circuits, each including a magnet coil, one leg of the guard circuit and one of the conductors.

794,196. Electric Circuits for Railway Signaling. Henry W. Spang, New York, N. Y., assignor to Charles H. Ketcham, Yonkers, N. Y. Application filed October 3, 1903.

A track circuit is formed of two lines of rails of a section of track having a suitable source of electricity connected to one end of the rails. A controlling magnet has two coils connected to the other end of the rails, a conductor extending along the circuit and connected with ground connections. The track circuit at its opposite ends affords an additional metallic and ground circuit including a magnet coil, a line of rails, the conductor and ground connections and an additional ground circuit embracing the other magnet coil, a line of rails and ground connections.

794,208. Electrothermal-bath Apparatus. Frank W. Weeks, San Antonio, Texas, assignor to the Weeks Electrical Company. Application filed February 24, 1903.

A couch-like arrangement has a number of incandescent lamps mounted in the framework to apply light and heat to the patient's body.

794,210. Dynamo-electric Machine. Dimitry Balachowsky, Paris, and Philippe Caire, Levallois, France. Application filed November 21, 1902.

A double set of brushes are connected two and two, each of the two connected brushes embracing a zone of commutation having the neutral point or points within the zone. Thus the demagnetizing force of the armature may be transformed into a magnetizing force to assist the field and without sparking at the brushes. (See cut.)

794,212. Metallurgical Furnace. George H. Benjamin, New York, N. Y. Application filed March 31, 1903.

The combined materials passing through the furnace are subjected to the physical effects of an electric arc.

794,218. Electric Switch. Willard E. Dow, Braintree, Mass. Application filed January 9, 1905.

An electric switch comprises a central conductor plate having a shouldered socket portion at one end and a shouldered boss at the other end. A base is molded about the opposite end portions, and fixed contacts are put adjacent the plate at the opposite sides.

794,220. Electric-circuit Closer. Monroe Guett, Hartford, Conn., assignor to the Hart & Hegemann Manufacturing Company, Hartford, Conn. Application filed November 4, 1903.

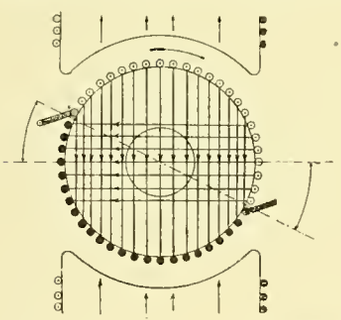
An electric circuit closer having a concealed insulated circuit terminal and several other circuit terminals is supplied with a removable key which, when thrust into the circuit closer engages the neutral terminal and when in the circuit closer can be rotated to make such contacts as will provide an electrical path from the neutral terminal to either of the other terminals.

794,242. Tape-controlled Telegraphic Transmitting Apparatus. Donald Murray, London, England. Application filed January 5, 1905.

A lengthwise-moving tape perforated with a series of signal holes arranged in a single line along the tape cooperate with a single reciprocating rod adapted to enter the perforations or to strike against the unperforated portions of the tape. The tape and the rod control the direction of action of a lever adapted to thrust a contact lever over from a marking to a spacing contact or vice versa, the thrust being delivered direct from the motor mechanism of the transmitter and being independent of the strength of the tape.

794,245. Electric Apparatus for Producing Sound Signals. Charles H. O'Brien, Augusta, Maine, assignor to the O'Brien Electrophone Company, Augusta, Maine. Application filed July 18, 1904.

Co-operating with an electromagnet is a sound-producing vibrating body capable of being vibrated directly by the electromagnet. A variable resistance is connected directly to and carried by and adapted to be vibrated with the body, a source of electrical energy and means for causing electricity to flow from the source through the electromagnet and variable resistance being also provided.



NO. 794,210.—DYNAMO OR MOTOR WINDING.

794,255. Electric Furnace. Cecil L. Saunders, Cleveland, Ohio. Application filed February 15, 1901. Renewed November 18, 1903.

Combined with a horizontal continuous annular trough forming a hearth are means for continuously rotating the hearth, positive and negative electrodes supported on the hearth and adapted to convey current to and from the material thereon, stationary contact pieces with which the electrodes make temporary contact and connections from the contact pieces to the source of electricity.

794,266. Electric Signaling and Electropneumatic Train-control System. John A. Whyte, Toronto, Canada. Application filed March 5, 1904.

A block comprises one insulated section of a conductor which is divided into a series of insulated sections. The first track rail is divided into a series of insulated sections; the second track rail is used as a common conductor for all the blocks. Suitable wiring connects the insulated section of the conductor to the immediately preceding insulated section of the first track rail, and suitable wiring also connects the immediately preceding section of the first track rail to the second track rail.

794,269. Automatic Electric-railway Switch. Walton D. Woolley, Normandy, Mo. Application filed August 3, 1904.

Combined with a trolley wire and a switch are an electromagnet associated with the switch and means connected with the switch operable by the electromagnet for throwing the switch. A conduit is provided for the magnet connections, the conduit having a vertical portion terminating in a curved portion opening downward by which ingress of moisture along the wires to the magnet is prevented.

794,296. Electric Display Lamp. Henry J. Gille, St. Paul, Minn. Application filed January 5, 1903.

A cap or cover for the tip end of an incandescent lamp is described.

794,309. Insulating Block for Electric-light Canopies. Isaac J. Parker, Boston, Mass. Application filed November 8, 1904.

An insulating block for electric-light canopies and back plates consists of a main portion, and parallel flat jaws extending from the main portion and separated by a straight groove or slit whereby the curved edge of the canopy or back plate may be held firmly between the straight jaws, the block being made of insulating material.

794,334. Wireless Telegraphy and Transmission Across Space. Alessandro Artom, Turin, Italy. Application filed May 3, 1904.

Apparatus for signaling by electromagnetic waves comprises aerials forming a downwardly open angle of 90 degrees, a conductor connected to each of the aerials forming with one another an upwardly open angle of 90 degrees and the aerials extending generally in the direction of transmission of the waves.

794,343. Telephone Switchboard. Martin C. Burt, Chicago, Ill., assignor to F. A. Meidinger, Chicago, Ill. Application filed January 26, 1904.

Associated with a telephone switchboard are a tubular wire distributor open at both ends, a wire cable entering one end, its wires radiating from its longitudinal axis, radially disposed couplings for the wires mounted on the distributor and means at the other end of the distributor arranged to create a current of air directly through the end and through the distributor and the wires.

794,348. Telephone System. William W. Dean, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed September 14, 1903.

A line-signal-controlling magnet and a common source of current are connected with the line at the central office. Means under the control of the subscriber permit a flow of current over the line from the source to operate the magnet and thereby the line signal. A cut-off magnet in series in the line between the line-signal-controlling magnet and the connection terminal is adapted to be operated when a connection is established with the line by the connective means to render the line signal inoperative. (See cut on next page.)

794,349. Telephone System. William W. Dean, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed September 14, 1903.

In the system described a cut-off magnet is located between the line-signal-controlling magnet and the connection terminals, and has its differential windings disposed in the opposite sides of the line. The cut-off magnet is operated when a connection is established with the line by the connective means to render the line signal inoperative.

794,358. Electrical Controller. Ray P. Jackson, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed June 6, 1904.

A main drum having an actuating plate one face of which is provided with projections co-operates with a reversing drum having a plate one face of which is provided with projections that are engaged by the actuating plate projections to move the reversing drum to one of its "on" positions and to lock it in that position.

794,362. Electric Motor. Benjamin G. Lamme Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed January 3, 1905.

Combined with a source of alternating-current energy are a source of direct-current energy and a motor having series-connected armature and field-magnet windings. Means cause the ampere-turns in the field magnet winding to assume a higher value when the motor is operated by direct currents than when it is operated by alternating currents. (See cut.)

794,363. Electric Motor and Controlling Means Therefor. Benjamin G. Lamme, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed January 3, 1905.

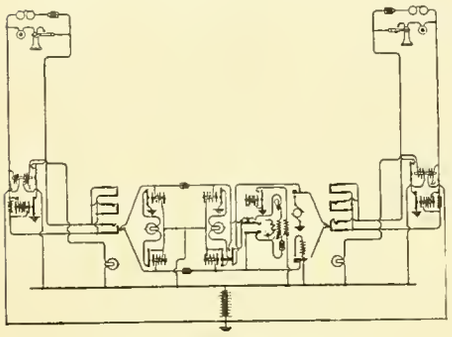
A motor having series-connected armature and field-magnet windings is provided with an inductive winding and a non-inductive resistance which are connected in series with each other and have their inner terminals connected to a source of energy and their outer terminals respectively connected to the outer terminal of the field magnet winding and to a point intermediate its ends. (See cut on next page.)

794,365. Voltage Regulator. Paul M. Lincoln, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed June 30, 1904.

A resistance and a rotary cylinder comprise two sections separated by an angular insulation plate. A contact device is in constant engagement with one section of the cylinder and is connected to one terminal of the resistance. An adjustable contact device and means for automatically adjusting it in accordance with the voltage applied to the resistance terminals so that it will engage the one or the other cylinder section or each of them in alternation is provided.

794,370. Telephone Lock-out Mechanism. Thurston Matheny and Ruben C. M. Hastings, Athens, Ohio. Application filed July 22, 1904.

Telephone signaling and lock-out mechanisms comprises a receiver hook, a receiver-hook lock at each local station, a manually operable selecting means movable at each station a different number of times for permitting the release of the lock and means operable on each of the movements for transmitting a signal to central.



NO. 794,348.—TELEPHONE SYSTEM.

794,395. Electrical Measuring Instrument. Frank Conrad, Edgewood Park, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed January 20, 1904.

An alternating-current electrical measuring instrument comprises primary and secondary field coils, a bipolar core therefor, a rotatable conducting member between the pole pieces of the core and auxiliary coils on the pole pieces that are connected in series with the secondary coils.

794,398. Electric Drill Motor. Francis E. Drake, St. Louis, Mo. Application filed September 30, 1904.

The electric drill has an outer casing and passages for the circulation of air. An electric fan motor is placed within the casing for forcing the air through the passages. A supply circuit operates the drill and an independent supply circuit operates the fan motor.

794,435. Thermal Cut-out. Theodore Varney, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed June 24, 1904.

A supporting block having a deep central chamber and two relatively shallow side chambers that are separated from the central chamber by partitions or walls and are provided with contact terminals contain a fuse-holding block having a central projection provided with a groove to receive the fuse wire, and having side projections provided with contact terminals adapted to make locking engagement with the terminals in the block.

794,442. Controller for Electric Motors. Frederick Wright, Fishkill, N. Y., assignor of one-half to Adolph G. Hupfel, New York, N. Y. Application filed February 10, 1905.

The controller embodies an arrangement of brush contacts and secondary contacts so arranged that by movement of a switch the sources of energy terminating in the various contacts may be connected to the motor in multiple or series.

794,458. Incandescent Electric-lamp Socket. Louis C. Gollatz, Providence, R. I., assignor to the Providence Gas Burner Company, Providence, R. I. Application filed December 14, 1904.

An adapter for electric-lamp sockets has a screw-threaded shell, a screw-threaded central sleeve for engaging the central stem of a Thomson-Houston socket, a locking plate having teeth and means for moving the locking plate bodily to engage with the stem.

794,459. Wireless Telegraphy. William S. Hogg, Washington, D. C. Application filed May 6, 1905.

Detector apparatus for use in space telegraphy embodies a comminuted microphonic material and electrodes between which the material is included, one of the electrodes having a small capacity for heat and the other a large capacity for heat.

794,497. Thermostat. John D. Gould, New York, N. Y. Application filed October 8, 1904.

A metal plate of relatively low fusing point and a relatively porous insulating sheet upon one side thereof are located between two metal plates of relatively high fusing point in close contact therewith. An insulating chamber peripherally incloses the plate of low-fusing metal and a terminal for a circuit conductor is electrically connected with each high-fusing plate.

794,501. Storage-battery Grid. Michael Heisser, Chicago, Ill. Application filed July 5, 1904.

A storage-battery grid comprises a frame provided with a number of parallel cross bars, the cross bars being Z-shaped in cross section and so disposed that the webs of the bars extend at an incline from one side to the other of the frame. The outer faces of the flanges of all of the bars lie in two substantially parallel planes, the bars providing substantially V-shaped grooves in their upper and lower faces for retaining lead oxid. The flanges of the bars are wedge-shaped and terminate in sharp edges.

794,518. Circuit Breaker. John B. Laing, Sun, W. Va. Application filed March 28, 1904.

On a non-conducting hanger are terminals and a bridging member connecting the terminals and forming a continuous contact for the trolley wheel, the member being movable to break the circuit.

794,519. Automatic Block-signal System. Jörg Lanz, Rodaun, near Vienna, Austria-Hungary. Application filed January 21, 1903.

Block-station apparatus consists of two batteries, two relays and two signal wires with their respective signal bells and release relays. The two rails are partly used for block-circuit conductors. The semaphore, operated by a guard, only allows a train to pass out of the section traveled upon when the signal bell and release relays of the next block station are operated by the current of the battery of the next but one block station.

794,565. Electric Arc Lamp. Marion A. Stogsdill, Indianapolis, Ind., assignor to the Pyle Electric Headlight Company, Indianapolis, Ind. Application filed October 26, 1904.

A clutch holds the upper electrode and a rod is connected with the clutch for operating it. A lever is fulcrumed at one end to the frame, at its other end adapted to elevate the rod. A bell crank pivoted to the frame is actuated by a solenoid. A connecting rod between the bell crank and lever transmits power from the former to the latter. (See cut.)

794,573. Apparatus for Catching Fish. Michael Ward, Pittsburg, Pa. Application filed March 8, 1905.

A source of electrical energy mounted on a boat is communicated to a net having strands of conducting material connected alternately to the opposite terminals of the source of electrical energy.

794,580. Automatic Electric Heat Control. James I. Ayer, Cambridge, Mass., assignor to the Simplex Electric Heating Company, Boston, Mass. Application filed February 6, 1905.

A switch opens and closes the circuit to a movable heating device, a stationary regulating device being automatically controlled by the temperature of the movable device when placed thereon. The regulating device operates at predetermined temperatures of the device to effect the opening and closing of the switch.

794,588. Method of Manufacturing Incandescent Electric Lamps. Henri Casassa, Milan, Italy. Application filed January 4, 1901.

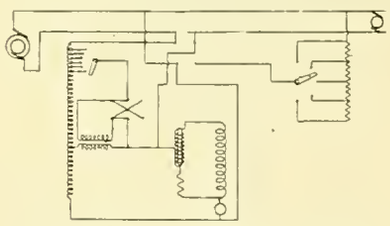
A method of forming impermeable joints between oxidizable metallic conductor wires and glass bulbs in electric lamps consists in heating the wires to a red heat before and retaining the wires at a red heat during the coating with the glass, thereby driving off the gases which are formed and oxidizing the wires. The oxidized wires are coated exteriorly of the bulb with a readily fusible substance capable of commingling with the metallic oxide. By creating a vacuum in the bulb the substance will be drawn inwardly and commingled with the metallic oxide, forming an impermeable mastic.

794,604. Portable Conveyer. George E. Gannon, Colorado City, Colo. Application filed December 15, 1904.

The buckets or carriers of the conveyor are propelled by electric motors.

794,645. Insulator Bracket for Telephone Poles, etc. Knudt G. Springen, Zumbrota, Minn. Application filed March 10, 1905.

A staple-like member having an eye intermediate of its ends is driven through an insulator bracket into the pole. Means adapted to connect with the eye pass around the pole and are fastened at the back.



NO. 794,363.—ELECTRIC-MOTOR CONTROL.

794,647. Electrostatic Magnetic Separator. Henry M. Sutton, Walter L. Steele and Edwin G. Steele, Dallas, Texas. Application filed February 3, 1902.

A magnetic separator comprises a magnetically constantly energized surface, means for feeding material thereto and a cleaner rotatable adjacent to the surface and magnetically energized by induction therefrom to remove material from the separator.

794,656. Construction of Electrical Meters. Otto T. Bláthy, Budapest, Austria-Hungary. Application filed November 10, 1902.

The mechanical features of an electric meter are described.

794,669. Thread-twisting and Waxing Machine. Albert H. Forsythe, Sarcoxie, Mo. Application filed April 9, 1904. Renewed June 17, 1905.

The only electrical feature about the apparatus is an electric alarm device.

794,675. Fluid Gauge. Morris Martin, Malden, Mass., assignor to George W. Gregory, trustee, Boston, Mass. Application filed November 18, 1904.

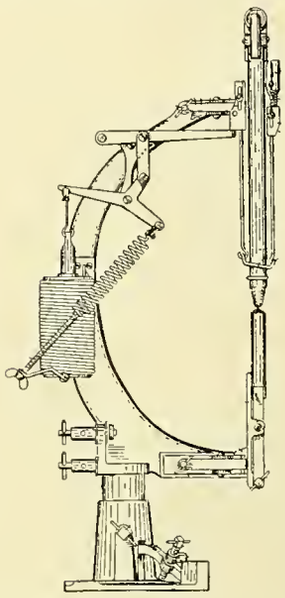
A tube provided with a plate in the upper portion contains a compass box having a magnetic needle disposed above the plate. A shaft is sustained in the tube and a permanent magnet is mounted at the upper end of the shaft between the plate and the compass box. A float is guided and turned by the tube in the rising and falling movement of the float due to changes in the fluid level.

794,676. Fluid Gauge. Morris Martin, Malden, Mass., assignor to George W. Gregory, trustee, Boston, Mass. Application filed March 1, 1905.

A float which is contained in a tube rises and falls with the level of the fluid and at the same time is rotated by a spiral groove in the tube. It actuates a permanent magnet which by its rotation accomplishes the rotation of a magnetic needle just above it, which in turn indicates the level of the liquid.

794,677. Fluid-operated Gauge. Morris Martin, Malden, Mass., assignor to George W. Gregory, trustee, Boston, Mass. Application filed August 31, 1903.

A magnetic needle indicates the level of the fluid, it being rotated by a magnet which is in turn rotated by the movement of a float.



NO. 794,565.—ARC LAMP.

794,678. Fluid Gauge. Morris Martin, Malden, Mass., assignor to George W. Gregory, trustee, Boston, Mass. Application filed August 19, 1904.

A vertical shaft is adapted to be turned in the head of the gauge and has an attached permanent magnet. A separate compass-box having a magnetic needle is sustained at the top of the head. A tube having a spiral guide depends from the head, and a float is located within the tube and guided thereby, the float in its rising and falling movement turning the shaft and magnet.

794,679. Fluid Gauge. Morris Martin, Malden, Mass., assignor to George W. Gregory, trustee, Boston, Mass. Application filed November 28, 1904.

The gauge head has a filling opening and a depending tube. A rock-shaft in the tube is provided with a permanent magnet. A float turns the rock shaft and magnet and a compass box sustained at the upper end of the head closes the filling opening.

794,686. Portable Audiphone. Eugene W. Schneider, New York, N. Y., assignor to the Mears Ear Phone Company, New York, N. Y. Application filed March 27, 1905.

A hollow handle having a conducting path contains a battery. A microphone transmitter is attached to one end of the handle and an earpiece to the other. A connecting piece of insulating material is located at each end of the handle, and means in each connecting piece make contact with the battery and the conducting path in the handle so as to secure a circuit between the microphone transmitter and the ear piece.

794,702. Telephone System. William W. Dean, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed May 27, 1901.

Combined with a subscriber's line circuit are two cut-off relays for the line, a line relay, a line signal controlled thereby, a source of current and means for operating one or the other of the cut-off relays under different conditions of use for rendering the line signal inoperative.

794,703. Crushing Apparatus. Malcolm Dickerson, Newark, N. J., assignor of eighty one-hundredths to the Freid Engineering Company, Orange, N. J. Application filed June 11, 1904.

Pressure is applied to the rolls of the crusher by electromagnets.

EXPIRING PATENTS.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on July 17, 1905:

386,103. Secondary Electric Clock Movement. C. Bohmeyer, Halle-on-the-Saale, Prussia, Germany.

386,111. Electric-wire Insulator. H. H. Cutler, Newton, Mass.

386,129. Automatic Telegraph Transmitter. Z. P. Hotchkiss, Oak Park, Ill.

386,149. Galvanic Battery. A. V. Meserole, New York, N. Y.

386,150. Galvanic Battery. A. V. Meserole, New York, N. Y.

386,175. Police Signal Apparatus. J. C. Wilson, Boston, Mass.

386,184. Electric Railway. R. A. Cheseborough, New York, N. Y.

386,189. Electrical Bulletin. P. B. Delany, New York, N. Y.

386,225. Electrical Distribution by Storage Batteries. G. W. Walker, Bethlehem, Pa.

386,340. Dynamo-electric Machinery. G. Minot, Paris, France.

386,380. Telephone Transmitter. C. W. Brown, Montreal, Quebec, Canada.

386,441. Apparatus for Electric Welding. E. Thomson, Lynn, Mass.

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LIBRARY OF ELECTRICAL ENG'G

A Glance at Recent Electrical Development in Oregon.

By C. M. Hyskell.

When one stops for a moment to consider the electric power development which is exhibited by plants now nearing completion or recently completed in various parts of the state of Oregon, the outlook must be satisfactory to him who watches with interest the onward march of the practical applications of electricity. The newer electrical power plants are nearly all examples of water-power development, but there is one interesting and conspicuous exception—although even that, to be sure, is operated in conjunction with a large hydro-electric installation—and that is the steam plant just completed by the Portland General Electric Company in Portland. This modern station will generate 10,000 horsepower in electric current, doubling the company's former capacity, which was 10,000 horsepower from its waterpower plant at Willamette Falls, Oregon City.

Turning to the Oregon Waterpower and Railway Company one finds that it is bringing to completion a two-year task of constructing a 20,000-horsepower plant at Cazadero, on the Clackamas River, 40 miles from Portland, at a cost of about $750,000.

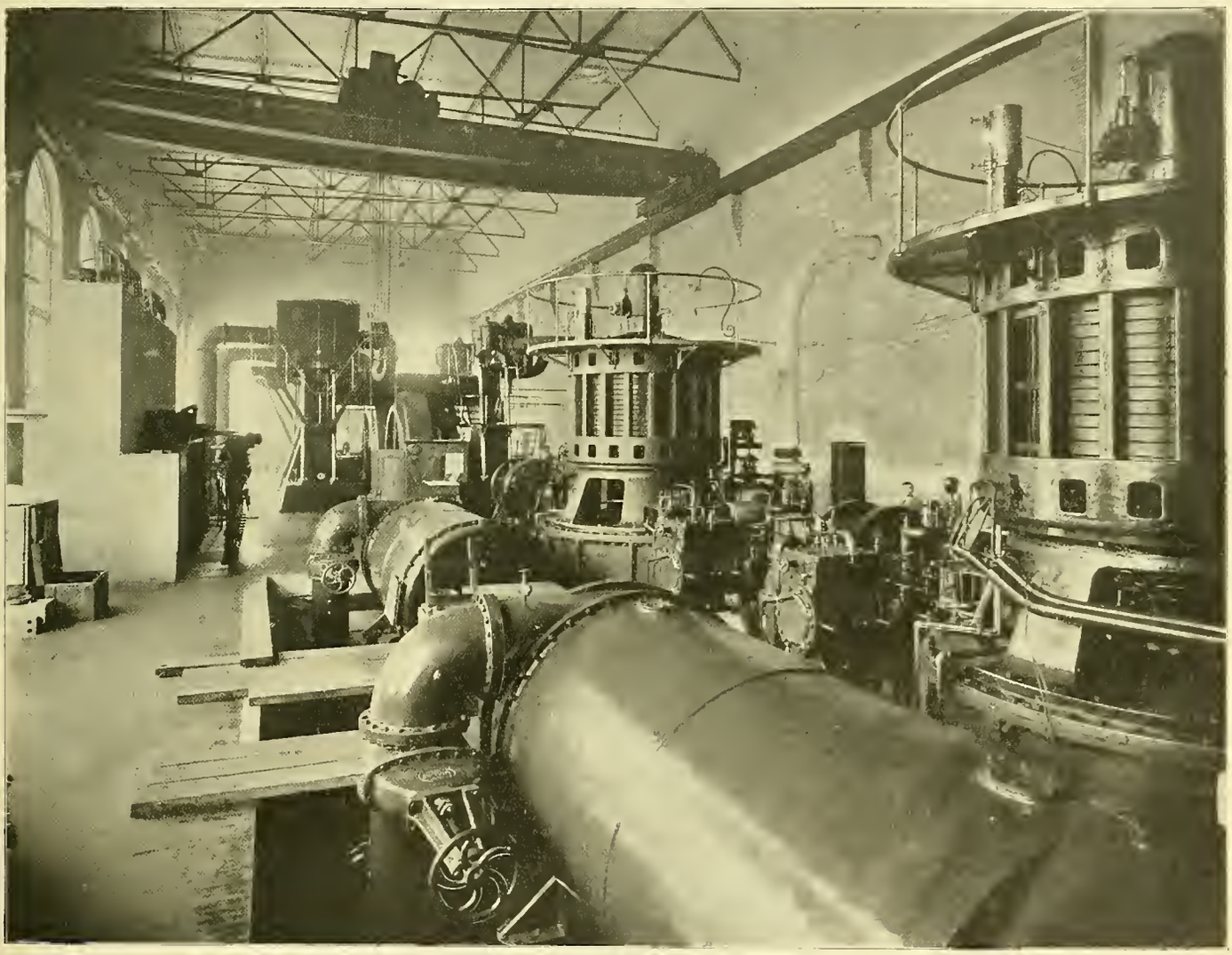
Looking toward the southwestern part of the state there is the Gold Ray Electric Power Company, which has just completed a dam and electric power plant at Gold Ray, on the Rogue River, where it will generate 5,000 horsepower and light the cities of Medford, Grant's Pass, Tolo and Gold Hill, and furnish power for mining operations in the Grant's Pass district.

Up in the northeastern portion, near the Washington state line, the Northwestern Gas and Electric Company at Walla Walla, Wash., has just completed a dam and power plant on the Walla Walla River, in Umatilla, Ore., generating 3,000 horsepower and lighting the cities of Pendleton, Walla Walla, Athena and Weston. The company's plan includes construction of an electric road at Walla Walla, furnishing street-car service and extending into the country to connect several nearby towns.

Then, too, work has just been begun by the Atlas Construction Company of San Francisco on construction of an electric railway connecting Portland, Hillsboro and Forest Grove, the total length of the line to be 26 miles. The company will not construct a power plant. Current will be bought from local companies that are now installing large additional generating capacity to meet the rapidly increasing demand for electric light and power in the Willamette Valley.

It will be seen that there is a conspicuous movement in the development of electric power and transmission by means of waterpower and steam plants, principally the former, in Oregon. The Portland General Electric Company's new steam plant in Portland is one of the most important improvements, as the company has been furnishing most of the electric light and power in the vicinity of the exposition city. It has been lighting the city of Portland; selling power for operation of the Portland Consolidated railway lines, consisting of more than 100 miles of street-car tracks; selling a part of the power necessary for operating the Oregon Waterpower and Railway Company's standard-gauge railway system of 100 miles between Portland, Cazadero, Oregon City and Canemah, and also supplying current for driving the Portland Flouring Mills, the largest on the Pacific Coast.

When the management of the Lewis and Clark Exposition decided to forego construction of a lighting plant on the grounds, and entered into a contract with the Portland General Electric Company for 100,000 incandescent lights, requiring 4,000 horsepower, the company determined on immediate construction of the additional plant. It decided to erect a steam plant in Portland as a measure of precaution against possible disasters to which waterpower plants are subject, and also because such a steam plant could be operated cheaply with sawdust fuel from the large sawmills.



ENGINE ROOM OF PORTLAND GENERAL ELECTRIC COMPANY'S NEW STEAM POWER STATION IN PORTLAND, OREGON.

The new power station is of brick and concrete-steel construction. It has a stack 230 feet high and 12 feet in inside diameter. The plant is equipped with 10 Cahall water-tube boilers, each rated at 1,040 horsepower, 175 pounds pressure. Foster superheaters and Goubert feed-water heaters. The boilers are arranged in five batteries. Either oil or sawdust can be used as fuel, the boilers being provided with Dutch ovens and Morrisey oil burners. There is storage for 2½ carloads of oil. Steam is supplied to two 1,400-horsepower marine-type vertical compound engines, built by the Willamette Iron and Steel Works, Portland. Each engine is direct connected to a 1,000-kilowatt, 33-cycle, three-phase General Electric alternator. There is one Ideal engine driving an exciter of

85-kilowatt capacity: also one motor-generator exciter of 60-kilowatt capacity. Conspicuous features of the plant are two Curtis steam turbines, each rated at 1,500 kilowatts. The new plant is known as Station E. The total horsepower of its engines and boilers and the kilowatt capacity of the generators are as follows: Boilers, 10,400 horsepower; engines, 2,900 horsepower; steam turbines, 4,236 horsepower; generators, 5,145 kilowatts.

The current generated is three-phase, 33-cycle, 10,000-volt, and is led to a sub-station in another part of the city, a mile distant, in the downtown district, where it is changed by static transformers to 2,300 volts, to be used for lighting.

Most of the power installations at the present time are 500-volt direct-current, connected to the railway system, but as rapidly as possible it is intended to change these motors for those using three-phase 60-cycle alternating current, a third wire being run out into the suburbs where necessary for this purpose. Where the amount of power used is extensive, as in the manufacturing district, a power feeder will be run. The motors at the present time connected to the system amount to approximately 5,400 horsepower.

The wires of the distributing system throughout the city are all placed overhead on poles varying in length from 60 feet in the business area to 40 and 45 feet throughout the residence districts. There are a few lines of 50-foot poles running into the residence districts, and all the high-tension circuits are carried out from the sub-station on 70-foot poles.

For the residence and business lighting the city is divided into areas, each area being fed by a separate 2,300-volt feeder. Current is distributed to pole transformers at various points and stepped down to 117 and 234 volts on the three-wire system, at which voltage it is distributed to customers.

Considerable work has been laid out for the future, and orders have already been placed for a 1,000-kilowatt motor-generator set and a 1,000-kilowatt rotary converter. Arrangements are also made for the installation at Station B and Sub-station A of bus bars, including General Electric type H switches, marble panels, bus-bar compartments, etc. The railway side of the Oregon City Transmission line will also be rebuilt.

Turning now to two other interesting plants, it may be mentioned that the Oregon Waterpower and Railway Company expects to complete its large power plant at Cazadero, on the Clackamas River, by the first of next January. It will install there five generators or more, each having a capacity of 2,500 kilowatts, with a current stepped up to 34,000 volts and transmitted to Portland for operation of its railroad system, and for sale to other industrial enterprises. A large contract has been made with the Portland General Electric Company, which will take the surplus power from the railway company's plant. At the present time the railway system is operated partly on purchased power from the Portland General Electric.

There has been an immense increase in Portland during the last two or three years in the demand for electric power and light. The growth of Portland's population has been fully 35,000 since 1890. The building records show that 4,000 houses were erected within the city limits in the last 12 months. The electrical companies propose to equip their plants to meet a continuation of this growth for some years to come, not only in Portland but the entire lower Willamette Valley, and extend their lines many miles in all directions.

WILLAMETTE FALLS WHERE PORTLAND GENERAL ELECTRIC COMPANY GENERATES 10,000 HORSEPOWER.

A difficult task in electric power installation has recently been completed on the Walla Walla River, in Umatilla County, where the Northwestern Gas and Electric Company has built a plant for producing light and power current from a reservoir and fall in a mountainous region 5½ miles from the dam and intake on the river. The water is carried from dam to reservoir in a 48-inch wooden-stave pipe 29,000 feet long. The route lays across canyons and hills, crossed by trestles and cuts, and in some places inverted siphons with 170 feet head have been used. The company will furnish light for Pendleton, Walla Walla, Athena and Weston, and for a street-car line to be built at Walla Walla. It is said the construction of the pipe line was the most difficult ever undertaken in a western power plant. The reservoir is located on a mountain side, from which the water falls 356 feet to the plant. Donkey engines were used in the construction work to hoist materials along the precipitous parts of the route.

EXTERIOR OF WILLAMETTE FALLS POWER PLANT OF PORTLAND GENERAL ELECTRIC COMPANY.

TERMINALS AND DOCKS OF OREGON WATERPOWER AND RAILWAY COMPANY ON WILLAMETTE RIVER IN PORTLAND.

Electric Capstans for Harbor Service.

The electric capstans at Antwerp Harbor which were described in the Western Electrician of June 10th can no longer be considered as in the experimental stage, as the experiments referred to have been satisfactorily concluded. The Compagnie Internationale d'Electricitité of Liége, Belgium, says that the installation at Antwerp Harbor now includes 18 such capstans in regular service, while six others are being constructed in the works of the company, and one is being exhibited at the Liége Universal Exposition. Two other capstans of the same type have been ordered by the city of Antwerp, and the four capstans of Bahia-Blanca harbor, mentioned in the article, were supplied by the same company.

CLACKAMAS RIVER WHERE CAZADERO PLANT OF OREGON WATERPOWER AND RAILWAY COMPANY IS LOCATED.

Electric Tramway and Railway Exhibition in London.

The third electric tramway and railway exhibition was held in London on July 3d to 14th inclusive. It was noteworthy from the fact that several of the largest firms in the country did not exhibit, but the reason for this was probably not due to any want of confidence in the value of the exhibition. All the known systems of surface-contact traction were on exhibition and the general merit of the exhibition lay in the variety of new details appertaining to traction work. Devices for short-circuiting broken sections of trolley wire, apparatus for preventing damage to the overhead equipment or to passengers by the jumping of the trolley, new designs in lifeguards, etc., were numerous.

The exhibition was opened on the first day by the Earl of Derby, who was at one time president of the Board of Trade. The exhibition was well attended, and delegates were present from the tramways committees all over the country. There were about 160 stands or exhibit booths erected.

The annual conference of the Municipal Tramways Association of Great Britain took place on July 4th and 5th, and many valuable and interesting papers were read.

On each day the exhibition opened at 10 a. m. and was kept open till 10 p. m. Music was furnished by various bands. An exhibition committee of 17 members had charge of the affairs. The chairman of this committee was Mr. James W. Courtenay.

The influence which electric-railway development has exerted within the last few years in what may be called the heavy-duty service was strikingly shown in the various exhibits. Hitherto continuous-current motors have been used entirely in England for railway service, but success elsewhere has now led the London, Brighton and South Coast railway to determine to equip a short length of line for single-phase work, while a Welsh electric power company is installing three-phase motors on a light railway. Some of the appliances necessary for such methods were exhibited at the exhibition.

What may almost be described as a totally new branch of the traction industry was also well represented. Motor omnibuses have ceased to be an alarming object to the railway manager in England, who now recognizes in them a useful ally which will help to feed his lines, and run where, for special reasons, his tracks may not be laid. That the motor omnibus has a wide field of usefulness is recognized, but its limitations are such that no corporation or company need fear for the security of its tramway investment where that has been made with reasonable care. The vehicles which were shown by enterprising makers in this exhibition presented a number of interesting features, and were well worth the examination of the railway managers.

Electrical Testing Laboratories of Iowa State College.[1]

By L. B. Spinney.

Appreciating the fact that there is great need in Iowa of a testing laboratory at which reliable tests of electrical apparatus may be had at reasonable cost, the department of electrical engineering has undertaken to establish and maintain in connection with its laboratories for instruction work an equipment in standardizing and testing apparatus which shall be available for such purposes.

PORTLAND, (ORE.,) GENERAL ELECTRIC COMPANY'S HYDRAULIC PLANT.

Up to the present time the greatest demand has been for lamp-testing work, and a special effort has been made to provide for tests of this character.

The lamp-testing equipment consists of photometers, electrical measuring instruments, standard incandescent lamps for use as working standards and a storage battery for supplying a constant electromotive force.

The principal photometers are a standard Reichsanstalt three-meter photometer bench graduated to millimeters and equipped with a Lummer-Brodhun screen and an appliance for rotating the lamp under test, and a Matthews integrating photometer which is used for mean-spherical-candlepower measurements.

This latter device consists essentially of a series of 11 pairs of mirrors disposed at various angles about the lamp, which is being tested in such a manner as to throw upon the photometer screen a quantity of light which is proportional to its mean spherical candlepower. In order to obtain the mean spherical candlepower of a lamp it is only necessary to balance this illumination of the screen by means of light from a source of known candlepower, as in the ordinary methods of photometry.

The study of mean-spherical candlepower which is made possible by this apparatus promises to be of great interest and importance, since it is believed that in the not far-distant future incandescent lamps will be rated on the basis of mean-spherical candlepower instead of mean-horizontal candlepower which is customary at the present time.

This apparatus also lends itself very readily to the measurement of the mean-horizontal candlepower and the candlepower in various directions above and below the horizontal. Measurements of this character are made by covering all but the horizontal pairs of mirrors and by tipping the lamp into the positions desired. In these tests as well as in mean-spherical candlepower measurements the lamp is caused to rotate while it is being tested. The use of the photometer in this way enables the study of the distribution of light from an incandescent lamp and a determination of the various effects of shades, reflectors, etc.

This photometer is regarded as a very valuable part of the lamp-testing equipment, not only because of its wide range of usefulness but because it makes possible for ordinary test purposes mean-spherical and other measurements which would be practically impossible without it. Ordinary methods for mean-spherical measurements involve long and tedious labor and are therefore expensive and, except for special purposes, altogether impracticable. By means of the Matthews integrating photometer mean-spherical measurements and mean-horizontal measurements are made with equal facility and with but small expenditure of time and labor lamps may be compared with respect to their mean-spherical as well as their mean-horizontal effects.

For use in the photometric work there have been provided 15 standard incandescent lamps, ranging from four candlepower to 32 candlepower. The majority of these were obtained from the electrical testing laboratories, and are accompanied by certificates of seasoning and standardization. These lamps are used as secondary standards for all incandescent-lamp tests. In addition to these secondary standards there are primary standards which may be used for check purposes and special tests.

The equipment in measuring instruments consists of a semi-portable Weston laboratory standard voltmeter having three scales, a Kelvin multicellular electrostatic voltmeter which is used for checking work and measurements on alternating-current circuits and Weston ammeters of suitable range for measuring the current consumed by the lamps tested. The storage battery which is used as a source of electromotive force in the lamp-testing work is a battery of 60 Chloride accumulators of 120 ampere-hour capacity mounted in glass jars. This battery is used for the initial candlepower and wattage tests referred to above and for certain of the life tests described below.

PART OF WOODEN PIPE 5½ MILES LONG TO CARRY WATER FROM RIVER TO RESERVOIR OF NORTHWESTERN GAS AND ELECTRIC COMPANY IN UMATILLA COUNTY, OREGON.

Provision is also made for making life tests of lamps. For this purpose there is provided a lamp rack fitted with suitable sockets and rheostats for adjusting the voltage. An integrating wattmeter is used for measuring the total energy supplied to the lamps under test and a recording voltmeter for indicating any possible variations which may take place in the voltage.

Standards are also provided for checking and calibrating ammeters, voltmeters and wattmeters and for the accurate measurement of resistances.

At the present time tests are being made for the people of the state at the rate of $1 per dozen or fraction of a dozen for initial candlepower and wattage tests of incandescent lamps. Other tests are made at corresponding rates. It is proposed in all of this testing work to make the charges as reasonable as is consistent with its actual cost.

1. From The Iowa Engineer. The author is professor of physics and electrical engineering at Iowa State College, which is located at Ames, Iowa.

Death of J. Holt Gates.

J. Holt Gates, a man well known in the electrical industry for many years, died quite suddenly in Chicago on July 13th, the immediate cause of his death being heart failure. Mr. Gates was born in Brooklyn in 1862, being the youngest son of General William Gates of the artillery service, United States Army. He served in the Twenty-third and Seventh regiments of the New York National Guard, and in the United States Navy for three years, but he had a great liking for commercial pursuits and an active and energetic disposition, and he left the navy to follow a business career.

J. HOLT GATES.

Mr. Gates started his electrical career in Chicago with Westinghouse, Church, Kerr & Co. in 1885. This firm had just taken the agency of the Westinghouse Electric and Manufacturing Company, shortly before organized in Pittsburg. Mr. Gates afterward removed to Pittsburg and spent a year in the shops. He then went to Texas, where he managed the Westinghouse company's interests in the South for three years. From there he returned to Pittsburg and later came to Chicago, leaving the Westinghouse company after seven years' service. Immediately after the World's Fair in Chicago in 1893 he became the sales manager of the old Siemens & Halske Company of America, with headquarters in Chicago, and subsequently went into business for himself, as agent for various electrical companies, among them being the Walker company and the Waddell Entz company.

In 1899 the firm of Gates & Randolph was formed by Mr. Gates and Robert J. Randolph, to act as western agents for the sale of direct-current apparatus of the Triumph Electric Company of Cincinnati; the alternating-current apparatus of the Warren Electric Manufacturing Company of Sandusky, Ohio; the instrument business of the Empire Electrical Instrument Company of New York; the switchboard and specialties of F. A. La Roche & Co. of New York; the business of the Sterling Arc Lamp Company of New York, and the Elmer P. Morris rail bond, with various other details. This firm finally dissolved, however, and from that time until his death Mr. Gates acted as sales agent for various types of electrical and steam machinery.

One of the enterprises which Mr. Gates was connected with about 1895 was the manufacture of a dynamo which he had invented, with the object in view of obtaining a machine simpler in construction and easier to erect than those then in use. The company which he formed at that time to manufacture the dynamo was known as the Gates Electric Manufacturing Company and was also located in Chicago.

Mr. Gates was a member of the Sons of the Revolution, the Nassau Boat Club in New York and the Chicago Athletic Association. He leaves a wife and one son 16 years old. He is also survived by one brother and one sister.

An electrotechnical exhibition will be held at Kiev, Russia, in 1906, and the announcement is made that the Ministry of Finance will permit the importation of the latest appliances and inventions in the realm of electrotechnical science for purposes of exhibit under the following rules: (1) The exhibition committee must deposit security to the amount of customs duty according to the tariff, which will be returned when the goods are re-exported, which must take place not later than three months after the closing of the exhibition: (2) the goods are to be exported by way of the same custom houses through which they entered Russia.

A New Instrument for the Measurement of Alternating Currents.[1]

By E. F. Northrup.

The instrument and methods of measurement described in this paper were developed to meet the frequent need of means for easily and accurately calibrating alternating-current instruments—ammeters and voltmeters, whatever their capacity; also to suggest an inexpensive method of measuring with high precision very large alternating currents regardless of their wave form or frequency. Incidentally, the instrument and methods should prove sufficient for the accurate measurement of currents of very high frequency where ordinary methods would not be applicable.

A further object kept in mind was to make it possible to utilize an installation of a direct-current potentiometer outfit, to measure alternating currents and pressures with nearly equal facility and precision.

The instrument and the method of using it have been successful because the following important features have been realized: (a) It is used as a zero instrument, and does not depend upon any calibration or determination of any constant of the instrument; (b) it operates with extreme sensitiveness, and being perfectly "dead-beat" is adapted to work with fluctuating currents; (c) it may be used with or without low-resistance shunts, when used with them, it has an unlimited upward range of current measurement, and when used without them, its lower range is down to from two to five milliamperes; (d) as the operation of the instrument depends upon the heating effect of currents, it is wholly independent of wave-form and frequency.

Referring to Fig. 1, two small wires (A B) of No. 33 hard-drawn silver wire when shunts are used, lie parallel to each other at a distance of 0.158 in, being held near their extremities by ivory clamps (C C). Each of the ends of the two wires are connected to binding posts through the medium of heavy leads and soldered joints.

One face of a small circular disk of ivory (D) rests against the two wires at their middle point, a 0.5-inch circular mirror being fastened to the other face. Fastened at the center of the ivory disk, and half way between the wires, when the disk is in position on the wires, is a small hook. To this, through the medium of a thread, is fastened a small adjustable spiral spring. The small ivory disk maintains its position by friction and the tension of the spring. The wires bend back under the tension of the spring about 0.875 inch from the vertical. The ivory disk does not rest directly upon the wires, but bears upon each wire through the medium of a small agate stud, shaped like the head of a screw, each wire being in the slot of the agate stud which rests upon it.

The two ivory clamps holding the wires near

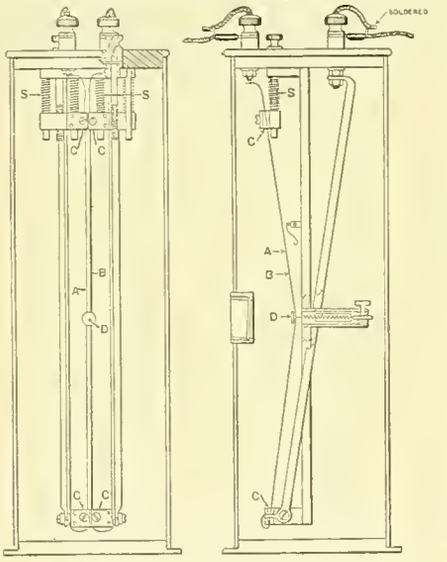


FIG. 1. COMBINED DIRECT-CURRENT AND ALTERNATING-CURRENT POTENTIOMETER.

their upper extremity are made separately adjustable in a vertical direction by means of thumbscrews, which pass through the hard-rubber top of the instrument. Springs (s s) prevent lost motion when the ivory clamps are screwed up or down. The arrangement of parts above described is supported by a brass frame and a circular hard-rubber top.

By means of the adjusting screws, the tension of the two wires may be so adjusted that the plane of the mirror will be vertical to a line drawn in the direction of the spring which holds the mirror against the wires. Now if any elongation occurs in the wire on the right, that side of the mirror will be drawn down or back by the spring, or a deflection to the right is obtained. Likewise, if an elongation takes place in the wire on the left, the mirror will deflect to the left. If, however, an exactly equal elongation occurs in both wires at the same time, the plane of the mirror will not tilt, but simply move back, keeping parallel to itself.

If the mirror is observed with a telescope and scale, say at a distance of one meter, very minute angular deflections of the mirror will be easily observed, while a sinking back of the plane of the mirror away from the scale will not be observable.

Now if an alternating current of unknown strength be sent through the wire (A), the wire will elongate, deflecting the mirror toward the left. Pass an adjustable direct current, which can be measured, through the wire (B), until the deflection is reversed and brought back to zero on the scale. If, when the deflection is zero, and certain precautions to be stated later have been observed, the strength of the direct current is known, the strength of the alternating current will also be known; for it is exactly equal to the direct current. This, however, is on the assumption that equal currents through the wires (A) and (B) produce equal

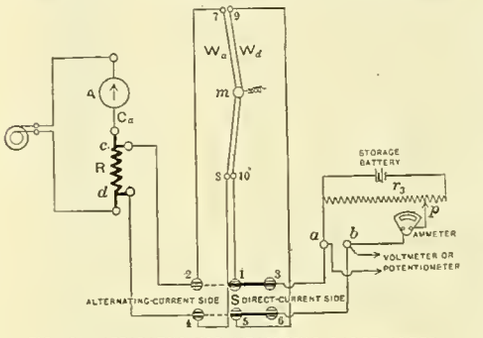


FIG. 2. APPARATUS FOR MEASURING LARGE ALTERNATING CURRENTS.

elongations of the wires. Previously to comparing the currents, connect the wires (A) and (B) in series, and send a current through the circuit: if under these conditions the mirror be not deflected at all, or only slightly, it proves that the two wires are pratcically equally elongated by the same current strength. The limit of this possible small deflection may be taken as the true zero of the instrument. If this zero is maintained under working conditions, it means that the strength of the alternating current in the wire (A) is equal to the strength of the adjustable and measured direct current in the wire (B).

The instrument, however, if limited to such currents as could be passed directly through its wires, have comparatively little value. We shall show how it may be used with shunts so as to measure alternating currents, however large.

The arrangement of the complete circuits for measuring a large alternating current for the purpose of calibrating an alternating-current ammeter (A) is shown diagrammatically in Fig. 2. An important accessory to the instrument is a quick-acting double-throw switch, marked (S) in the diagram. (W_a) and (W_d) represent the two wires of the instrument and (m) the mirror. (R) is a low-resistance shunt, preferably of manganin, having a negligible temperature coefficient, furnished with tap-off points (c) and (d), between which the resistance (R) has previously been determined. The ammeter indicated in the diagram will measure from one to two amperes of direct current; (r_3) is a slide-wire resistance along which a slider (p) may be moved, thereby varying the pressure difference at (a—b) from zero to the value of the electromotive force of the storage battery.

The points (a) (b) on the direct-current side of the circuits have leads attached to them which go either to an accurately calibrated direct-current laboratory standard voltmeter, or to a potentiometer. It will appear later that, except for the highest possible precision, it is more convenient to employ the standard voltmeter, but assume for the present that a potentiometer is employed to give the potential difference between (a) and (b).

When the instrument is installed a permanent adjustment of the resistances, at any convenient temperature of the wires and leads, must be made as follows: (See Fig. 2.)

The resistances—

9 to 10 = 7 to 8.

10 to 1 + 9 to 5 = 8 to 4 + 7 to 2 and

2 to c + 4 to d = 3 to a + 6 to b.

Thus, while this gives the over-all resistance from (a) through the wire (W_d) to (b) equal to the over-all resistance from (d) through the wire (W_a) to (c), the different portions of the circuit must be matched in resistance, as stated above.

It will be observed that if the switch (S) is closed on the alternating-current side the two wires (W_a) and (W_d) are thrown in parallel, that the two parallel-connected circuits have the same resistance, by construction, and that to these parallel circuits at the points (2) and (4) is applied the same potential difference, this potential difference being the drop on the low resistance (R) carrying the alternating current. The drop over (R), inasmuch as it is a low resistance, is only slightly lowered by being shunted by the two wires of the instrument and their leads, and this lowering of the potential is not appreciably greater when the two wires in parallel shunt the resistance (R) than when only one wire with its leads shunts this resistance. Disregarding the slight lowering of the potential, which, as will appear later, is of no consequence, we observe that both wires will now have passing through them equal currents, each current being nearly the same as would pass through the one wire (W_a) if the switch (S) were open, and only this wire could receive current.

With the resistances of the parallel circuits correctly adjusted to equality, both wires will get equal currents, both will elongate equally, or very nearly so, and the mirror (m), instead of rotating will move back, maintaining its plane parallel to the position which it has with no current passing.

When the switch (S) is thrown to the direct-current side, the potential drop over the resistance (R) is now applied to the wire (W_a) only; and the the direct potential difference between the points (a) and (b) is applied to the wire (W_d). This drop between (a) and (b) can be varied by the slider (p) and measured by a voltmeter or potentiometer applied at (a) (b). The ammeter gives the current taken by the wire (W_d).

The shunt resistance (R) may be designed to carry any current, however large. The same resistance (R), or a combination of resistances, may be designed with several tap-off or potential points, so that the instrument may always have approximately the same potential applied to its alternating-current side, whatever the strength of the current to be measured. This potential drop is best made between 0.25 and 0.5 volt. The necessary drop of potential being so low, the energy dissipated in the shunts is small, and therefore they may be of very moderate size. It is also easy to make them practically non-inductive.

Consider now the circuits to be arranged as above described, and that a standard voltmeter is used, calibrated to give a full-scale deflection for about 0.75 volt, to indicate the direct potential between (a) and (b). Then proceed to take measurements to calibrate the alternating-current ammeter (A), (which may have any current-carrying capacity whatever above one ampere), as follows:

A shunt (R) and tap-off points are first so placed that when the ammeter reads a full-scale deflection the drop on the shunt (R) from (c) to (d) varies from 0.25 to 0.6 of a volt, but preferably 0.5 volt. If the ammeter is known to read approximately correct, and since the value of (R) is known, we can gradually increase the current through the ammeter and shunt resistance until the proper potential drop is obtained—that is, the drop that will properly sensitize the alternating-current instrument. If, however, the ammeter gives no guide to the true value of the current the switch (S) may be left in its open position: the alternating-current instrument can then be read as a deflection instrument. In this

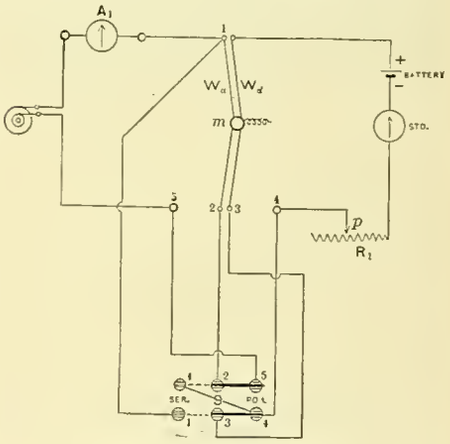


FIG. 3. APPARATUS FOR THE MEASUREMENT OF SMALL CURRENTS.

case the current through (R) should be increased until the alternating-current instrument deflects to the end of the scale, when the drop over (R) will be about right for the condition of good sensitiveness.

The adjustment being made, the switch (S) is closed on the alternating-current side, when the alternating-current instrument will take a steady zero position; and if carefully made and adjusted, exactly the same zero position as when no current is passing.

The zero position is now carefully noted and the switch (S) is then thrown to the direct-current side. The instrument will at once deflect until by moving the slider (p) the direct potential between (a) (b) balances the alternating potential between (c) (d), when the instrument will return to zero position. This adjustment can be made with great exactness, say to within one-twenty-fifth of one per cent. The switch (S) may now be thrown across the alternating-current and direct-current sides alternately to prove that the adjustments have been correctly made; this will be the case if no permanent deflections result. The voltmeter is read, also the direct-current ammeter and the alternating-current ammeter (A) being calibrated. These readings give all the data for making a very exact

1. Abstract of a paper read at the annual convention of the American Institute of Electrical Engineers, Asheville, N. C., June 21, 1905. Mr. Northrup is of the Leeds & Northrup Company of Philadelphia.

calibration of one point on the scale of the ammeter under test. Other points on the scale can be similarly taken by varying the alternating current and also the shunt resistance (R). Inasmuch as, by varying this latter, we can read a small current with the same precision as a large one, the low points on the scale of the instrument under calibration can be determined with as great precision as the high points.

In practice the direct-current ammeter is omitted. A preliminary set of readings are taken to determine its indications corresponding to the different potentials that may be produced between (a) and (b). With a given instrument and set of working wires and leads and voltmeter the current in the circuit (p b) (Fig. 2) is a function of the potential difference between (a) and (b). This function may therefore be found by trial and plotted as a curve. This having been done, it only becomes necessary in calibrating an ammeter to take readings, in addition to the instrument being calibrated, of a voltmeter, and the zero position of the alternating-current instrument. The expression which gives the value of the alternating-current (C) through the ammeter (A) is

$$C_a = \frac{r - R}{r R} E + c = K E + f(E) \qquad (1)$$

where r is the resistance of the voltmeter, R the value of the shunt used, E the potential read on the voltmeter and c the current in the circuit (p). K is a constant, and as 10 volues of R will cover all currents from one to 1,000 amperes, the values of K can be calculated once for all. Furthermore, by properly choosing the values of R and K, they can be made to assume the convenient values 10, 100, etc. f (E), the function of E, is readily taken from a curve and added to the product K E. f (E) is usually small compared with K E, and need not be accurately known.

If a potentiometer be used to read the potential at (a) and (b) instead of a voltmeter, the value of C_a is

$$C_a = \frac{E}{R} + C = \frac{E}{R} + f_1(E) \qquad (2)$$

Here f_1 (E) is the function that c is of E, when no current is shunted through a voltmeter, and, as in the use of a voltmeter, it may be determined by trial and plotted as a curve.

It is possible to measure E more accurately with a potentiometer than with a voltmeter, and the alternating-current instrument is at least four or five times as sensitive in its indications as a large laboratory standard Weston voltmeter. It is therefore desirable, where great precision is required and the alternating current being measured can be held steady, to use a potentiometer instead of a voltmeter. For all ordinary calibration purposes, however, the latter instrument is quite sufficient and easier to read. If the current to be measured is less than about 1.5 amperes, it can be passed directly through the instrument, no shunts being required.

For the measurement of small currents a modification in the connections and method of measurement is desirable. We have found the connections shown in Fig. 3 to be most convenient for this purpose.

In this diagram (A_1) is any alternating-current instrument to be calibrated that does not take more than 1.5 or two amperes, and (STD) is any form of standard instrument that will accurately measure a small direct current. Now, when the switch (S) is thrown to the side (SER), the wires (W_a) and (W_d) are so connected that the same current from the cell (B) will pass through them in series. This current may be regulated by the rheostat (R_1). When the switch is thrown to the side (PA'L) the alternating current will pass through the wire (W_a) and the direct current through the wire (W_d).

With the switch in the position (SER) the differential zero of the instrument is noted. This zero, by careful construction and choosing of the working wires, may be made to differ not more than a fraction of a scale division from the no-current zero. The switch is now thrown to the position (PA'L) and the rheostat (R_1) is adjusted until the instrument shows no deflection from the zero position found when the switch was in the position (SER). The switch may now be swung from side to side once or twice, the rheostat (R_1) being more finely adjusted until there is not the slightest deflection. The value of the alternating current that is the square root of its mean-square value, is now equal to the direct current as read by the standard instrument (STD). The accuracy of this comparison can be made very great. If the alternating current is perfectly steady for a period sufficient to read the instruments, an accuracy of one-twenty-fifth of one per cent. is not too much to expect if the current being measured has a value which is such as to give the instrument a good sensitiveness.

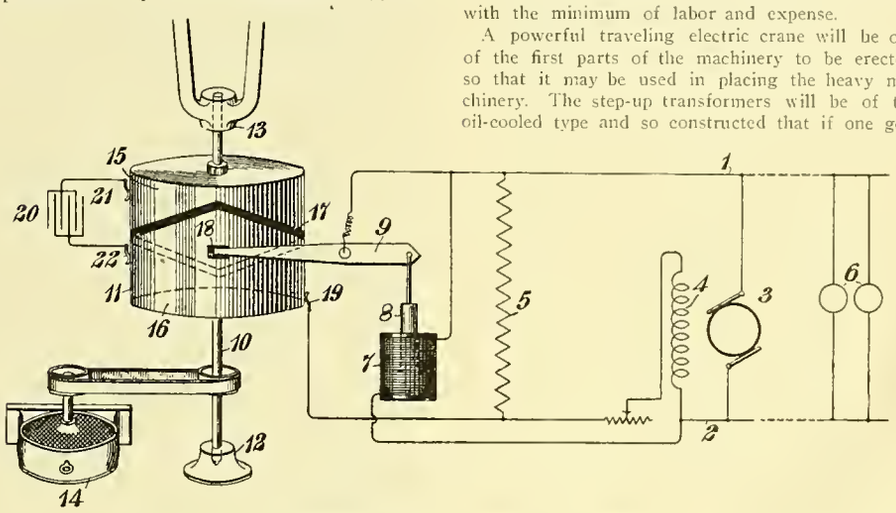
If it is required to read very small currents, it becomes necessary to change the wires in the instrument, using finer wires suited to give the necessary sensitiveness, which is always obtained if, when passing the current to be measured through one wire only, the instrument gives nearly a full-scale deflection.

Voltage Regulator with Rotating Cylinder.

It has been proposed to regulate the voltage of a supply circuit by intermittingly cutting resistance into and out of the circuit of the field magnet of the main generator through the action of a solenoid upon a vibratory contact terminal that is in position to make and break contact with an adjacent stationary contact terminal. To attain this object Paul M. Lincoln of Pittsburg has invented a voltage regulator of some interest. Instead of employing a vibratory contact terminal which is caused to automatically make and break engagement with an adjacent stationary contact terminal and thus cut a resistance into and out of circuit, he provides a continuously rotating cylinder or drum formed in two segments separated by insulation, the form of which is such as to effect the desired result by means of a continuous contact of one of the circuit terminals with the surface of the drum.

In the accompanying diagram the main circuit (1) (2), the voltage of which is to be regulated, is supplied by a generator, the field-magnet winding of which is normally connected in series with a resistance (5), suitable translating devices which require substantially constant voltage being connected to the circuit in the usual manner.

Connected across the circuit so as to be sensitive to the voltage is a comparatively high-resistance solenoid (7), the movable core of which is suspended from a pivoted conducting arm (9) that



VOLTAGE REGULATOR WITH ROTATING CYLINDER.

is electrically connected to the conductor (1) of the main circuit. Suitably supported upon a shaft or spindle (10) is a drum or cylinder (11), the shaft (10) being mounted in suitable bearings (12) and (13), and being continuously rotated by any suitable means—such, for example, as an electric motor, this motor being supplied with current either from the generator or from a separate source of energy, as may be desired.

The drum is made up of two segments (15) and (16), which are separated by insulating material (17), the adjacent faces of the two segments, and consequently the material (17) which joins them, being so formed that on one side of a given diametral plane the segment (16) constitutes the greater portion of the length of the entire cylinder, while on the opposite side the segment (15) constitutes the major portion of the length of the cylinder.

The arm (9) is provided with a contact device or brush (18) that makes continuous electrical contact with the surface of the drum, and the conductor (2) is in constant electrical connection with the segment (16) of the drum by means of a suitable brush (19). The two segments are permanently connected through a condenser (20), by means of brushes (21) and (22), which serves to absorb such sparks as may be produced in the operation of the device.

In the operation of the apparatus it will be noted that if the voltage on the circuit rises the solenoid (7) will draw the core (8) downward, and thus raise the brush (18). If the arm (9) and the core (8) are in approximately the positions indicated in the diagram, the brush (18) will be alternately in contact with the segments (15) and (16), but if the voltage rises sufficiently the core will be drawn downward, the brush will be raised so that it will be continuously in contact with the segment (15) during the entire rotation of the drum, and there will be no short circuit around the resistance (5). On the other hand, if the voltage is so low that the brush is permitted to descend to the point where it makes continuous contact with the segment (16), a continuous short circuit is thereby established. If the brush is at an intermediate point, as indicated in the diagram, it will pass from one segment to the other, and thus alternately make and break the short circuit around the resistance (5). It will be understood, therefore, that the average amount of resistance in series with the field-magnet winding of the generator may be maintained such as to insure a substantially constant voltage on the line.

This voltage regulator is patented, the patent being assigned to the Westinghouse Electric and Manufacturing Company.

Up-to-date Power Plant in Fort Wayne.

The plans for a $1,000,000 power house for the Fort Wayne and Wabash Valley Traction Company in Fort Wayne, Ind., have been approved, and bids for its construction will be received until August 1st. The plans call for the production of 10,000 horsepower and the plant will have several interesting features. The turbine engines will rest on a solid base immediately over the boilers, so as to require the steam to traverse as short a space as possible in reaching the blades, and the exhaust will travel as little space as possible in returning. The furnaces will be automatically fed with coal dumped into chutes, and the ashes will be removed with the minimum of labor and expense.

A powerful traveling electric crane will be one of the first parts of the machinery to be erected, so that it may be used in placing the heavy machinery. The step-up transformers will be of the oil-cooled type and so constructed that if one gets out of order it can be disconnected and run on rails to a point where the electric crane can lift it and permit its repair.

The building will be of pressed brick with an interior of glazed white tile. It will be the only steam plant in the whole Fort Wayne and Wabash Valley system, but Lafayette, Logansport, Peru, Huntington, Bluffton and other sub-stations will be suitably equipped.

Another Municipal Light Plant in Trouble.

At Portland, Mich., the electric lights are said to be unsatisfactory, and this because the municipal dam which furnishes the power has insufficient capacity for the lights connected. The citizens are considering whether to improve the plant or sell it and contract for light with private persons. A correspondent at Portland says, in the Grand Rapids Herald:

"The former method has been considered by those who like the municipal-ownership plan. It will cost $3,700 to improve the plant so as to take care of the present needs, but as to further requirements nothing would be secured, and it would only have to be enlarged when the demand for lights grows stronger. By the second plan S. E. Jarvis, who proposes to build a large electric plant here in the near future, says he will take a contract to furnish light for 25 per cent. less than the village can produce it. He also proposes to buy the local plant and pay what the appraisers will agree is a correct value. There is a great sentiment in favor of the latter plan, and if the contract be let, it will aid Jarvis to interest capital in the new Portland dam, which will be built as soon as sufficient business can be shown to take the entire output."

At the Stuart Street station, Manchester, England, the coal consumption is but 3.2 pounds per kilowatt-hour.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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DATES AHEAD.

Ohio Electric Light Association (annual convention), Hotel Victory, Put-in-Bay, August 16th to 18th.

International Association of Municipal Electricians (annual convention), Erie, Pa., August 23d, 24th and 25th.

Old Time Telegraphers' and Historical Association (annual meeting), New York city, August 29th to September 1st.

American Electrochemical Society (general meetiog), Bethlehem, Pa., September 18th, 19th and 20th.

American Electrotherapeutic Association (annual meetiug), Academy of Medicine, New York city, September 19th, 20th and 21st.

American Street Railway Association (annual convention), Bellevue-Stratford Hotel, Philadelphia, September 25th to 29th.

IN SEVERAL American cities owners of large buildings with exterior walls of light-colored stone or of the white glazed brick or terra cotta now so popular are put to considerable expense to keep them clean. Men with scrubbing brushes, soap, water and washing compounds attack the stone, brick or terra-cotta walls from scaffolds, and, in the case of large buildings, the operation, which may be done once a year or oftener, is an undertaking involving much labor and time. In Chicago, at least, most of the accretions that are removed from the buildings at the cost of so much trouble are due to the smoke of soft coal, with which the atmosphere is burdened. Now the greater part of this fuel consumption might be done away with, and no doubt in the future will be done away with, by the use of electric power generated in large stations a dozen miles, perhaps, from the center of the area supplied. Electricity is doing much for the farmer, providing him with the telephone and the electric railway and in some cases with electric lights for his home and motors for his agricultural machinery. It has done much for the resident of the city, making possible rapid transportation, the telephone door, well lighted streets, electric power and many other conveniences. But its use in both city and country is capable of indefinite expansion, and in the former the doing away of the smoke nuisance may be hopefully expected as one of the greatest of its benefits.

MR. A. MOSELY, that indefatigable English champion of American industrial methods and education, has read Prof. John Perry's criticism of engineers and schools in this country—to which we recently called attention—and he is not satisfied with it. In his opinion American education and the belief of the people in the value of it lie at the foundation of American prosperity. He thinks that education in the United States is sounder and more practical than in the United Kingdom, and anything but "slipshod," as Professor Perry describes. Mr. Mosely points out that after scores of British engineers had failed to make the mining enterprises in South Africa pay, practically educated American engineers brought order out of choas there and made South African mining one of the wonders of the world. "Could such a result," he continues, "be achieved with a 'slipshod' system of education? I venture to think not. On the contrary, it was the scientific knowledge of these men, and others like them, combined with a mode of analysis lacking entirely in the British engineer of the past, that allowed them to score successes where we failed. I consider that the American system of education, whereby the reasoning and thinking capacities of the student are stimulated to the utmost, largely accounts for this phenomenal success." In one point, the low pay of teachers in America, Mr. Mosely agrees with Professor Perry, but he remarks that, even so, the salary rate of teachers in the United States is princely, compared with that in England.

The fact is that while Professor Perry is in a large degree justified in asserting that our education is superficial, Mr. Mosely is also right in saying that it is practical. It accomplishes, to a creditable extent, the end sought to be attained, and in exhibiting this result is perhaps "sound." American education is the result of American conditions, and, although it has many and glaring faults, it has helped us along fairly well. But to what extent it may prove valuable as a model to other nations, other peoples, with other problems, other environments, other aspirations perhaps, must determine for themselves. At any rate, Americans sincerely believe in a wide diffusion of education, or the elements of education, and the advancement of the whole mass of the people in the ways of justice, knowledge and truth.

IN INDIANA, where the interurban electric railway has been developed to a remarkable extent, the question of competition with steam railroads in passenger rates has become one of serious proportions. At the present time one of the important subjects before the Indiana Railroad Commission is a charge of discrimination in passenger rates made by the steam-railroad companies along the lines paralleled by electric interurban lines. The interurban managers charge that in order to meet the local interurban competition many of the older railroads have made special rates meeting the interurban rates, these special rates being considerably under the regular three-cents-a-mile charge. This is alleged to be a discrimination, for wherever the railroads are not paralleled by the interurbans the regular rates are charged.

One case cited shows the grounds for the complaint. The "Big Four" railroad, in order to meet the traction competition between Indianapolis and Lafayette, has made a special rate between the two cieties, so that residents of Lafayette can come by the steam roads as cheaply as by electric. But the two roads are not parallel all the way down to Indianapolis, however, the steam road going to Lebanon, then to Indianapolis, while the traction goes first to Frankfort, then to Lebanon and then to Indianapolis. The result is that, although the steam road will grant a cheap rate from Lafayette to Indianapolis, it charges the regular rate to Indianapolis from points between Lafayette and Lebanon. Situations similar to this are to be found in other parts of the state.

AN ENGINEERING correspondent of the London Times, discussing the amalgamation of engineering societies in England in the light of the Carnegie gift for a united engineering building in New York, makes some observations that will be read with interest in this country. Speaking of the existing duplication of effort and plant in his own country, the writer says: "The present system tends to narrowness. It is no secret that the management of the principal societies is in the hands of close rings, and that there is more or less risk that outsiders of independent thought and action may be kept aloof. Many engineers of broader spirit feel that much of the narrowness that now characterizes the various societies would be abolished by a wider handling of the subject. During the discussion of the Carnegie offer by the American Society of Civil Engineers it was felt that, though the offer was most munificent, a certain financial responsibility was entailed upon each society joining in the scheme, and that the failure of one of the joining bodies might throw an undue load upon the remainder. In so large a country as the United States it is scarcely likely that with headquarters at New York any serious shrinkage of membership could possibly occur, even should the commercial capital of the future be Chicago. In Great Britain there is no likelihood of London ever being displaced from its present position, and the country as a whole is too accessible to London to render probable any serious rivalry such as a distant center of equal population like Chicago may set up in competition with New York, which, moreover, is not the seat of government as in London."

It is true that for several reasons New York can never occupy the position in this country that London does in Great Britain and Paris does in France. Chicago has, in the Western Society of Engineers, with its Electrical Section, a flourishing engineering society that is virtually a union engineering society now. This organization occupies rented rooms which are insufficient for its needs, and in course of time will undoubtedly have a building of its own which may be expected to be a rendezvous for all classes of engineers and for men engaged in allied pursuits. Mr. Carnegie's generosity in providing funds for the erection of a United Engineering Building and Engineers' Club in New York is entitled to cordial appreciation, and the progress of the work is watched with sincere and sympathetic interest in Chicago and other parts of the country. But naturally the benefits of the new buildings and new equipment will be largely local in character; and bodies of engineers or technical men several hundreds or thousands of miles away, however friendly to their confreres in New York, and much as they appreciate the honor to engineering expressed by Mr. Carnegie's benefaction, will be forced to provide similar accommodations for themselves, perhaps on a more modest scale, or go without. It is this situation which causes the difference between the United States and Great Britain to which the engineering correspondent alludes.

Contractors' Convention and Electrical Exhibition in Boston.

Boston, July 22.—The fifth annual convention of the National Electrical Contractors' Association, which has been held in Boston during this week, was undoubtedly one of the most successful gatherings of the organization that has been known in its history. An electrical exposition which brought together about 100 exhibitors was an accompanying feature of the convention, and public interest in this exhibit of the latest appliances and inventions in practical electrical work brought large numbers of visitors to the big Mechanics' Building on Huntington Avenue, where the convention proceedings took place.

The exhibition, of which Chester I. Campbell was manager, opened last Saturday evening and closed today. Some of the most prominent electrical concerns in the country had elaborate displays of their products.

Members of the association began to arrive on Monday last from all parts of the country, and by Wednesday morning, when the public opening ceremonies took place, a majority of those in attendance had registered. There were nearly 200 of them, many being accompanied by members of their families, the guest list almost equaling that of the members themselves. President F. L. Barnes of the Massachusetts Electrical Contractors' Association gave the convention its formal start with an address of welcome and introduced the national president, Mr. E. McCleary of Detroit, who congratulated the Massachusetts organization upon the manner in which it had planned for the exposition and arranged for the convention details. His address was a concise review of the progress of electrical science and of the work of the association in its endeavor to maintain a high standard in all the allied branches of the electrical business. He referred to the modern character of the industry, the product of recent generations, and to the marvelous development of electrical apparatus since the application of electricity for practical purposes became a factor in our industrial life. He also alluded to the underwriters, and said that the association opposes special rates, demanding uniformity throughout the country.

F. E. Cabot, president of the National Board of Underwriters, who was the next speaker, replied to the remarks of the president relative to underwriters' rates, and stated that the organization which he represented was thoroughly desirous of co-operating with the electrical contractors in securing proper regulations and rates.

A telegram was received from Charles Eidlitz of New York, first president of the association, who was expected to speak at the opening exercises, conveying his regrets to the association for his unavoidable absence from the convention. T. Carpenter Smith of Philadelphia spoke in his stead, his topic being chiefly the relations existing between the contractors and the inspectors. Some of the requirements imposed by the inspectors he characterized as not only vexatious but unreasonable, although there was a disposition on the part of both, he was glad to state, to work toward a more harmonious understanding.

James A. Cole, chief wire inspector of the city of Boston, spoke of the relations between the contractors in this city and the inspectors. He pointed out to the contractors the important fact that the responsibility of the contractor ends when his work has been approved by the inspecting official, while the liability for fire losses and injury to life and limb on account of defective or faulty construction remains with the inspecting department permanently. Hence the necessity for a rigid system of inspection.

G. M. Stuart of Boston was called upon to speak for the jobbers, and T. E. Beran of New York for the manufacturers.

On Wednesday afternoon the association began its series of executive sessions. These were continued daily until the close of the convention, with morning and afternoon meetings, at which numerous topics of a business nature were taken up and discussed at length. These meetings were all held behind closed doors, as is the custom of the organization, guests and members of the press not being admitted. Among the matters considered were the underwriters' rules, work of the national conference on standard wiring rules, various labor questions and general trade conditions.

On Wednesday evening the members, to the number of about 135, attended a grand banquet at the Hotel Brunswick, and President McCleary was the lion of the occasion. There were no formal speeches, but an excellent vaudeville was a feature of the occasion and a topical song to the tune of "Hiram Green, Good-bye," had a chorus applicable especially to the retirement of President McCleary.

At the close of Thursday's executive session a harbor excursion to Nantasket Beach was enjoyed by the members and their guests, with many local representatives of electrical concerns and allied industries participating, so that the party numbered upward of 560 people. A short dinner at the Nantasket Point Hotel and a visit to Paragon Park, the showground at the beach, concluded the outing, which was thoroughly enjoyed in view of the excessive heat which has prevailed in the city and of the relief afforded by the trip to the seashore and down the bay.

Friday's proceedings included the election of officers. The following list was chosen:

President—James R. Strong, New York, N. Y.

First Vice-president—W. I. Gray, Minneapolis, Minn.

Second Vice-president—Walter C. McIntire, Philadelphia, Pa.

Third Vice-president—F. E. Newbery, St. Louis, Mo.

Treasurer—John R. Galloway, Washington, D. C.

Secretary—W. H. Morton, Utica, N. Y.

Sergeant-at-arms—J. C. Sterns, Buffalo, N. Y.

Directors—P. B. Martin, Little Rock, Ark.; E. M. Baldwin, Hartford, Conn.; Cyrus Mantz, Washington, D. C.; Arthur Frantzen, Chicago, Ill.; G. M. Sanborn, Indianapolis, Ind.; Edward Kunkle, Des Moines, Iowa; H. K. McCay, Baltimore, Md.; Seth B. Wetherbee, Boston, Mass.; F. J. Miner, Detroit, Mich.; L. L. Sanford, Minneapolis, Minn.; W. A. Carrao, St. Louis, Mo.; Paul H. Jaehing, Newark, N. J.; James R. Strong, New York, N. Y.; Marshall L. Barnes, Troy, N. Y.; James Hilton, Syracuse, N. Y.; E. M. Lawton, Cincinnati, Ohio; E. R. Heller, Philadelphia, Pa.; George F. Rohn, Milwaukee, Wis.

It was decided that the convention of 1906 shall be held in Cleveland, Ohio, on the third Wednesday in July, and the semi-annual meeting of the directors will take place in Cleveland in February.

On Friday evening the ladies in attendance at the convention gave a reception at Paul Revere Hall in the Mechanics' Building in honor of the newly elected officers and to the local committees in recognition of the many courtesies extended to them during convention week.

Retiring President McCleary was presented with a handsome silver table service at the reception as a token of the esteem in which he is held and in recognition of his invaluable services as president of the organization.

DELEGATES AT BOSTON CONVENTION OF NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION.

Exhibits and Exhibitors at the Boston Convention.

J. W. McDowell of the Manhattan Electrical Supply company, New York, looked out for the interests of his company.

The India Rubber and Gutta Percha Insulating Company was represented by its popular manager of sales, James B. Olson.

The Standard Paint Company of New York exhibited its compound and tapes, and the display was in charge of G. F. Ernshaw.

The De Laval Steam Turbine Company, Trenton, N. J., was represented by its special sales agent, Charles Garrison, who exhibited a model of a one-kilowatt turbine generator.

The Osburn Flexible Conduit Company of New York came to the front with a fine display of the renowned "Flexduct," and was ably represented by C. E. Corrigan and W. P. Ambos.

The Eastern Wire and Cable Company of Boston was represented by Major C. W. Knight. It made no display, but its booth was equipped for the comfort of its callers, who were many.

The Blake Electric Company of Boston, Mass., exhibited a line of switchboards and panel boards; also the Macfarlane panel board. The exhibit was in charge of Frank R. Blake and Hugh J. Quinn.

The Economical Electric Company of New York exhibited the famous Turn-down lamp. The exhibit was in charge of W. T. Abely. L. Loebenthal of New York was in attendance for a part of the time.

Harvey Hubbell, Bridgeport, Conn. exhibited his well-known chain-pull sockets, pull-attachment plugs, clusters, shade and shade holders. The exhibit was in charge of the sales manager, H. W. Bliven, and G. S. Hadley.

The Yale & Towne Manufacturing Company of New York exhibited portable electric hoists, triplex and duplex differential chain blocks and overhead trolleys. The company was represented by C. W. Beaver and William Hazelton.

G. M. Gest of New York, expert electrical subway contractor, had an exhibit of photographs of work done by him in different cities in the United States, Canada and Mexico. W. T. Jackson of Cincinnati, his western representative, was in charge.

W. J. Murdock & Co. of Chelsea Mass., made no endeavor at an exhibit. However, W. J. Murdock and George A. Murdock were much in evidence, telling all they knew about the "solid" telephone receivers and push buttons as manufactured by the company.

The Chase-Shawmut Company of Newburyport, Mass., exhibited all its electrical specialties, but took occasion at this time to call attention to its National Electric Code fuses. The company was represented by Sales Manager Harry P. Moore, J. J. Miley and F. D. Masterson.

The Worcester Electric Manufacturing Company of Worcester, Mass., made an exhibit of an isolated-plant switchboard, as well as knife switches, panel boards and cabinets and new code fuse blocks. The display was in charge of James McGrady, general manager, assisted by John McGrady.

The Electro-Dynamic Company of Bayonne, N. J., exhibited one of the company's type 5-S four-to-one interpole variable-speed motors belted to a generator. The motor was reversed under various conditions of load and speed, showing many remarkable results. There was also on exhibition different sizes of motors running from one horse-

power at a speed ratio of four-to-one up to 10 horsepower at a speed ratio of four-to-one. Altogether, the motors exhibited by this company covered 123 distinct varieties. The exhibition was under the direction of G. H. Condict and conducted by F. S. Mitchell, with F. G. Bell and G. B. Warner assisting.

John A. Roebling's Sons Company of Trenton, N. J., had a very attractive booth, where copper wire and wire rope was continually talked about. H. L. Shippy, treasurer, New York, was in attendance; also Frank W. Harrington, S. B. Van Nortwick of New York, and Albert Mann, New England agent

The National Carbon Company of Cleveland, Ohio, made an exhibit of arc-light carbons, electrodes for furnaces and all kinds of carbon brushes for generators and motors; also Columbia dry batteries, flash-light batteries and all kinds of wet batteries. The company was represented by J. C. Irvine, New England agent.

The Pettingell-Andrews Company of Boston, Mass., exhibited the company's products, including reading lamps and mosaic glassware. It also showed a full line of Okonite Company's wire and tapes and the Warren Electric Specialty Company's well-known Peerless fans. The exhibit was in charge of Fred W. Cramphorn.

The Alphaduct Manufacturing Company of New York exhibited Alphaduct flexible conduit. The interior of Alphaduct conduit is smooth, hard-finished cotton duck, very smooth for the entrance of the wire. In addition, it is dusted inside with powdered soapstone, which acts as a lubricant. It is very flexible and thoroughly approved.

The Holophane Glass Company of New York displayed a full line of Holaphane globes and Pagoda reflectors, exhibiting many new styles, making a very attractive display of scientific glassware. The exhibit was in charge of I. W. Farquharson of the New York office, and H. C. Jones, manager of J. S. Codman Company, New England representative.

The Wireless Railway Company, Philadelphia, Pa., exhibited a working model complete in every detail of the Pullen surface-contact system of electric-car propulsion, which attracted great attention. This system is adaptable to both new and existing railways. The exhibit was in charge of George F. Bradstreet, Charles E. Kelly and the inventor, Leon W. Pullen.

The Trumbull Electric Manufacturing Company, Plainville, Conn., made an attractive exhibit of a line of knife switches, iron boxes, panel cut-outs and porcelain specialties. The following-named gentlemen were in attendance: Frank T. Wheeler, president; J. H. Trumbull, treasurer; Henry Trumbull, secretary; Frank Trumbull, George W. Edge and C. W. Jones.

The American Electric Sign Company of Boston had an interesting exhibit of its flashers, time switches and electric signs. In attendance were J. L. Russell, president; C. I. Wetmore, Boston manager; R. G. Van Norman, New York manager; C. R. Borden, sales agent. They report a fair business. This company was the official sign-maker for the show.

The Couch & Seeley Company, represented by E. B. Seeley and F. C. Redfield, displayed a full line of strictly high-grade telephones for interior and exchange work, both central-energy and magneto. The telephones in use by the Marconi Wireless Telegraph Company and the Ovington Manufacturing Company at the exhibition were furnished by this company.

The W. S. Hill Electric Company of New Bedford, Mass., exhibited field discharge switches, motor switches and standard switches; also tablet boards, rough castings and iron switch-box cabinets. It also showed a 6,000-ampere switch. Included in the exhibit was a sample board of circuit-breakers for the Cutter Company, Philadelphia, Pa. The exhibit was in charge of F. A. Knowles.

The D. & W. Fuse Company of Providence, R. I., had a very attractive exhibit, covering a complete line of fuses and cut-outs, service boxes, transformer cut-onts and subway boxes. In addition to its fuses, it also exhibited Deltabeston wire, showing a line of different field coils insulated by the new Delta method. The company was represented by Secretary W. S. Sisson, C. E. Harmon and R. W. Adams.

CHESTER J. CAMPBELL, MANAGER BOSTON ELECTRICAL EXHIBITION.

The H. W. Johns-Manville Company of New York had an exhibit of National Electric Code standard fuses, Sachs Noark standard fuses, electrobestos and Transite electric wire conduits; also fire extinguishers, line material, fuse blocks and fuse boxes. The exhibit was in charge of A. D. Newton, manager electrical department, Boston branch; J. W. Perry, manager electrical department, New York; W. R. Walsh and E. L. Cameron.

The S. H. Couch Company, Boston, Mass., telephone manufacturers, made a good display. The apparatus was mounted on revolving columns of ornamental design. Among the telephones shown was the new apartment-house system, including vestibule and janitor's telephone. This system is superseding the old-time speaking tube in many modern apartment houses. The Couch automatic reset intercommunicating telephones were shown in every style. The all-nickel desk standard was especially noticeable on account of its neat appearance and compactness. The Couch automatic system accomplishes with a common return system what formerly required metallic circuit, thus saving in cost and size of cable. Those in attendance were S. H. Couch, William Couch, C. E. Monroe, F. C. Whitman and C. H. Moulton.

The Bryant Electric Company and Perkins Electric Switch Manufacturing Company of Bridgeport, Conn., exhibited a full line of the two companies' specialties, making a special exhibit of the Perkins push-button switch, the Perkins panel switch and the new line of Bryant enclosed fuses. The exhibit was in charge of V. C. Gilpin, and in attendance were W. C. Bryant, president, E. R. Grier, sales manager, and E. K. Patton, manager Chicago office.

Among the many beautiful exhibits the large and handsomely arranged exhibit of the Eastern Carbon Works, Jersey City, N. J., was well to the fore. The largest carbon plate made in the world was shown, besides numerous sizes down to small fragile pieces. Carbon brushes of all sizes, shapes and grades made up this department. The company's well-known cells occupied a good-sized space. The dry-battery department occupied the prominent part of the booth and was an attractive feature. The Eastern high-grade dry cell was shown in five sizes. The Atlantic dry cell shown is constructed well, mechanically and electrically, and at low cost. The Eastern battery connector is new in this line. It is so constructed that vibration will not loosen it. The Eastern staff consisted of G. W. Mills, William Mills and O. L. Turgeon.

The American Circular Loom Company, Chelsea, Mass., made an extensive and elaborate exhibition of the company's product. There was a truck load of Circular Loom and Electroduct at either end of its large space, with provision made between for the comfort and convenience of its many visitors. The company was represented by A. T. Clark, H. B. Kirkland, Thomas H. Bibber, Oscar Hoppe, R. B. Corey, M. T. King and Harry Adams.

The exhibit of the Gleason molding boxes was displayed in a booth shaped like the regular pattern molding box and contained samples of the entire line and also samples of two new specialties recently put on the market—a molding box to mount any surface or flush appliance of round or rectangular shape and reduction box for splitting three-wire molding circuits into two or more wire circuits. The exhibit was in charge of John L. Gleason and R. Eberhardt.

The Stuart-Howland Company of Boston, Mass., made an exhibit of George Cutter specialties, Renim specialties, the Franklin reflector specialties; also the Wizard and Henrick igniters, as well as the Edison primary batteries and fan outfits, Sterling lamps, G. E. fans, the Standard Paint Company's products, and was represented by A. E. Payne, C. B. Wetmore, R. M. Merritt, J. B. Bailey, H. DeSteese, J. E. Wilson, C. R. Fish, H. A. Dalton and J. W. McNair.

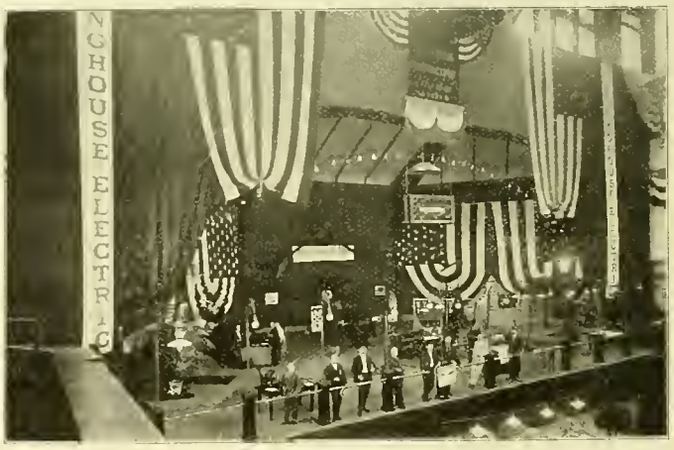
The Sprague Electric Company of New York exhibited Greenfield flexible steel conduit and armored conductors; also a full line of outlet and switch boxes, and the "breezes of the famous Lundell fans;" also Sprague motors, ranging from two to 10 horsepower. The company has developed a type of brass-armored flexible conductors, especially adaptable to marine work. The exhibit was in charge of Alex. Henderson, H. C. Farnsworth, Boston representative, and H. H. Hornsby.

Pass & Seymour of Solvay, N. Y., exhibited a full line of P. & S. material, particularly their double-pole brass-shell sockets and receptacles. They also called special attention to their sign receptacles for wood and metal signs of all descriptions, and say that their temporary socket is a very popular one. The exhibit was in charge of W. Brewster Hall, sales agent, New York; John W. Brooks, sales manager, Solvay; A. M. Little, sales agent, Solvay, and B. E. Salisbury, general manager, of Solvay.

The H. T. Paiste Company of Philadelphia, Pa., exhibited a standard line of sockets, Holoshade sockets, P-K attachment plug, P-K baby knife switches, Fielding receptacles and rosettes. It also showed a new line of Paiste wooden panel boxes, iron panel boxes, 16 styles of new panel and entrance switches and cartridge cut-outs. On a back board it showed practical wiring of panel cut-out and Fielding receptacles. The exhibit was in charge of E. A. Jenkins, secretary; C. I. Hills, sales manager, and George MacElivee (known as Aleck the electrician).

The Benjamin Electric Manufacturing Company of Chicago, New York and San Francisco, made, as usual, an exhibit with its entire line of National Standard Code products, and was represented through its New York office. In this exhibit special stress was laid on the recent improved fea-

General Electric Company.



Westinghouse Companies.

EXHIBITS AT BOSTON ELECTRICAL SHOW.

tures of the series wireless clusters and fittings, especially adapted for high-tension work and street-car lighting, as well as the company's turn-down arc-burst cluster. The new "daylight" cluster, with its individual diffusing shades, attracted attention by its pure white light and beautiful appearance. The booth covered a large space, especially designed for the comfort of visitors, and was in charge of Basil G. Kodjbanoff, M. E., manager of the New York office.

The Shelby Electric Company of Shelby, Ohio, had an interesting exhibit consisting of a dark-room booth in which was set up a full testing set consisting of a photometer with angulator attachment, and instruments for the measuring of efficiency of incandescent lamps. A striking feature of the exhibit was a demonstration of the comparative effective illumination obtained from the Shelby lamp and from a lamp of the usual type made by other factories. The exhibit was in charge of C. W. Cartwright, manager of tthe Boston branch office.

the reason it can be used for two or three-wire work and with cotton link, plug or enclosed fuse. The direct connection is derived from the contact of the fuses directly on the bus bars. This arrangement also very materially reduces the size of the board and the cost of containing box. Another important feature is the protection of live bus bars, it being practically impossible to short-circuit the mains accidentally when using tools about the panel, because all the exposed parts are protected by the branch fuses except the main lugs. The exhibit also included a considerable line of the J. & M. back-connection boxes and knife switches. It was in charge of M. H. Johnson, W. H. Morton and J. H. Camphorn.

The Electric Gas Lighting Company had a fine showing of interior telephones and switches. It was represented by H. C. Thomson, general manager, and Mr. W. F. Abely; also Mr. Boardman, Mr. Young, Mr. Sherman, Mr. Howes, Mr. Norris, Mr. Lea, besides Mr. Haines, manager of the Chicago branch, and Mr. Bongard from the Toronto branch. Much favorable comment was made on the new metallic circuit automatic intercommunicating telephone. There was also a Rotokoll switchboard, which is a very neat and effective device. Another interesting feature of the exhibit was the stormproof instrument employed in marine installations, such as were installed on the Minnesota and Dakota of the Great Northern Steamship line running to Oriental ports from Seattle. This company, although comparatively new in the telephone field, shows in all its goods the advantage of long years' experience in the electrical manufacture.

machine runs as a motor delivering alternating current and turning the busy back attachment, which consists of a high and low-speed cylinder made up of collector rings subdivided in various ways, the object being to interrupt the current from the storage batteries, producing signals for use at the switchboard and at the instruments of the subscribers. Louis E. Hill and Edwin W. Schildknecht were in charge.

The exhibit of the Westinghouse companies occupied the entire stage in convention hall. The Westinghouse Electric and Manufacturing Company had on exhibition a full line of arc incandescent lamps, portable electrical-measuring instruments, switchboards with necessary instruments and attachments, fan motors for operation by both alternating and direct current, a full line of Westinghouse fuses, also circuit-breakers and transformers. The Nernst Lamp Company had on exhibition a line of lamps and the Cooper-Hewitt Electric Company had several samples of the mercury-vapor lamp. In the Westinghouse exhibit

ELECTRICAL EXHIBITION HELD IN CONJUNCTION WITH THE CONTRACTORS' CONVENTION IN BOSTON LAST WEEK.

The Simplex Electric Heating Company of Cambridgeport, Mass., had an unusually complete display of electric heating and cooking devices, which was unexcelled for its attractiveness and beauty. The novel cooking appliances especially interested the women, as hot weather adds no terrors to the housekeper who bas an electrically equipped kitchen. Practically every kind of an electrical heating device imaginable for home and factory use was on exhibition and won the admiration of the many spectators. The exhibit was in charge of Charles W. Richards and A. W. Doe.

The Bossert Electric Construction Company, Utica, N. Y., made an elaborate display of panel boards and cabinets, switches, outlet boxes, Monitor bushings, Erickson insulators and flexible-conduit bushings. The booth was arranged in most elaborate style for the convenience of all visitors who wished to avail themselves of this particularly cool and fascinating spot. The exhibit was in charge of F. T. Foxenberger, Utica, N. Y., and F. B. Smith, New England representative, of Boston. The company was also represented by W. P. Crockett, Chicago, and R. B. Corey of New York.

The exhibit made by Johnson & Morton of Utica, N. Y., was of particular interest, by reason of their new Universal direct-connection panel, which was displayed. This board is called universal for

The Holtzer-Cabot Electric Company exhibited some of its specialties and a few representative types of its standard machines—a 7½-horse-power multipolar motor and a 250-ampere plating dynamo, also dental lathes for alternating and direct current. This company also showed its new six-speed alternating-current lathe for dentists' use. There was also exhibited some of the special telephone machinery manufactured by this company, a multi-cycle ringing set having a speed governor for selective party-line signals, consisting of a motor driving four generators of different frequencies. The machine which attracted the most attention was a dynamotor with busy back attachment for telephonic signaling. This

there was in operation a Stafford plain cotton loom driven by a small three-phase direct-connected Westinghouse induction motor. The purpose of showing this machinery was to demonstrate the feasibility of driving such a loom without intermediate clutch or other starting device. The cotton woven by an expert weaver of the Stafford company and portions of the finished fabric were handed to visitors as souvenirs. Suspended from the ceiling above the exhibit was a high-tension static electric sign spelling the name "Westinghouse." This sign was operated at from 30,000 to 50,000 volts and the static disturbances of the sign and the illuminating effects did much to hold the attention of the visitors. The Westinghouse companies also had their motoscope and biograph exhibition of a trip through the Westinghouse Works. Views showing the various operations through which the electrical machinery passes were shown, with an occasional view of the comic sort mixed in to vary the programme. The exhibit was lighted by the various lamps of Westinghouse manufacture, including the Nernst lamp, the Westinghouse incandescent lamps, Westinghouse direct-current multiple arc lamps and Cooper Hewitt mercury-vapor lamps. Along the front of the stage, suspended from the iron posts which held the brass railings in place, was a liberal supply of Nernst lamps. An arch was formed

over the stage by the use of Westinghouse incandescent lamps having frosted globes, while a number of Westinghouse direct-current multiple arc lamps were burning in different sections of the exhibit. Two Cooper Hewitt vapor lamps were hung from the ceiling above the stage. Altogether the illumination of the Westinghouse exhibit was most brilliant and effective. The exhibit was beautifully decorated with the national colors, intermixed with palms. The company was represented by R. L. Warner, New England manager; C. B. Humphrey, manager detail sales; D. E. Manson, manager Boston office; T. H. B. Whipple, general lamp agent; J. William Smith, cashier Sawyer-Man Company; Messrs. Watts, Merrill, Bates, Osborn, Gibbs, Bond, Chase, Wahn, Abbott, Walton and Ewing of the Boston office of the Westinghouse Electric and Manufacturing Company; D. E. Clark, manager of the Westinghouse Machine Company; Mr. Holbrook, manager Boston office of the Nernst Lamp Company, and J. C. McQuiston, superintendent of the Westinghouse Companies' Publishing Department, who was in charge of the Westinghouse exhibit.

The General Electric Company had one of the largest exhibit spaces in the center of the main floor at the Boston electrical exhibition, covering about 1,300 square feet. The principal feature of this exhibit, and one of the newest things in the entire exhibition, was the new 2½-watt incandescent lamp described in the Western Electrician of July 8th. The exhibit was brilliantly illuminated with these units. This is the first exhibition to the general public where this carbon filament has been shown, and the electrical contractors, under whose auspices the exhibition was held, were glad to have the show characterized by this important piece of apparatus. The new metallized carbon-filament lamp is made in three sizes, Nos. 3, 4 and 5, the watt consumption being 125, 187½ and 250 watts per lamp, respectively. These lamps are used with a special line of Holophane Pagoda reflectors, which are made in two forms, one known as the form D, which distributes the light in a downward direction, and the other, known as the form C, which concentrates the candlepower in a downward direction. The lamps present an attractive appearance, and as the actual gain is 20 per cent. greater efficiency, on an equal basis of life, the company predicts that they will surely meet with a hearty reception. They are particularly suitable for use where the arc lamp is too large and the ordinary incandescent too small. The company also exhibited a mercury-arc rectifier operated on 220-volt, single-phase, which was converted to 110 volts, direct current, the load being a circuit of the new incandescent lamps. This rectifier had a capacity of 30 amperes and was in constant operation. Small motors of various types were shown, both alternating and direct-current motors. One of the company's new automobile motors was also exhibited, as well as a miscellaneous collection of standard electric-motor fans. A new General Electric flatiron also made its appearance here for the first time and naturally a great deal of attention from the public. The company's moving-picture machines were constantly surrounded during the exhibition by an eager crowd, which never failed to appreciate the winning by the electric locomotive of its race with the steam train on the New York Central lines. Other pictures were those of the employes leaving the Schenectady works, the Baltimore and Ohio electric locomotive and the New York subway trains, which are operated by General Electric motors and multiple-unit control system. Not the least attractive feature of the company's exhibit consisted of comfortable reception spaces arranged at each end of the exhibit in an artistic manner. A unique feature of the exhibit was the omission of the hackneyed form of railing and the substitution of a row of small palms and other plants. In attendance at the exhibit were C. B. Davis, Boston manager; J. P. Felton, supply manager of the Boston office; O. F. Brastow, L. E. Smith and J. A. Wilson of Boston; E. M. Kinney of Schenectady, N. Y.; W. M. Wright of New York and F. H. Gale, advertising manager. Other callers during the week were T. Beran, New York supply manager, and D. R. Bullen of Schenectady.

BOOK TABLE.

BERLIN-ZOSSEN ELECTRIC-RAILWAY TESTS. Translated from the German by Franz Welz, with introduction on train resistance by Louis Bell. New York: McGraw Publishing Company, 1905. Pp. (eight by 11¼ inches), 100, with 61 illustrations. Price, $3.

Naturally a mass of valuable data resulted from the famous Berlin-Zossen high-speed tests in Germany, and all this material was carefully preserved and worked up with the characteristic German exactness and thoroughness. The book under consideration gives the results of these tests and the curves which were plotted from the data taken. Besides this, there is contained a complete description of the construction of the road, the cars and the line, with all the details as to the manner of taking the readings. The book is carefully prepared and makes a valuable work of reference concerning these important tests.

A New Property of Radium.

Considerable interest has been awakened of late concerning the experiments of Mr. Butler Burke in the Cavendish laboratory at Cambridge University in England. Although it has been repeatedly shown that the emanations of radium are usually fatal to bacteria, Mr. Burke has discovered what he believes to be life-producing qualities in the rays, though there is much to discountenance the probability of this theory. Mr. Burke's experiment was this:

He took some sterilized gelatine, such as is used by bacteriologists for making cultures. Into this sterilized gelatine he placed some sterilized radium. As both the radium and the gelatine were absolutely free, so far as known, from any form of organic life when mixed, no growth should afterward appear, according to all the known laws of nature. But, nevertheless, in a few days tiny growths did begin to appear which much resembled colonies of bacteria. These colonies were examined by eminent authorities who decided that they could not be bacteria, although they exhibited every evidence of living organisms.

It is entirely possible, as some believe, that these growths, whatever they may be, are of a crystalline nature. Crystals, as is well known, form by subdividing and branching out, subdividing again, etc. Bacteria multiply in a similar way—a single bacterium breaks up into two, the two each divide again, making four, and so on in regular geometrical progression, up into numberless millions. It is the thousands upon thousands of bacteria, starting from a single bacterium so small as to be indistinguishable with the aid of the most powerful microscope, that make the little cultures or growths which are distinguishable, after a sufficient time has elapsed succeeding inoculation, in the gelatine preparations used by bacteriologists in their experimental work. The question, therefore, which has been brought up by Mr. Burke's research is this: Are the growths which he has discovered really a form of organic life generated spontaneously by the wonderful powers of radium, or are they of a crystalline nature and without life? Whatever the answer to the question may be, radium is evidently the cause of the phenomenon, and the experiments are very interesting.

Chicago Street-railway Situation.

A. B. Dupont of Detroit has arrived in Chicago, and after a brief conference with Mayor Dunne the mayor said that Mr. Dupont would proceed at once to investigate the proposed 243-mile municipal street-railway system. From Mr. Dunne's remarks it is also clear that he believes the fact that this proposed road is being planned may spur the street-railway companies to complete negotiations for the sale of their property.

A letter has been received in Chicago from Robert Crawford, former town councillor of Glasgow, who is coming to Chicago to investigate the possibilities of municipal ownership, and incidentally to talk to the country at large on "Municipal Socialism and Its Practical Workings in Glasgow." Mr. Crawford was to have come to Chicago with James Dalrymple on his recent visit here, but was taken sick and could not come. Now he proposes to come at his own initiative.

Corporation Counsel Lewis has drafted a new idea to tax the street-railway companies, in which he holds that the street space occupied by the street railways should be taxed as real estate. He holds that the car companies are operating under a lease and not under a franchise, and they should be taxed on their leasehold. If the new idea is pushed it would yield a tax of $648,000, it is figured, but would also create endless litigation.

The Rateau Steam Regenerator System.

One of the most interesting applications of steam turbines is the employment of steam at low pressure, and particularly exhaust steam coming from engines working intermittently. This last class of engine includes hoisting engines, pile drivers, rolling mills, steam hammers, etc. By the nature of their work these engines are not able to benefit from the same advantages as engines which work continuously. This is owing to the special difficulties in application of condensing plant, multiple-expansion and superheating to such engines. The majority of such engines discharge the exhaust

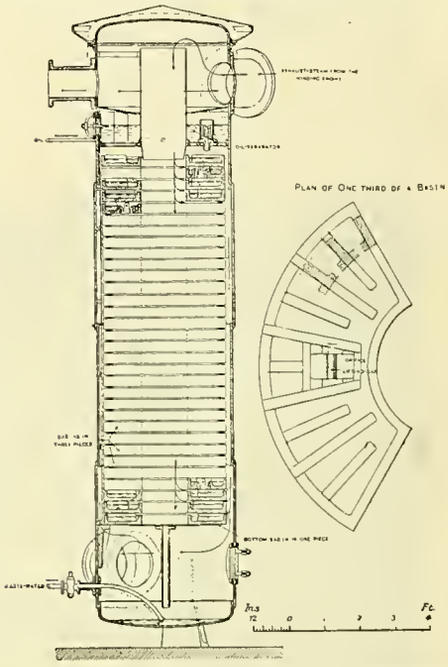


FIG. 1. STEAM REGENERATOR WITH FLAT CAST-IRON TRAYS.

freely into the air, and the quantity of steam which is thus lost is considerable. The Rateau patent steam regenerator system has, it seems, solved the interesting problem of the employment of such waste steam.

The regenerator is intended to regulate the intermittent flow of steam before it passes to the turbine, and it consists essentially of a vessel containing solid and liquid materials, which play the part of a "flywheel for heat." The steam collects and is condensed as it arrives in large quantities in the apparatus, and is again vaporized during the time when the exhaust of the principal engine diminishes or ceases. The necessary variations for condensation and regeneration of this steam correspond to fluctuations in pressure in the regenerator, this pressure rising when the apparatus is being filled and descending when it is discharging into the turbine. Water, which has a very high calorific capacity, has been used as a heat accumulator or "flywheel," but in order to rapidly communicate to a liquid mass a considerable quantity of heat, corresponding to the latent heat of steam to be condensed, it becomes necessary, owing to the poor conductivity of water, either to arrange it in thin layers or to cause a rapid circulation, in order to increase the surface of contact between the steam and the water itself. The first solution

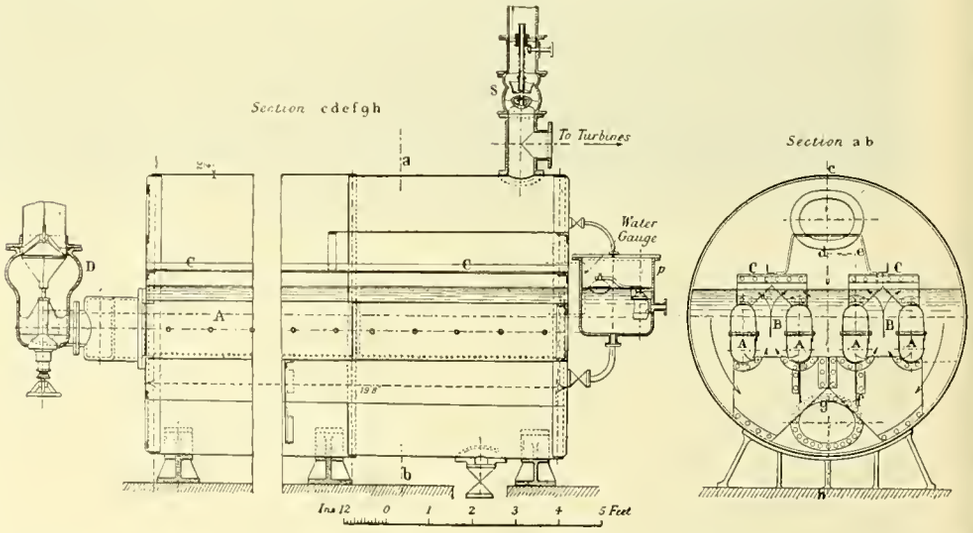


FIG. 2. STEAM REGENERATOR OPERATING WITH RAPIDLY CIRCULATING WATER.

of the problem gave rise to the regenerator with flat cast-iron trays in which water is contained in shallow vessels arranged one above the other (Fig. 1). The second solution of the problem gave rise to the regenerator with water only, in which a rapid circulation was produced by the injection of steam into the body of the liquid itself, as shown in Fig. 2.

The low-pressure turbine, fed by the regular flow which comes from the regenerator, and working, driving two direct-current dynamos at 1,400 revolutions per minute. The turbine receives steam from the regenerator at 15 pounds absolute and discharges in a central condenser giving a vacuum of 26 inches. This outfit has been running day and night for several months at a normal load of 650 horsepower measured at the brushes. The steam consumption of the turbine is 32 pounds of steam per electrical horsepower, this including the condensation in the regenerator. The 650 horse-

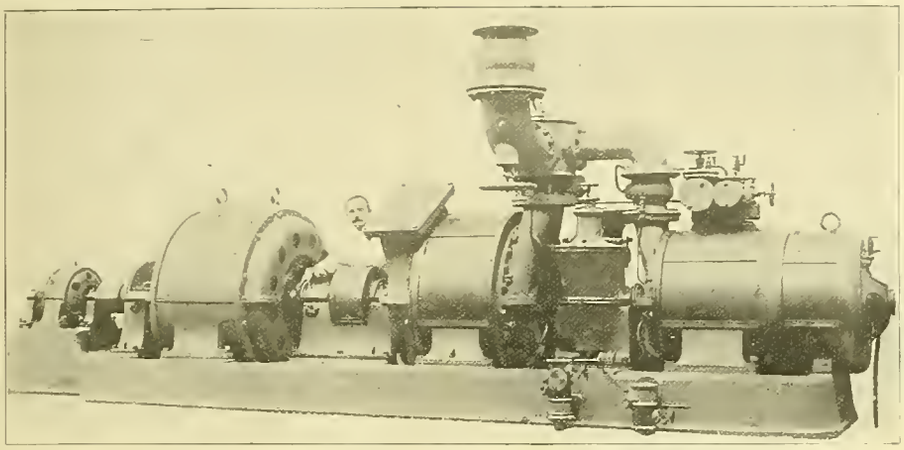


FIG. 3. HIGH AND LOW-PRESSURE TURBINES OPERATING ON THE SAME SHAFT.

for example, between an admission pressure of 15 pounds per square inch and a vacuum at the condenser of 27 inches of mercury, can furnish an electrical horsepower for about 31 pounds of steam per hour. In a moderate-sized mine shaft, consuming 13,000 pounds of steam per hour, it is calculated to be possible to economize under these conditions 350 electrical horsepower. In steel works where reversible steam rolls are employed, consuming about 45,000 pounds of steam per hour, it is believed to be possible to develop, by means of regenerators and turbines, an extra output of 1,100 electrical horsepower. It is desirable to mention that the prime movers are in no way affected in their working by the presence of the regenerators and turbines. In order to have the turbine independent of the shutdowns of the hoisting engines or rolling mills, a reducing valve allows the live steam of the boilers to be admitted in the low-pressure turbine, when there is no call for steam in the primary engine. Another process consists of admitting, automatically, live steam in a high-pressure turbine having a common shaft with the low-pressure turbine (Fig. 3). The idle boilers blow off their steam, and this waste steam is transformed into power by the Rateau process. This method was applied for the first time at Bruay, France, and the installation has worked satisfactorily since August, 1902, when it was first put in use. The output of the direct-current turbo-generator in this plant is 300 horsepower.

Fig. 4 shows the Poensgen Steel Works regenerator, containing pig-iron trays. The regenerator is 18 feet high and 12 feet in diameter. This regenerator regulates the exhaust of a reversible rolling mill and of a battery of steam hammers, the total discharge of these engines being approximately 21,000 pounds of steam per hour.

Fig. 5 shows a low-pressure Rateau-type turbine

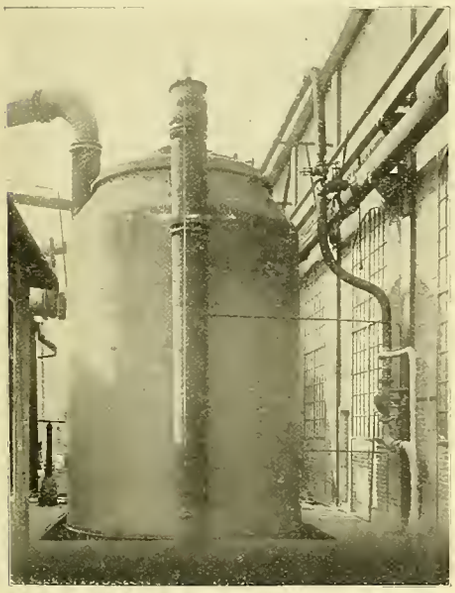


FIG 4. STEAM REGENERATOR WITH PIG-IRON TRAYS AT POENSGEN STEEL WORKS.

power obtained by the utilization of steam is employed actually in driving the whole train of the mill; also for lighting purposes and for furnishing current to an electric furnace.

Another very interesting application of this system is the utilization of the exhaust steam of two rolling mills in Scotland to run a low-pressure turbine driving a Rateau air compressor. The air is compressed at 23 pounds per square inch and is sent into the blast furnaces. In Europe 50,000

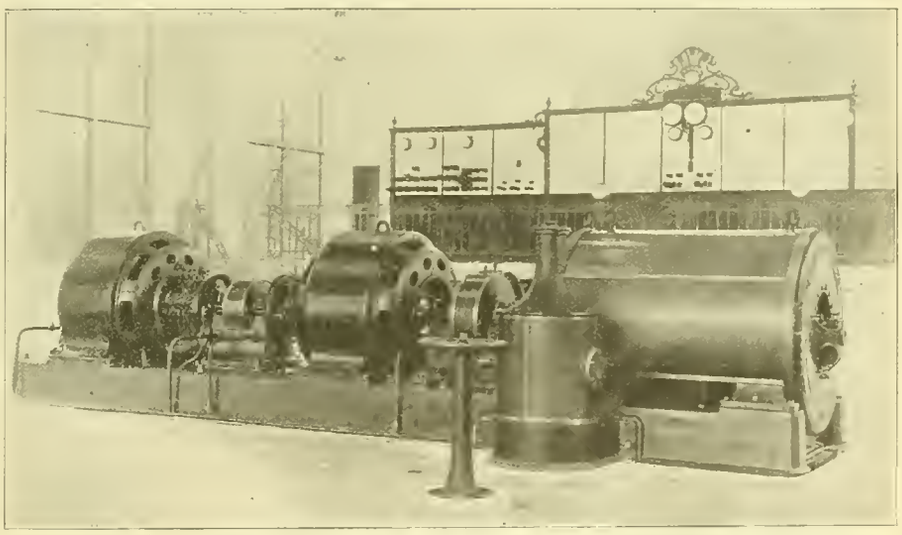


FIG. 5. LOW-PRESSURE RATEAU-TYPE TURBINE DRIVING TWO DIRECT-CURRENT DYNAMOS.

horsepower has already been put in service or is under construction. The Rateau Steam Regenerator Company of Chicago is contracting for several thousand horsepower in America, these applications being placed in steel works and mines of various kinds.

Court Decides for Wireless Company.

A temporary injunction has been granted the De Forest Wireless Telegraph Company restraining city officials and police of Chicago from interfering with the De Forest company in the transmission of messages. As stated in the Western Electrician of July 15th, the space-telegraph company was sending messages, under contract, from the wireless station in the Railway Exchange Building to the steamer City of Traverse, which took up a position each day near the intersection of the Illinois, Indiana and Wisconsin state lines on Lake Michigan. As it was known that horserace results were being received on the boat and in consequence bets were taken on board, the police seized the wireless apparatus in the land station as a means of suppressing the gambling.

Manager W. H. Ocker of the De Forest company at once asked the United States Circuit Court for an injunction restraining interference with its business, and the injunction was granted by Judge S. H. Bethea on the ground that the wireless company clearly is engaged in interstate commerce business and the federal statutes protect it. The court said that if the state laws were being violated the way to stop it is to take the property of the gamblers. Mr. Ocker said his company had no inclination to encourage gambling. The company merely wants the right to operate its space-telegraph system and handle business brought to it. If gamblers are violating the law, Mr. Ocker thought there ought to be some way of reaching them without interfering with his company's business. At the time of writing, the City of Traverse has not resumed its lake trips, but the De Forest company is ready to transmit to the boat all messages containing no improper language.

Extending Electrical Service in San Francisco.

The San Francisco Gas and Electric Company is opening a number of sub-offices in the residence districts of the city. This portion of the work is under the supervision of J. Schwartz. The offices in the Chinatown district, under the management of Louis Schuck, has proved a decided success, and the company reports a heavy increase in service in that district. Another sub-office has been opened at 209 Clement Street, in the Richmond district, a fashionable residence section and one that is growing rapidly. Wires have been stretched from the main part of the city across the intervening sand wastes to the Sunset and Ocean Beach districts, which are also rapidly filling up with permanent residents. Here alternating current only will be transmitted at a high pressure. It will be transformed to 220 volts, at which pressure it will be used. A sub-office is being constructed at Forty-seventh Avenue, and several wiring concerns have opened shops in that vicinity. Altogether, a great amount of work along this line is being done.

Electricity for the Pennsylvania Road.

Speaking of the improvements underway and those contemplated by the Pennsylvania railroad on its main line and branches between Jersey City, Washington and Pittsburg, the Elizabeth (N. J.) Journal says that electricity as a motive power is one of the most important objects to be attained in the working out of plans now in hand in the main office of the company in Philadelphia.

"One of the first results of the completion of the tunnel under the Hudson River to the new Pennsylvania railroad terminal in New York will be the running of trains by electricity directly from Newark under the Hudson River, and thence via the Long Island railroad to all parts of Long Island. The equipping of the Long Island railroad for electrical propulsion is but a part of this general plan for the retiring of the steam locomotive. The approach to the tunnel on the New Jersey side will practically begin at Newark, where it may be asserted on pretty good authority, a large power house will be erected. Another immense distributing center of the electrical force necessary will probably be reared on the meadows either east or west of the Bergen Hills. The company is endeavoring to maintain the greatest secrecy concerning its plans for the future, but the further development of the scheme of electrical motive power steadily westward may well be anticipated once the plans are fully carried out between Newark and Long Island."

General Electric Standard Enclosed Fuses and Cut-outs.

The General Electric Company is now furnishing a complete line of National Electrical Code Standard enclosed fuses and cut-outs ranging from three to 600 amperes in both the 250 and 600 voltages. The cut-outs and fuses are uniformly compact and durable, and the insertion or removal of the fuses is easy and safe. The accompanying illustrations show the several types of these devices. Fig. 1 is a three-wire, double-branch, 250-volt, 3-30-ampere cut-out. Fig. 2 is a single-pole, 600-volt, 401-600-ampere cut-out. Fig. 3 is a 250-volt, 65-100-ampere fuse. Fig 4 shows

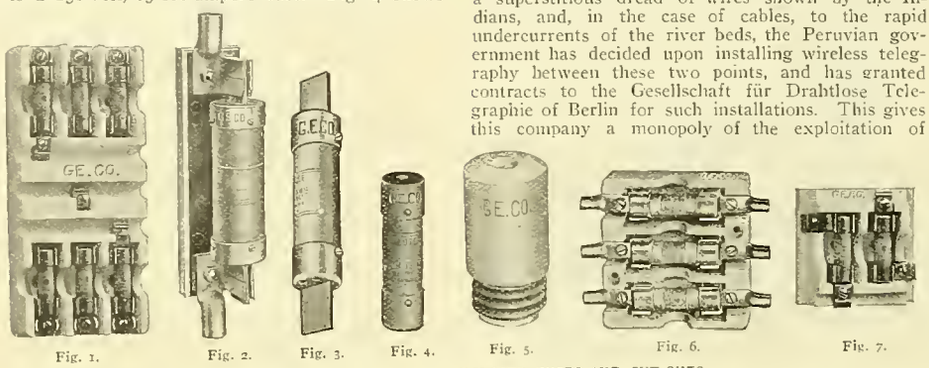


Fig. 1. Fig. 2. Fig. 3. Fig. 4. Fig. 5. Fig. 6. Fig. 7.

GENERAL ELECTRIC STANDARD ENCLOSED FUSES AND CUT-OUTS.

a 250-volt, 31-60-ampere fuse. Fig. 5 is a 250-volt, 30-ampere, removable fuse plug. Fig. 6 represents a three-wire, main-line, 250-volt, 31-60-ampere cut-out. Fig. 7 is a two-wire, cross-over, 250-volt, 3-30-ampere cut-out.

For fuses rated from three to 30 amperes, 250 volts, cut-outs similar to the Edison plug cut-outs are furnished, and for fuses from 31 to 60 amperes, 250 volts, two and three-wire main-line and single-branch cut-outs are supplied. All other sizes of fuses are provided with single-pole cut-outs. With all cut-outs are used the General Electric wrought-copper cable terminals, with the exception of the 30-ampere, 250-volt sizes. These are provided with washer and screw terminals.

The fuses are of the well-known enclosed-fuse type, ferrule or knife-blade contacts being used according to the requirements of the code. The knife-blade type, in addition to the standard parts, has a brace placed in each end of the tube to engage the screws which hold the end caps in place. The brace is rigidly attached to the contact blades. This forms a strong mechanical joint which does not depend solely upon the shearing strength of the fiber tube. The knife-blade contacts are of punched copper, and when used with the standard switch clips provide the best form of contact. The parts being copper of high conductivity, generously proportioned, the heating is reduced to a minimum.

In the ferrule type the contacts are made by phosphor bronze clips designed to give the utmost contact and elasticity in the smallest possible space.

The renewable fuse plug consists of a brass tube with the lower end threaded to fit the standard screw shell, and the upper part insulated by a porcelain shell. There is also in the upper end a spring clip which receives the ferrule contact of the reload, the ferrule on the other end forming the center contact of the plug. The reloads are the 30 and 60-ampere, 250-volt enclosed fuses.

Elevated Road Abandons Freight Project.

An ordinance was recently passed by the Chicago City Council permitting the Metropolitan West Side Elevated Railroad Company to do a freight and package business over its line. But so stringent were the conditions of the ordinance that at a meeting of the board of directors of the company the whole matter was dropped. The city wanted a large percentage of the gross receipts from the freight traffic; elevators were required to be built, and many crossing lights to be installed at various points. Altogether, such a large initial outlay was required at the beginning that the company could not see its way clear to a substantial profit. Besides, at the end of 10 years a new ordinance would have to be asked for.

Space Telegraphy in Peru.

Ordinary telegraphic or cable communication between Lima, the capital of Peru, and Iquitos, the main Peruvian harbor on the Amazon River, being impracticable, owing to the dense forests and a superstitious dread of wires shown by the Indians, and, in the case of cables, to the rapid undercurrents of the river beds, the Peruvian government has decided upon installing wireless telegraphy between these two points, and has granted contracts to the Gesellschaft für Drahtlose Telegraphie of Berlin for such installations. This gives this company a monopoly of the exploitation of wireless telegraphy in the country. Telegraphic connection already existing between Lima and Puerto-Bermudez, beyond the Cordilleras, the latter place has been chosen as the starting point for the wireless service. Bermudez and Iquitos, a distance of 1,000 kilometers, will be connected by three intermediate stations. Wireless communication may eventually be extended from Iquitos to Manaos, on the Amazon River, and thence to Para, so that a connection between the Atlantic and the Pacific oceans would be effected.

Incandescent Concentric Diffuser.

The incandescent concentric diffuser, recently designed by the General Electric Company, will prove of interest to those who have in the past been bothered by the problem of obtaining adequate illumination under mezzanine floors, in basements and similar places, where low studding eliminates the arc lamp, and large area the separate incandescent lamp.

Grouping incandescent or Meridian lamps necessitates, for the best results, a reflector with the widest possible range of lower hemispherical distribution. This new incandescent concentric diffuser, with its corrugations of progressively increasing amplitude, is believed to exactly serve the purpose.

The diffuser (Fig. 1) is 26 inches in diameter, and is made of steel, coated with high-grade Austrian air-dried enamel, which, unlike all other enamels, does not turn yellow, but becomes whiter with age. The black deposit which usually accumulates on the ceiling above the lamps is received by the diffuser, from which it can be readily washed off, so the diffuser protects the ceiling, in addition to giving an excellent distribution of light.

The diffuser can be installed near the ceiling or on any extension rod, and any standard make of cluster with four-inch base can be used. The best effects have been obtained with one 25 or 50-candlepower Meridian lamp in the lower socket, and three, four, or five standard frosted eight, 16 or 32-candlepower incandescent lamps set radially, as shown in the illustration.

From the chart (Fig. 2) it will be seen that the lower hemispherical candlepower has been increased about 40 per cent. and that the general distribution of downward light has been greatly improved.

The radial lines shown in the chart correspond to angles of 10 degrees in elevation, being marked in degrees of arc above and below the horizontal. The distance along these lines from the center to a point on the curve represents the intensity of candlepower in that direction. For instance, referring to the solid-line curves, it is found that at 60 degrees below the horizontal the cluster alone gives 85 candlepower. This may be read either at the right or left-hand side of the sheet. When the diffuser is used this is increased to 136 candlepower, showing a gain of 60 per cent. in this particular direction. While it is not advantageous to have all the light concentrated directly beneath the lamp, it is obvious that the most useful light is that thrown below the horizontal, and that the light thrown above the horizontal cannot be utilized except as it is reflected downward from the ceiling.

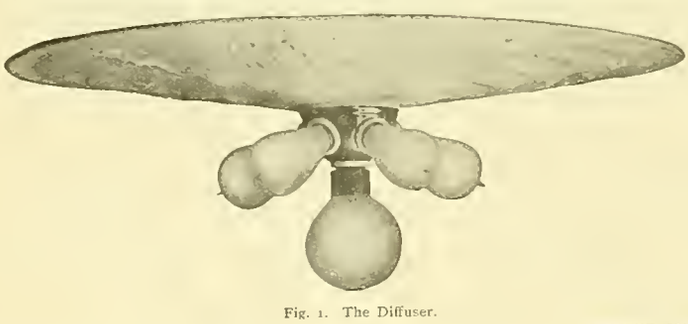


Fig. 1. The Diffuser.

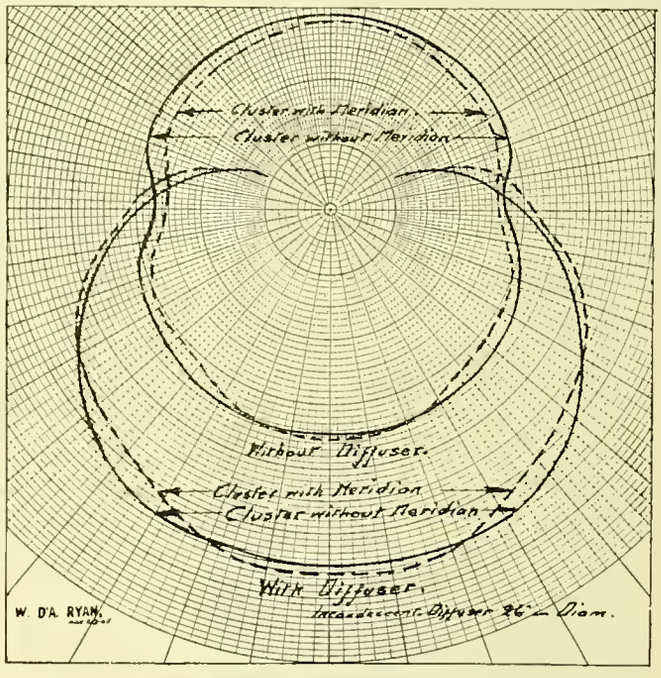


Fig. 2. Chart Showing Distribution of Light.

INCANDESCENT CONCENTRIC DIFFUSER.

QUESTIONS AND ANSWERS.

Useless Currents in Cable Sheaths.

H. C. S. of Medford, Ore., asks this: "What amount of eddy currents will be exchanged between three No. 0000 lead-covered cables 200 feet long, carrying 100 amperes per phase at 2,200 volts, three-phase, if the lead covers are permanently grounded? Is there any practical difference for this current and distance between the method above stated and that of using a three-wire cable with the three wires contained in one lead sheath which is grounded?"

ANSWER.

It seems apparent that the inquirer refers to useless currents created between the lead sheaths of the three cables. If the lead sheaths of these cables are in contact with one another at more than one point there is likely to be an induced secondary current flowing through them. With the sheaths tied together only at their ends, and under the conditions cited in the question, this may be from 20 to 30 or more amperes. The lead portions of these cables should therefore be in contact with one another only at one end, where the ground connection should also be made. The voltage between the conductors has nothing to do with the question.

In a three-conductor three-phase cable the induced pressure in the lead, which causes these secondary currents to flow, is absent, as the magnetic field of one conductor is neutralized by that of the other two.

Connection of Lamps to Test Wires.

W. H. F. of Delavan, Ill., says that in the plant with which he is connected they have a set of test wires running back from the center of distribution on a commercial circuit to a voltmeter in the station. He wishes to know if cutting in a number of lamps on the test wires will effect the readings of his voltmeter.

ANSWER.

Cutting in lamps across the pressure wires

would reduce the voltmeter readings in proportion to the number of lamps inserted. It is obvious that enough lamps might be inserted in parallel in the circuit so that the lamps would not light up, and although the pressure across the bus bars at the distributing center might be nearly normal, the difference of potential back on the test wires would become less and less as lamps were cut in. The voltmeter would then not be measuring the drop at the distributing center but at the group of lamps. Carrying the idea still further, suppose enough lamps were inserted in the test circuit at some point to form virtually a short circuit. It is evident in that case there would be no reading indicated in the voltmeter.

The Mercury-vapor Lamp.

F. H. McC. of Omaha, Neb., asks for information concerning the Cooper Hewitt mercury-vapor lamp.

ANSWER.

The mercury-vapor lamp of Mr. Peter Cooper Hewitt of New York city consists essentially of a glass vacuum tube made in various shapes, though generally of an elongated shape with a bulb at one end. Leading-in wires enter the tube at opposite ends and connect with electrodes inside. The negative electrode consists of a mass of mercury in one end of the tube, and the positive electrode is of a conducting metal.

Normally no current can flow through from one electrode to the other, as there is no conducting medium. As soon, however, as the mercury is vaporized a direct current will flow from the positive to the negative electrode through the mercury vapor as a conductor, which gives forth an intense light, the peculiar characteristic of which is that it possesses no red rays, and all objects falling under its influence appear of a greenish-gray color, with an effect which has been described as "ghastly."

To break down the initial resistance, which is very high, and vaporize the mercury sufficiently to allow a direct current at the ordinary pressures to flow, various methods have been devised. The original method was to break down this resistance by a high-potential "kick" or impulse of alternating current produced by an interrupter and induction coil in a secondary circuit. Another method suggested was to heat the vapor to the volatilizing point by a resistance coil which was then cut out of circuit. Still another method, now extensively used is to tilt the lamp so that the mercury will run the length of the tube, thus forming a temporary metallic conductor between the electrodes. When this is broken a portion of the mercury is vaporized and the arc established.

A recent modification of the mercury-vapor lamp is the mercury-vapor rectifier. The principle of this, roughly stated, is that current can only flow in the vapor in one direction, consequently if alternating current be applied to the terminal, only one-half the wave will flow through, the alternations of the opposite sign being cut off. The converter consists of a large bulb, or vessel, in a receptacle in the bottom of which there is placed a quantity of mercury acting as the cathode. There are also four positive electrodes, for a three-phase converter, one for starting the continuous current and one for each of the three phases of the polyphase current. First, the continuous current is switched on and the lamp acts as in the case of the ordinary mercury-vapor lamp. Next, the several phases of the polyphase current are switched on, and, finally, the original starting direct current switched off. It is then found that the four positive electrodes are all working; three-phase current is being sent in and direct current is being taken out from the mercury electrode and the original starting electrode.

The Copper Market.

The present marked feature in the copper market is a pronounced demand from domestic sources. Large sales have been made at 15 to 15¼ cents a pound for both Lake and electrolytic. Both Europe and America are putting in a demand for large supplies and production is being closely pressed by consumption. European consumers have been watching their chance to buy for nearby delivery, and considerable copper has been taken for shipment between now and September. Exports of copper for the first six months of 1905 amounted to 290,754,240 pounds, as against 255,458,560 pounds for the first six months of 1904, an increase of 35,295,680 pounds. The total exports for the 12 months ended June 30, 1905, amounted to 590,222,080 pounds, or within 222,315,187 pounds of the United States production for the year 1904.

New Westinghouse Generators and Motors.

A new line of Westinghouse direct-current self-contained generators, designed for railway, lighting and industrial service at 125, 250 and 550 volts, is shown in Figs. 1 and 4. These generators are adapted for belt driving or for direct connection to waterwheels, steam engines or other prime movers, where frames with bearings are desired. Figs. 1 and 4 show, respectively, a 250-kilowatt generator of this type and its armature.

The frame consists of a circular yoke of cast-iron divided horizontally into two parts and mounted upon a bed-plate of cast-iron, to which are bolted the pedestals which carry the armature bearings. Laminated poles with spreading tips are bolted to the frame, and any pole and its coils may be removed without disturbing either the armature or frame. The inner surface of the yoke is carefully machined to form a seat for the pole pieces, which are shaped to fit.

The shunt and series field coils are separately wound and are held in place by the spreading pole tips. Ventilating spaces are provided between the coils and between coils and poles in such a way that thorough ventilation is secured. The coils are taped and impregnated by processes which make them entirely moisture-proof. The field windings are regularly proportioned, so as to provide an increase of potential of about 10 per cent. at the terminals from no load to full load, though other compounding may be obtained if desired.

In the larger multipolar machines with parallel-wound armatures, sparking at the brushes, wasteful heating in the armature winding and abnormal magnetic strain upon the armature—troubles occasioned by inequality in material or by displacement of the armature from the center of the field—are obviated by the following method of balancing the magnetic circuit: A number of points in the armature winding which are normally at equal potential are connected by leads through which balancing currents may pass from one section of the winding to others. These correcting currents are alternating in character, leading in some coils and lagging in others, and consequently magnetize or demagnetize the field poles in such a way as to produce the necessary magnetic balance.

Figs. 2 and 3 show, respectively, a type HX induction motor and its secondary complete with starter. The motor is designed for constant-speed service and belongs to that class of induction motors without contacts or any connection whatever between the supply circuit and the rotating element. The starting mechanism is mounted on the shaft external to the frame, and consists of a device by means of which resistance is inserted in the winding of the revolving part when starting and gradually cut out as the speed increases until the winding is short-circuited. Thus, by a gradual development, the starting current becomes practically the running current, which is a very important feature on small systems where a constant voltage is essential and which would be considerably affected by throwing the motor suddenly on the line.

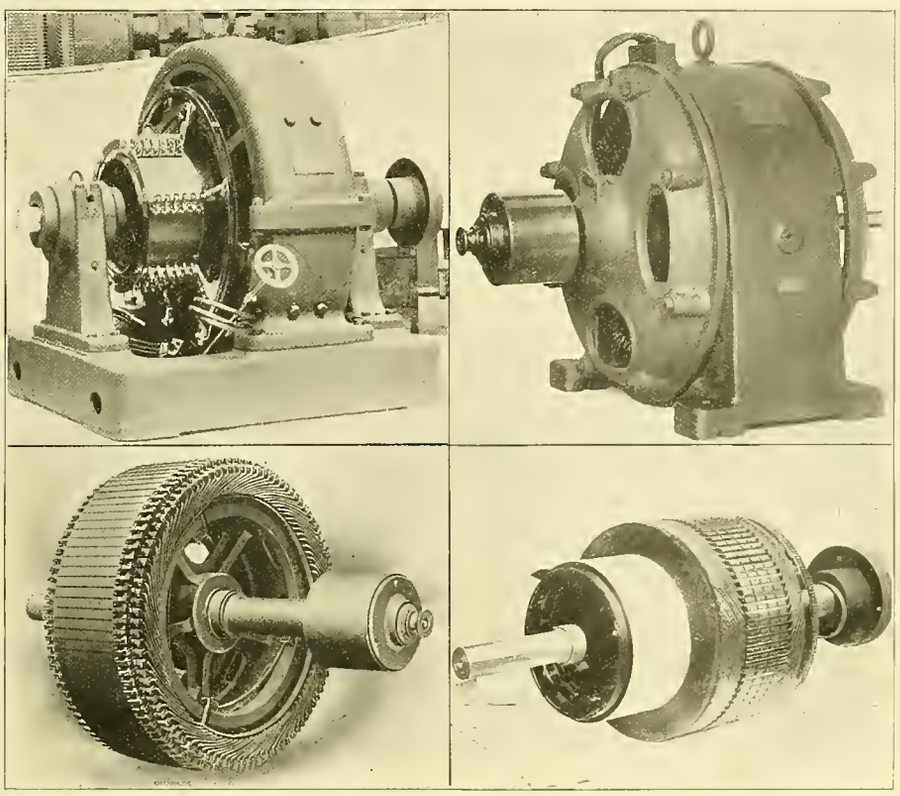


Fig. 1. 250-Kilowatt Direct-current Generator. Fig. 2. Westinghouse Induction Motor.
Fig. 3. Secondary of Induction Motor, Complete with Starter. Fig. 4. Armature of 250-Kilowatt Direct-current Generator.
NEW WESTINGHOUSE GENERATORS AND MOTORS.

The armature core of the slotted-drum type is formed of carefully annealed punchings built up on a cast-iron spider, on an extension of which the commutator is mounted. Liberal ventilating ducts make possible a thorough circulation of air while the machine is in operation. Coils formed of copper strap are used, and are held in their slots by fiber wedges. The generous proportions of the commutator insure the best commutation and low temperature under all normal conditions of operation.

No part of the rocker ring supporting the brush-holder arms projects over the commutator, thus leaving the carbon holders and commutator readily accessible at any point. The carbon holders are of the sliding type, with shunts, the tension on the brushes being obtained by long, flat, spiral springs, which give a uniform pressure over a wide range of movement without change in adjustment. The brushes and moving elements are light and follow the surface of the commutator without chattering.

Separate pedestals, bolted to the bed-plate, support bearings of the Westinghouse self-oiling type, which consist of cast-iron shells lined with babbitt metal and lubricated by means of rings which ride upon the shaft and dip into large reservoirs filled with oil. The bearing housings and shells are divided horizontally into two parts, to facilitate mounting and removal.

The frame of the motor is a solid ring of cast iron with feet for supporting the machine. Slide rails may be used or not, as desired. The core carrying the stationary windings is built up of steel punchings which exactly fit the bore of the frame and which are firmly held together between two iron rings. Substantial brackets, carrying the bearings for the rotating element, are bolted to the cast-iron frame, and may be fastened in four positions, permitting the motor to be mounted on the floor, side wall or ceiling, and the oil reservoirs to always be in the proper position. By means of oil rings revolving in the reservoirs copious lubrication is provided for the motor while in operation.

To secure the starting characteristics above mentioned the secondary windings are similar to those of a polyphase generator. Insulated copper bars are inserted in the partially closed slots in the steel punchings of the rotor. These punchings are mounted on a cast-iron spider which is keyed to the shaft. The overhanging tips of the teeth hold the bars in the slots. The end connectors are secured to the bars after they are in place, and the leads are brought out through the hollow shaft to contacts in the starting device.

These motors are built for two and three-phase circuits in sizes from five to 50 horsepower for 3,000 and 7,200 alternations. Standard voltages

are 100, 200 and 400 for machines up to 20 horsepower, and 200 and 400 volts from 20 to 50 horsepower. The motors retain a high efficency even on light loads; therefore their all-day efficiency is very high, as in general service motors may operate on light loads much of the time. The speed regulation between no load and full load has been found by test to be very small, a valuable feature in many applications.

Suitable Cars for City and Suburban Service.[1]

By T. W. Wilson, C. E.

On inspecting the cars in use in the various localities, one is impressed by the fact that the general trend is toward a larger and more commodious car. In interurban traffic we seem to be approaching very nearly to steam-railroad practice, and very rightly, too, as the conditions existing on a modern, up-to-date interurban line are very similar to those on a steam road. By comparing the average dimensions, it will be seen that, while an interurban electric car averages 40 feet over corner posts, the steam coach averages about 60 feet; that while the length over buffers of the trolley car averages about 50 feet, the steam passenger coach goes to 70 feet, and that while the weight of the interurban car body averages about 30,000 pounds, the steam passenger coach will average about 40,000 pounds. These increases in the weights and lengths of interurban cars have all been gradual but sure, and the reasons for them may be summarized as follows:

First, it must be kept in mind that the chief business of an interurban electric road is to compete with the steam roads. Up to a few years ago the suburban traffic was entirely handled by the latter and the people have become accustomed to the wide seats and commodious quarters of those roads. In order to divert the traffic to the trolley lines it is necessary to furnish as many of these conveniences as possible, added to which are the natural advantage of electricity over steam, such as the freedom from smoke and dirt, the transfer privilege and frequency of service.

In order to make a paying proposition out of an interurban line it is absolutely necessary that everyone shall be provided with a seat, except in cases of emergency; therefore, the larger the car the more it will earn per mile and per hour. The limits of size will be largely at the mercy of local conditions.

Another reason for the increase in weight and length of the interurban car is the question of safety. In order to compete successfully with steam roads (and that is surely the object of all interurban properties), it is necessary to operate the cars at 45 or 50 miles an hour. In order to do this safely, heavy M. C. B. trucks, powerful motors and strong bodies are necessary, and all of these factors tend to increase the dimensions.

When there is heavy traffic from one thickly populated city or town to another, and one car will not carry the people, then the multiple control, or the trailer service, becomes advisable. In Buffalo it was found that a three-car train, comoosed of two multiple-control motor cars and one trailer, gave the best results. Economy in wages is evident, only one motorman and three conductors being required for the train. The movement of cars in trains also minimizes the danger of collision, in that, instead of having three separate units under three separate controls and sets of orders, there is but one unit and one set of orders. This method of operation is especially valuable on single-track road with sidings, where the liability of accident is directly proportioned to the number of sections It may be possible that eventually it will be advisable to operate a four-car train, though it would seem that this would be a little too unwieldy for the run in the city. On the Buffalo and Niagara Falls line, on the other hand, it is not practicable to operate three-car trains, primarily because the line is full of curves and grades, necessitating the constant slowing down of the car and the subsequent building up of speed, and it would be impossible to make the schedule run except with a single car. Buffalo experimented last year with a 44½-foot trailer behind the same length motor car on this division, and found that the service was too much for the motors.

In summing up the interurban situation, it would seem that 60 feet is about the limit of the length over all of cars which are operated on an interurban line with city terminals. Where the line is entirely on private right-of-way there is no reason why the cars cannot more closely approximate steam practice. As the steam roads have had years of experience, there is no reason why we should not avail ourselves of that experience.

Turning now to the subject of city service, we are confronted with different conditions in different cities which require many varieties of equipment ranging from the small motor and trailer car of Washington to the commodious 46-foot cars of St. Louis and Chicago. The local conditions must be considered before criticizing the equipment of any city. In Washington they have two small open cars, one a motor and one a trailer, the whole train being handled by one motorman and one conductor. The climate is so mild that portions of these open cars are run all the year round. The carrying capacity of these two cars is about 80 people seated, and when it is considered that the weight of the motor car is only 17,000 pounds and the weight of the trailer car 7,000 pounds, it will be seen at once that for this service this system is probably as economical as could be devised, both in the consumption of power and in the wages of trainmen. An interesting fact in connection with this service is that they have fewer accidents with one conductor handling the two cars than they formerly had with two.

The trailer service, however, as a general rule (except in very large cities), is only economical and advisable for travel during rush hours and handling crowds from amusement parks, baseball games, etc. As an all-day proposition, in cities with moderate travel, it is hard to fill two cars unless the schedule is arranged to fill the cars rather than to give adequate service to the public. If the motor car is a closed car and the trailer an open car, as is the case in Buffalo, the people naturally take the open car, and the closed motors run practically empty in summer. For the handling of crowds Buffalo has found the trailers invaluable, as at least three trailers, and sometimes four, can be attached to a motor car, thus giving a total capacity of 250 persons to the five-car train. The motor and trailer cars, of course, are equipped with air brakes and controlled entirely by one motorman from the front car, with a conductor on each car. The economy of this method of handling crowds in trainmen's wages and power consumed is obvious.

During the last year Buffalo has been operating closed trailers as "smokers" during the winter, and open smoking trailers during the summer, but, as stated above, except in rush hours it is hard to comfortably fill the train.

In answer to the query as to what is a suitable car for the city service, it seems that first and foremost the car should be designed for both summer and winter conditions. It is not economical to carry a long line of open cars which have to be jacked up in the fall and stored away for six or seven months without earning a dollar, and the same is true of the closed cars which are stored during the summer. This fact is becoming generally recognized among street-railway managers, and has caused the development of the "convertible" and the "semi-convertible" types. During the last year hundreds of these cars of both types have been built and are now in successful operation. As to the meaning of the terms "convertible" and "semi-convertible," it may be said that the former is a car which during the summer time is entirely open, with either a running board on the side or an aisle in the center, or both, and in the winter time is a closed car; while the latter is simply a closed car with cross seats and large windows, the bottom sill of the window averaging about 25 inches from the floor, and the sash disappearing into roof pockets. For mild climates a full convertible car is most appropriate, while for cities such as Buffalo, Detroit and Chicago, the semi-convertible car is preferable. Cleveland experimented with the full convertible type last year, and during the summer was delighted with them; but when the cold weather came on it was found almost impossible to keep the cars warm.

The following is submitted as our idea of the best car for service in northern cities: First, the car should be a semi-convertible one, with a width the maximum that track centers and clearances will allow, and the length of body averaging about 30 feet. The openings into the body of the car should be as wide as possible with double sliding doors. The platform should be at least six feet in length, to allow two persons to enter or leave the car at the same time, and also to accommodate a large number of standing passengers. The car may be either a double or single ender, but for Buffalo service it is necessary to operate the car from either end, and even where the car is normally operated from one end only, it would seem to be poor economy not to install an emergency controller at the other end. A platform similar to the Detroit platform, but without the railing dividing it into two compartments, is suggested; instead of this railing an upright rod on both sides of the platform might be preferable. In arranging the seats, those near the door should be longitudinal, in order to allow more standing room, while those in the center of the can can be transverse, in order to encourage the people to ride and also for the reason that standing room is not so valuable in this portion of the car. With a 30-foot body, it would be possible to get seven cross seats on each side, or a seating capacity of 28 people, and this, together with four on each of the longitudinal seats, would make the total seating capacity of the car 44, with plenty of standing room at rush hours. This seems to be the average seating capacity of the latest types of cars in American cities, as will be seen by examining the accompanying table.

One of the classes of accidents which is most prevalent in electric-railway service today is that of "falling on or off the car." In order to minimize this class, we suggest the adoption of swinging gates similar to those now in use in Minneapolis. These gates should be placed on the right-hand side of the rear platform and should be operated by the motorman by means of a lever. It does not seem that the gate would be needed or advisable for the front platform, as the motorman can watch the entering and exit of passengers at his platform very readily. Having equipped the car with this gate and having installed a mirror, by means of which the motorman can see everything that occurs at the rear step, the starting of the car can then devolve upon the motorman, who, after glancing at his front step and seeing in his mirror that the rear step is clear, can then close his rear gates, give two taps with the gong as a signal to the conductor that all is clear, and then start his car upon two bells from the conductor. This will leave the latter free to devote his time to the collection of fares and the stopping of the car upon signal from the passenger.

1. Abstract of a paper read at the meeting of the Street Railway Association of New York held at Lake George June 27th and 28th. Mr. Wilson is general manager of the International Railway Company, Buffalo.

Latest Standards of Electric Cars in American Cities.

Place.	Car Length. Over Bumpers.	Car Length. Over Corners.	Platform Length.	Width, Maximum.	Car Op. 1 or 2 Direc-tions.	Seats. No. Cross.	Seats. No. Long.	Total.	Leogth Cross Seats.	Width Aisle.
Brooklyn	41 ft.	.....	.....	.....	2	40	8	48	34 in.	24 in.
Buffalo	36 ft. 5 in.	26 ft.	4 ft. 8½ in.	8 ft.	2	.....	34	34	.....	.....
Chicago	45 ft. 9 in.	32 ft. 5 in.	6 ft. 2 in.	9 ft.	2	28	16	44	35 in.	28 in.
Detroit	41 ft.	29 ft.	5 ft. and 6 ft. 6 in.	8 ft. 1 in. (Over sills)	1	24	19	43	.....	.....
Jersey City, Newark, etc.	42 ft. 8 in.	30 ft. 8 in.	6 ft. (Includes bumpers)	7 ft. 11½ in.	2	35	8	43	.....	.....
Kansas City	43 ft. 3 in.	30 ft. 7 in.	5 ft. 9 in.	8 ft. 6 in.	2	36	8	44	34 in.	.....
Nashville	42 ft.	30 ft. 6 in.	5 ft.	7 ft. 11½ in.	2	28	16	44	34 in.	23½ in.
Philadelphia	37 ft. (Over crown pieces)	28 ft.	4 ft. 6 in.	8 ft. 3 in. (Over posts)	2	32	8	40	.....	.....
Queensboro, New York City.	40 ft. 8 in. (Over vestibules)	30 ft. 8 in.	5 ft.	8 ft. 6 in.	2	28	16	44	37 in.	24 in.
St. Louis	46 ft. (Approx.)	33 ft. 4⅜ in.	3 ft. and 7 ft.	9 ft. 1 in.	1	40	12	52	32 in.	32 in.
Toledo	41 ft. 4½ in.	30 ft. 8 in.	4 ft. 8½ in. and 6 ft.	8 ft. 2 in.	1	28	16	44	34 in.	26 in.

Progress of the Steam Turbine.

During the six months ended June 30, 1905, the Westinghouse Machine Company contracted for no less than 82,000 kilowatts in turbo-generating machinery, averaging over 1,000 kilowatts capacity per turbine unit. These machines range in size from 200 kilowatts to 7,500 kilowatts. The latter will be among the largest turbines in the world, and three units of this size are under contract for Greater New York railway and lighting power stations. In the distribution of these machines among the various industries, the electric railway has claimed the largest number of machines, averaging 1,496 kilowatts in capacity; next in order are industrial plants, averaging 571 kilowatts capacity, and finally light and power plants, averaging 1,529 kilowatts capacity. In the order of total capacity, railway plants have required 38,900 kilowatts, lighting plants 26,300 kilowatts, industrial plants 12,000 kilowatts, and miscellaneous 4,800 kilowatts.

Power Development Near Chattanooga, Tenn.

Assurance is given that the proposed electrical power development and river improvement at Chattanooga, Tenn., in which the government is to assist, is now to be carried out. C. E. James and J. C. Guild, who have been working on the project, announce that the contract for the erection of the lock and dam and the electric power plant below the "Suck" on the Tennessee River has been signed, and responsible Chicago and New York men have arranged to furnish the funds necessary for the work. The general plans for the big undertaking were printed in the Western Electrician of June 10th. The Chattanooga-Tennessee River Power Company, which was incorporated recently to do the work, has been granted a franchise by the city of Chattanooga.

Indiana Telephone Items.

The Tri-county-Fort Ritter Telephone Company of Fort Ritter has filed articles of incorporation. The capital stock is $5,000. The company will install an exchange in Fort Ritter. Harvey S. Dixon, W. P. Holland, J. P. Allen and W. H. Reed are the directors.

Plans are forming for an Independent telephone system in Huntington, to replace the United Telephone Company, which was recently absorbed by the Bell company.

Over 300 telephone girls were given an outing at Broad Ripple on July 20th by the New Long-distance Telephone Company of Indianapolis. The girls were escorted by Mr. H. B. Sale, vice-president, assisted by Mr. Louis Hollweg, president, and Fred T. Loftin, secretary.

A farmer living near Goshen was awakened by a telephone call by a neighbor half a mile distant, informing him that his barn was ablaze. This was the first intimation he had that a fire was raging and he was enabled to save his live stock.

The telephone companies operating in Elkhart have been engaged in a telephone-rate war, and the Bell company has put in telephones in many places where no charges will be made for four months.

The large cable necessary to complete the connection of the United and the Central Union Telephone companies in Marion is now being put in. It is a big 600-wire cable made in Chicago specially for this purpose. Special switchboards are now being placed in the offices of both companies by electricians from Purdue University, and the cable will connect these two boards.

The Central Union Telephone Company made an effort to place 300 telephones in residences and business houses in Lebanon. There was to be no charge for the use of the telephones until the full 300 were installed. The citizens are so much opposed to a dual system that not even 100 would agree to the proposition, and this field is given up to the Independents.

The Central Union Telephone Company is arranging to put its wires underground in Terre Haute. The company grants the city the free use of one duct in each of the conduits for fire and police alarms. This company has just cut in a new exchange at Brazil. The new exchange is modern in every respect. The Central Union has also opened an exchange in Broad Ripple, a suburb of Indianapolis. Up to this time it handled its Broad Ripple business through its Indianapolis Central exchange. New country lines are being built out from the Broad Ripple exchange, which has equipment for handling 150 telephones. The Indianapolis Telephone Company has had a Broad Ripple exchange for some time, and keen competition is now anticipated. Both companies give free service with the city and over the entire county.

S.

The Telephone on the Pacific Slope.

The main exchange building of the Pacific States Telephone and Telegraph Company on Bush Street, San Francisco, is nearing completion. The building is to be eight stories in height and the exchange will have a capacity of 50,000 stations. It will be at once equipped for 20,000. The main executive office of the company will be located at New Montgomery and Minna streets. Work on the new building is now under way. The new office of the company at Powell and Eddy streets, which has just been completed, is the largest on the Pacific Coast.

W. W. Allen of San Francisco has just secured a franchise for a telephone system at Eureka, Cal., for which he bid $3,300. The same franchise had already been sold three times, but on each occasion the buyer forfeited his deposit by neglecting to pay the full amount of the purchase price.

The Fowler Independent Telephone Company has been incorporated at Fowler, Cal., with a capital stock of $7,500, of which $3,210 has been subscribed. Besides installing a local telephone system at Fowler the incorporators state that they will run lines between Fowler and Fresno, Oleander, Delrey, Selma and Lone Star.

The Two Rock Telephone Company of Petaluma, Cal., is now completing the rewiring of Petaluma. When this is completed the work of extending the line will be commenced. The company has elected officers as follows: President, T. G. King; vice-president, E. T. Nisson; secretary, G. W. Gaston.

A.

Ohio Telephone Notes.

Attorney John W. Warrington of Cincinnati appeared before the state board of appraisers and assessors a few days ago for the Central Union Telephone Company and argued for a reduction in tax valuation. The board has in the past placed a tax of $10 per set on telephone instruments. Mr. Warrington argued that since the expiration of patents the cost of telephone instruments has been reduced to $3 a set, and that the taxes ought to be reduced in proportion.

A franchise has been passed by the City Council at Lima giving the Central Union Telephone Company a franchise to use certain streets and alleys for the purpose of building conduits for the lines, the aggregate amount of duct required being about 40,000 feet. The company must furnish the city with telephones free of charge and string lines for the police-patrol, telegraph and fire-alarm system.

The Cuyahoga Telephone Company has formally taken over the plant of the Chagrin Falls Telephone Company, which was purchased by J. B. Hoge some weeks ago. This adds about 300 telephones to thte plant, and it is believed that the number will shortly be increased to 600. The contract department is keeping its record well up in the city, notwithstanding the summer dullness.

Articles of incorporation have been issued to the Clinton Bell Telephone Company of Clinton, the capital stock being $5,000. The incorporators are J. A. Smith, J. G. Hyde, Edward Schondel, Lena N. Oberlin and others.

The injunction suit of the city of Hamilton against the Home Telephone Company and the Hamilton Gas Light and Coke Company to prevent stringing electric service wires was heard by Judge Belden a few days ago and taken under advisement.

C.

Telephone News from the Northwest.

A local exchange will be installed at Watkins, Minn., where a company is being formed. The Tri-state Telephone Company will furnish long-distance connections.

State Examiner P. M. Kerst of Minnesota has started an examination of the telephone companies in the state to ascertain if they have made returns on the full amount of their gross earnings, on which they pay a three-per cent. tax.

The Mesaba Telephone Company has bought the local exchange at Grand Rapids, Minn.

The Sherburne County Telephone Company is putting in a new exchange at Becker, Minn.

The Northwestern Telephone Exchange Company will erect a new exchange building at Yankton, S. D.

The People's Telephone Company proposes to erect an exchange building at Superior, Wis.

The Tri-state Telephone Company will establish a toll station at Olivia, Minn.

The Wisconsin Telephone Company proposes to expend about $6,000 in improving its system at Eau Claire, Wis.

The Citizens' Telephone Exchange of Montevideo, Minn., will extend its line to Watson.

The Hancock County Rural Telephone Company of Britt, Iowa, has been incorporated. E. L. Stilson is president and A. L. Severlin, secretary.

The Hastings Independent Telephone Company of Hastings, Neb., has moved into its new exchange building.

A telephone company may be organized at Logan, Iowa, by local business men.

The Wells Telephone Exchange has been succeeded by the Woodward (Iowa) Mutual Telephone Company. L. W. Staker is president and A. F. Ingalls secretary.

The West Shore Telephone Company has applied for a franchise to operate in Milwaukee, Wis.

The Tabor (Iowa) Telephone Company has been dissolved and the business divided between the City Telephone Company and the Fremont County Telephone Company.

R.

NEW COMPANIES.

The Halstead (Kan.) Rural Telephone Company has been incorporated with a capital stock of $5,000.

The Citizens' Telephone Company of Corbett, Okla., has been incorporated with a capital stock of $10,000.

The Southern Michigan Telephone Company of Three Rivers, Mich., has been incorporated with a capital of $300,000.

The Geneseo Telephone Company of Geneseo, Ill., has been incorporated by C. Tomlinson, G. B. Dedrich and D. M. Stamm.

J. H. Wehn and associates of Bridgeport, Neb., have incorporated as the Wehn Telephone Company with a capital of $25,000.

T. H. Fleming, A. B. Puterbaugh and A. M. Fike have incorporated as the Milledgeville Mutual Telephone Company for the purpose of installing a telephone system in Milledgeville, Ill. The capital of the company is $10,000.

The Merchants' Association of New York city has reported on its recent investigation into telephone rates, and says that for the years 1889 to 1903 the profits derived from operating telephones in the city averaged 10.89 per cent. For 1904 the profits were 14.64 per cent. The committee suggests that telephone rates should be regulated by law, and says that a 10 per cent. margin would be reasonable profit. The association says that the recent reduction of rates has been due to its efforts.

Work of the National-Interstate Telephone Association.

The National-Interstate Telephone Association, which was formed in Chicago on June 20th, has begun its work in a systematic manner. The association has established general headquarters and opened an office at 708 Electric Building, Cleveland, Ohio, where John A. Harney, the assistant secretary, can be found at all times. Files have been secured with a view of gathering complete information on the telephone situation of the United States.

Information is wanted at once from state associations as follows: (1) Line and circuit maps of all important toll lines in the different states for the purpose of making up one good map of the Independent development of the United States which can be published for general use; (2) statistics as to the number of circuit miles of toll line, number of subscribers, number of exchanges and number of stockholders of the Independent companies in each state.

The executive council at its meeting in Chicago authorized the treasurer to issue a call for an assessment of one cent per unit for the purpose of putting the association on a substantial working basis. Notices for assessment No. 1 have therefore been sent out to the various state associations.

Numerous inquiries are being received from all parts of the country for prices on standard toll signs, stationery and other supplies bearing the official shield adopted at Chicago. In order to have the shield generally adopted throughout the country as soon as possible, arrangements have been made whereby especially low prices can be secured on toll signs, directory covers, letter-heads, envelopes and business cards if the support and co-operation of the various Independent companies is given. Price lists will be ready about August 1st and will be forwarded to anyone interested.

New Telephone Exchange for Meridian, Miss.

One of the strongest Independent telephone organizations which has thus far taken up the work of developing promising territory in the South is the new Home Telephone Company of Meridian, Miss., and the interests represented by Jones & Winter, electrical contractors of Chicago. This organization is building its initial plant at Meridian, from which point it proposes to extend its system throughout the state and adjoining territory by a network of toll lines and up-to-date plants in all of the principal cities now undeveloped by Independent systems.

The Meridian plant will be started with an initial equipment of 1,200 lines and an ultimate switchboard capacity and conduit provision for 4,800 lines. The construction will be a full-cable system, with cable and insulated wire for all leads. The equipment is to be furnished and installed complete by the International Telephone Manufacturing Company of Chicago, and is of its latest improved central-energy lamp-line system, multiple-switchboard type, with double supervisory clearing-out signals and new four-party-line apparatus, with indicating selective keys in each cord circuit.

Telephone Rates Too Low at the Start.

A decision concerning the rates which a local telephone company may charge its subscribers was handed down recently by Judge Harlan in the Circuit Court at Baltimore, Md. The Home Telegraph and Telephone Company of Baltimore, although claiming to lose money at the rates fixed by the City Council, was ordered to adhere to the rates made in 1896, when it obtained its franchise by agreeing to charge residence subscribers $36 a year and business subscribers $48. Meeting with difficulty in getting a franchise from the City Council of Baltimore, the Home company agreed to a resolution passed by that body to furnish service at the above figures. Six years after the agreement was signed the company, which had changed its name to the Maryland Telephone and Telegraph Company, found that business could not be carried on with profit at the old rates. An appeal was made to the city authorities to repeal the ordinance, but without success, and then the company raised the rates to $60 and $72 a year. The litigation lasted over two years and attracted widespread interest.

A Telephone in Salt Lake.

At a prominent bathing place near Salt Lake City a telephone has been installed 3,000 feet out in Salt Lake and connected with an exchange on shore. The primary object of the telephone was to summon aid to bathers in cases of imminent drowning. To make the system work satisfactorily is said to have presented difficulties, and perfect insulation was required to resist the salt water of the inland sea. Now it is possible to communicate with Spokane, Denver and the cities of Wyoming, Idaho and Utah while bathing in the Salt Lake.

GENERAL TELEPHONE NEWS.

The Winnebago County Telephone Company is building a line from Rockford to Burritt, Ill.

The Arcadia Telephone Company of Arcadia, Kan., has declared a dividend of five per cent. on its first year's business.

The Nebraska Telephone Company has bought a lot adjoining its present location in Lincoln, Neb., where it will build immediately, about doubling its floor space.

Department stores in some large cities are arranging to take care of night orders by telephone. Shoppers seeing bargains advertised in the evening papers can telephone their orders, and the goods will be delivered next day.

The board of commissioners of the Temiskaming and Northern Ontario railway in Canada will establish a government-owned telephone system from North Bay to New Liskeard, a distance of 113 miles, and as the railway is extended northward the telephone system will also be extended its full length. The line will likely be built this summer.

Secretary Bonaparte of the Navy Department has made a new contract with the local telephone company in Washington, cutting down the number of telephones. He has issued an order that no personal calls shall be made over the department telephones, with the result, it is said, of a reduction of 50 per cent. in the number of daily calls.

Franchise valuations have been fixed as follows on a number of telephone companies by the Kentucky state board of valuation and assessment: Jessamine Home Telephone Company, $12,464; New Castle Home Telephone Company, $3,000; Frankfort Telephone Company, $6,440; Carrollton Telephone Exchange Company, $10,000; Eminence Telephone Company, $9,000.

The Keystone Telephone Company of Philadelphia, Pa., has been reorganized and it is now proposed to extend and improve the service in every possible manner. The board of directors has been increased from five to 11 members, and the new board has elected the following-named officers: President, Nathan T. Folwell; vice-president, James Collins; secretary and treasurer, W. W. Wharton; general manager, C. E. Wilson. A New York concern has taken $4,000,000 of the company's bonds.

In a letter to the president of the National-Interstate Telephone Association the officers of the Morrow County Telephone Company of Mt. Gilead, Ohio, say that after a two-month trial of the experiment of connecting the two principal exchanges of the Morrow County company with the Central Union Telephone Company, the service was discontinued because it was found that nearly 90 per cent. of the subscribers chose the Independent connections. President A. A. Whitney and Secretary Mark Cook, who sign the letter, say that the Bell company will put in an exchange now that the connection has been discontinued.

MANUFACTURERS AND DEALERS.

A bulletin describing the automatic telephone exchange at Columbus, Ohio, has been issued by the Automatic Electric Company. The bulletin is plentifully illustrated and describes in detail the Columbus exchange, which is operated by the Columbus Citizens' Telephone Company.

The Tornquist Electrical Manufacturing Company of Davenport, Iowa, has just issued a new reduced price list on its line of knife switches and telephone protectors, and will be pleased to mail it to anyone interested, upon request. It has also reduced the size of its telephone protector and is mounting it on red lacquered slate. This innovation seems to be received favorably by the telephone trade. The company makes arresters for all kinds of telephone service, and customers are requested to specify the system they use.

The Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., reports having closed a contract with the North State Telephone Company of High Point, N. C., for a 1,200-line capacity generator-call visual-signal switchboard. It is stated that this is one of the foremost telephone companies in the state, and is under the efficient management of J. F. Hayden. The company also reports having closed a contract with the Anderson Telephone Company of Anderson, S. C., for an 1,800-capacity lamp-line-signal multiple switchboard. The general manager, E. S. Moorer, is a progressive Independent telephone man who has had much experience.

On July 1st the division of consular reports in the Bureau of Statistics, including the clerical force, all records, papers, books, supplies, furniture, files, etc., was transferred to the Bureau of Manufactures of the Department of Commerce and Labor, Washington, D. C. The work formerly performed by the division of consular reports will be continued under the direction of the chief of the Bureau of Manufactures.

CORRESPONDENCE.

Great Britain.

London, July 12.—The question of the supply of electricity in London is once more receiving considerable attention, owing to the $25,000,000 scheme having successfully negotiated the House of Lords, now being before the House of Commons. Much has been accomplished by the promoters of this scheme since they were successful in ousting their six or seven competitors when the schemes were originally before the House of Lords. Several of the local authorities, after vigorously opposing the bill, have come to terms with the company to take all the supply necessary, after the capacity of their present stations have been exhausted, in bulk on exceptionally low terms. Consequently a very strong case was made out for the second reading of the bill in the House of Commons last week, when an unusually long debate took place, and the bill was eventually sent for consideration to a committee by a majority of 40. The main opposition in the House of Commons was on the part of the local authorities, although the electric-supply companies also had their advocates. The chief point in the local authority case is that there is no purchase clause, as there is in connection with the existing companies, enabling the local authorities to buy up the company. But no purchase clause has ever been inserted in a "power" bill, and although the promoters have expressed a willingness to have some terms of purchase settled now, it must be confessed that this offer seems very much like a trick to facilitate second reading, because in the case of one of the local authorities with whom an agreement has been entered into the period is for 50 years supply. As the other companies are purchasable in 1931, only 26 years hence, there is not much likelihood of an agreement being come to on the one hand, and the precedents are far too strongly in favor of the big company on the other to anticipate that any such clause will be put upon them. The bill comes before a committee tomorrow.

The inauguration of the much-belated electric traction upon the Inner Circle a week ago was attended with unfortunate results. Exceptionally heavy rains fell on the morning of the inauguration, which had the effect of flooding a portion of the permanent way and causing a partial short circuit. The irony of the whole affair was the flaring placards announcing that electric trains would run every few minutes to everywhere, while as a matter of fact the old steam trains had to be requisitioned after much delay. However, the electric service has since been resumed and at present is working satisfactorily about one-fourth of the time-table. Very elaborate precautions have been taken in connection with the rolling stock to insure the public safety. All the doors are controlled by pneumatic power, while the outside of the cars have been covered with aluminum and painted red.

The work of the committee of the House of Commons which is considering the agreement between the postmaster-general and the National Telephone Company is almost completed, evidence now being heard on behalf of the employes. All the technical questions have now been disposed of, the postoffice officials practically stating that it would be impossible to construct an alternative system to that of the company throughout the country before 1911, the date of the expiry of the license. They have also strongly deprecated any such duplication of capital as would thus be involved, and although many of the municipalities urge that the provision of an independent system would be the best, the argument will hardly appeal to the unbiased mind on economic grounds. From a close study of the evidence before the committee it appears that although some modifications in the agreement will be recommended, nothing of a sufficiently drastic nature should arise to prevent the agreement being passed.

A length of electric railway, partly in tube and partly surface, has just been sanctioned. The line just runs into the city from the northeast suburbs of London, and those who have had experience of tube-railway legislation in the past will welcome the conditions under which the present line has been authorized. In the early days of tube railways practically no stipulations were put upon the promoters as to capital. Then came the "Yerkes period," and as a result measures were frequently rejected because the capital could not be guaranteed. The decision in the case I am now referring to would seem to have been given with the object of striking a mean of the two positions; it is that one-half of the share capital must be raised in one year, and that construction must be commenced within two years, otherwise the powers of the bill lapse.

G.

New York.

New York, July 22.—The installation of large exhaust fans, the opening of the forward doors of the trains and the lowered temperature have undoubtedly combined to ameliorate the distressing conditions in the subway. On Tuesday, for instance, when the street temperature in the shade was 98, a thermometer in the subway showed only 90 degrees. It is evident that many conditions, some entirely beyond control—such as the direction of the wind and the humidity of the atmosphere—are involved in the problem of ventilating the subway.

Repeated promises to run electric passenger trains on the Long Island railroad on a given day have not yet "eventuated." When, on the first experimental run, the current was turned onto the third rail, several leaks were discovered, and at one or two places it was found unsafe to allow road vehicles to cross the grades. An experimental train was run this morning from Rockaway Beach to Woodhaven Junction, but although it was under the charge of the electrical staff, a steam locomotive was attached to the rear of the train in case of need.

The New York state commission to deal with all matters connected with gas and electricity is now complete. The members are Frederick E. Gunnison of Brooklyn, John C. Davies of Oneida and Lucien L. Shedden of Clinton. The appointment is for six years and the individual salary $8,000 a year.

The newly incorporated Bushmiller Company of this city will deal in electric and gas fixtures. The capital is $5,000 and the head of the company is Siegfried Bushmiller.

J. G. Eager and associates have incorporated as the Electrical Repair Company with a capital of $5,000. Headquarters are in Jersey City.

Commissioner Best has advertised for bids for all the metal work for the anchorages and constructing the towers, cables, etc., for the new Manhattan Bridge. The bids are to be opened August 10 and the bidders are required to deposit securities in the amount of $1,500,000 for the faithful performance of the work. The time limit is 3½ years, and the advertisement announces that bids will be received only from firms whose plants justify the expectation that the work will be done well and promptly. The specifications drafted by the engineers of the bridge department fill more than 100 printed pages. Every rivet that is to be used in the giant structure is shown in the illustrated plans.

D. W. W.

Southeastern States.

Charlotte, N. C., July 22.—The town of Dunn, N. C., has ordered a new dynamo to enlarge the electric-lighting plant.

The Southern Power Company, recently incorporated with $7,000,000 capital, has selected directors as follows: Dr. W. Gil Wylie of New York, J. B. Duke, R. B. Arrington and R. H. Wylie of New York, W. S. Lee, Jr., of Charlotte, N. C.; Julius Christensen of Philadelphia; B. N. Duke and F. J. Fuller of Durham, N. C. W. Gil Wylie was elected president and W. S. Lee, Jr., second vice-president and chief engineer.

The wiring, etc., has been completed for the electrical operation of the Highland Park Mill at Rock Hill, S. C.

The Henrietta cotton mills at Henrietta, N. C., are being equipped with 1,000-horsepower electric drive.

Engineer J. M. Bandy, formerly of Greensboro, N. C., has completed a partial survey looking to the development of the Yadkin River by the Southern Yadkin Development Company, composed of North Carolina and Philadelphia capitalists, the estimated cost being $2,000,000. The power is estimated at 3,000 horsepower and the company proposes to build a cotton mill and to supply power to High Point, Salisbury and other towns.

It is rumored that the power for the proposed interurban electric railway from Charlotte, N. C., to Gastonia and probably to Concord, N. C., may be furnished by the newly organized Southern Power Company.

H. Carter of the Carter Motor Car Company has recently visited the town of Greensboro, N. C., where a factory may be located by the company.

L.

Ohio.

Cleveland, July 22.—Forty-eight electric railways in this state each reported gross earnings to the state auditor of over $25,000 for 1904. Ten of these companies showed a decrease in gross receipts over 1903 and the remainder showed a gain. The aggregate gross earnings for the year were $20,449,189, a gain over 1903 of $3,260,688. Of all the roads in the state the Cleveland electric leads with gross earnings of $4,544,943, as compared with $2,613,049 in 1903. Then follow in order the Cincinnati Traction company, the Toledo Railways and Light Company, and the Columbus Railway and Light Company. Of the interurban lines the Northern Ohio Traction and Light stands first with $895,731, against $882,276 in 1903. The Lake Shore Electric, the Columbus, Buckeye Lake and Newark, and the Columbus, London and Springfield were next in order.

An attorney for the Widener-Elkins syndicate was in Columbus several days this week, and it is said he made a thorough inspection of the Appleyard properties and began an investigation of their

titles. This looks as if the syndicate had formulated plans for purchasing these properties when they are sold by the courts.

Stockholders of the Toledo Heating and Lighting Company and the Toledo Gas, Light and Coke Company, recently merged, have chosen the following directors: H. E. Marvin, Homer Yaryan, W. F. Robison, Clarence Brown, James S. Brailey, Jr., J. K. Secor, L. B. Pierce, Charles F. Chapman, Jr., and Frank W. Coughling. The name of the new company, it is said, will be the Toledo Gas, Electric and Heating Company. The directors are working on plans for a new plant to be centrally located.

F. D. Carpenter, general manager of the Western Ohio Railway Company, is reported to have announced that a traffic arrangement has been entered into between that road and the Widener-Elkins properties in the West by which a mutual interchange of service will be had. The report is also current that negotiations between the Widener-Elkins syndicate and the owners of the Toledo, Bowling Green and Southern have again been taken up.

The Toledo, Defiance and Southern Railway Company of Defiance has been incorporated with a capital stock of $10,000 to build an electric railway through Hamilton, Butler, Preble, Mercer, Van Wert, Paulding, Defiance, Henry, Fulton and Lucas counties. A. K. Detwiler, T. T. Ansberry, W. H. Edwards, P. Kettenring and L. R. Schenck are the incorporators.

A new freight depot is being erected at Bryan by the Toledo and Indiana Railway Company. Three express trains each way a day will be operated, while 19 passenger trains will be operated between Toledo and Bryan.

Trolley guards will be put in at eight railroad crossings in Cleveland, according to the announcement of President Andrews of the Cleveland Electric Railway Company.

Lawrence, Barnum & Co. and Patrick Hirsch & Co. are said to have arranged to furnish backing for the extension of the Toledo and Indiana electric railway into Fort Wayne. A new company to be known as the Toledo, Fort Wayne and Western will be organized to build the extension.

The Bergholtz Coal and Electric Light Company of Bergholtz has been incorporated with a capital stock of $30,000 by T. E. George, S. M. Dorrance, W. E. Stemmetz, J. G. Kirk and Lewis McLain.

It is said the Widener-Elkins syndicate is negotiating for the Columbus, Urbana and Western from Columbus west, operating to Fishinger's Hill. Senator Foraker is interested in the company.

The Cincinnati Gas and Electric Company has decided to install a new set of storage batteries to cost something like $250,000. The batteries will be operated in connection with two 1,000-kilowatt rotary converters. The lighting business of the company has increased to such an extent that the improvements were needed.

For the first six months of the year the Northern Ohio Traction and Light Company has shown a gain of nearly $18,000 in surplus for stock over the corresponding period last year.

The Toledo and Jackson Electric Railway Company has been incorporated in Michigan to build an electric railway from Toledo to Jackson. C. R. Brand, William Nagle, S. A. Foster and W. P. Heston of Toledo and M. R. Bacon of Wyandotte are the incorporators. The right-of-way has all been secured.

Stockholders of the Springfield, South Charleston, Washington C. H. and Chillicothe road have decided to have the receiver sell the property as soon as an order of court can be obtained. It is said that Frank Patterson, promoter of the road, will bid on it, to be used in connection with another line he is promoting from South Solon to Wilmington.

The Ruprecht Igniter and Electric Company of Cleveland has been incorporated with a capital stock of $25,000 by Conway W. Noble, A. B. Strimple, George W. Hansen, E. L. Geismer and George P. Baer. O. M. C.

Indiana.

Indianapolis, July 22.—The citizens of Angolia have raised $15,000 for the St. Joseph Valley Traction line, and an election will be held to vote $35,000 more. The citizens almost unanimously, it is said, favor the subsidy.

The special election held in Kendallville to vote a subsidy for the Huntington-Warsaw line was carried by a very large majority. This secures for Kendallville the power house, as this was one of the provisions of the subsidy.

The Town Council of Boonville has granted the Evansville and Newburg Traction company a 50-year franchise to enter the city. Freight hauled by steam must be moved at night only. The Tennis Construction Company is building this line.

The building of the extension of the Toledo and Indiana electric railway into Fort Wayne is now assured. The new company will be known as the Toledo, Fort Wayne and Western.

The nine electric traction companies using the Indianapolis Traction and Terminal station have moved their freight department into the new freight house adjoining. It is now said that the passenger and freight-house facilities connected with these terminals are the best in the world. The freight business is gradually increasing.

The Indianapolis and Eastern Traction Company has let the contract for the construction of a $7,000 combination passenger and freight station in Newcastle. The through service on this line is proving very satisfactory.

The Oakdale Light, Heat and Power Company has filed articles of incorporation with a capital stock of $50,000. The company will establish a light and heat plant at Oakdale. The directors are R. H. Bouslog, A. N. Dukes and R. A. Edwards.

Estep & Mill are asking the North Manchester Town Council for an electric-light franchise, and will use the Laketon waterpower.

John Plan has completed arrangements and will soon ask for bids to put in an electric-light plant at Cicero. S. S.

Michigan.

Detroit, July 22.—It is rumored that another electric railway will be built between Toledo and Detroit, certain rights-of-way lying east of the Grand Trunk road having been purchased by some unknown persons. The line would be located along the shores of Lake Erie and the Detroit River and would connect with the Detroit United railway at Trenton.

It is now definitely known that the proposed Battle Creek-Grand Rapids electric railway will be built and also that a line will be built from Kalamazoo to Gull Lake to meet this line and thus connect these towns with Grand Rapids. Colonel Jacobs of Chicago is the leading promoter of the line.

The growth of the automobile manufacturing business in Detroit has been very rapid and this city, it is believed, now leads this country, if not the world, in the magnitude of this business. One of the leading companies has made shipments within a week to India, England, Sweden and Chile.

The mayor of Ann Arbor has vetoed the five-year street-lighting contract for the Washtenaw Light and Power Company on the ground that it did not receive a two-third vote in the council, and because he believes that a combination of gas and electricity is more satisfactory.

The mayor of Monroe has been upheld by the council in his veto of the sale of the municipal-lighting plant to H. W. White and the granting to White of a 10-year lighting contract. New bids for the plant will be asked.

Judge Wanty, in his ruling in the suit of the United States against the Chandler-Dunbar Water Power Company of Sault Ste. Marie, holds that the St. Mary's River is not a part of the Great Lakes and that the riparian rights of property-holders extend to the center of the stream the same as in an inland river.

Franchises have been granted the Peninsular Electric Light Company of Detroit to erect high-tension pole lines through Grosse Pointe, Hamtramck, Erin and Harrison townships. It is stated that this company, which is under the control of the Edison light company, has Port Huron as an objective point, and that light will be furnished there and at Mt. Clemens as cheaply as in Detroit.

The Grand Rapids-Muskegon Water Power Company has increased its capital from $1,000,000 to $2,000,000 and ordered an issue of $5,000,000 worth of bonds. The company is building a dam in the Muskegon River near Big Rapids and will furnish power and light to all nearby cities and towns.

The Manistique Merchants and Manufacturers' Association is pushing the project of building an electric railway between Manistique and Bay de Noquette. The line would pass through a rich farming region. Power has been offered cheaply by the Manistique Light and Power Company.

The South Haven Traction Company of South Haven has been incorporated with a capital of $800,000. C. G. W.

Northwestern States.

Minneapolis, July 22.—The City Council of Graettinger, Iowa, has let the contract for a new electric-light plant.

The promoters of the proposed electric railway from Council Bluffs, Iowa, to Griswold have organized temporarily by electing H. H. Van Brunt president.

The Polar Star Electric Company has received the contract for wiring the court house at Faribault, Minn.

O. I. Anderson has sold his mill and electric-light plant at Colfax, Wis., to E. B. and Albert Hill.

The Sioux City (S. D.) Service Company has been incorporated in New Jersey with a capital of $250,000 to construct and operate a lighting and heating plant in Sioux City.

The Fertile (Minn.) Brick and Tile Company proposes to sell its electric-light plant to the village.

M. L. Wahlert proposes to build an electric-light plant at Hardwick, Minn.

The Menominee Mechanical and Electrical Manufacturing Company proposes to erect a new factory at Menominee, Mich.

L. L. Stewart of Omaha, Neb., was granted a franchise to establish an electric-light system at Sumner, Iowa.

The Berggren Electric Company of St. Paul, Minn., has been awarded the contract to install the electric systems at Fort Crook, Neb., and at Fort McKenzie, Wyo. The total cost will be about $35,000.

The Creston (Iowa) Mutual Electric Light, Heat and Power Company has been incorporated with a capital of $50,000. R.

Pacific Slope.

San Francisco, July 21.—The San Francisco Electric Protective Company is installing an extensive burglar-alarm system in the new Shreve Building at the corner of Post Street and Grant Avenue. This building will be occupied by Shreve & Co., manufacturing jewelers, and it is understood that their plant is to be made as thoroughly burglar-proof as possible.

The Portland General Electric Company of Portland, Ore., has placed a blanket mortgage of $10,000,000 on its entire plant to secure a bonded indebtedness of $10,000,000. The proceeds of the bonds will be used for betterments.

The Fortuna Lighting Company of Fortuna, Cal., has let a contract to S. Merritt for the construction of a new sub-station at Loleta, Cal.

Plans have been completed for the installation of an electric-light plant at Cordelia, Cal., to supply Cordelia and the surrounding country. The work is in charge of John P. Emerson, electrical engineer.

A. Brown of Ukiah, Cal., has been granted a franchise to erect poles and string wires along the county roads of Mendocino County from Elk to Gualala.

President C. J. Walker and Engineer E. V. Griffes of the Oceanside Electric Company of Oceanside, Cal., together with a number of directors of the company, have been inspecting a location at Escondido, Cal., with a view of installing an electric-light plant at that place.

The Pescadero Water and Electric Company has been incorporated in San Francisco with a capital stock of $150,000 by G. W. Kaiser, J. R. Kenny, H. N. Baggs, B. F. Kohlberg and R. H. Goodwin.

W. L. Bechtel, manager of the Nevada Light and Power Company of Reno, Nev., is in San Francisco on business.

There is unusual activity in electric circles in San Francisco and there is a great deal of talk of consolidation and other changes. One of the largest houses handling electric machinery is known to be unusually busy, but the reason has not been disclosed. It is reported that the Southern Pacific Railroad Company has secured two valuable electric plants at Reno, Nev., and this, combined with previous reports that the Southern Pacific would take up the development of electric power, has caused a renewal of the talk of competition between the Southern Pacific Railroad Company and the California Gas and Electric Corporation. Negotiations are also supposed to be under way between the latter corporation and the San Francisco Gas and Electric Company which may lead to a consolidation of these two companies. A.

PERSONAL.

F. L. Mowry, superintendent of the Newark and Granville Street Railway Company of Newark, Ohio, has resigned to take a like position at Canton, Ohio. He is succeeded by H. A. Atherton of Newark.

John Otto, who has been in charge of the Long Beach plant of the Edison Electric Company of Los Angeles, Cal., has succeeded E. E. Caister, the district agent and local manager of the same company at Santa Barbara.

Warren Gregg of the Cleveland branch of the Lake Shore Electric Railway Company has been made superintendent of the Lorain street railway, which also operates a branch between Lorain and Elyria, Ohio. He succeeds Edward O'Hara.

W. W. Donaldson, well known to storage-battery men, died at Elk Ridge, Md., last month. Mr. Donaldson was prominent in storage-battery development, and at the time of his death was electrical engineer of the Gould Storage Battery Company of New York. He was an associate member of the American Institute of Electrical Engineers.

H. M. Smith, superintendent of transportation of the Rockford (Ill.) and Interurban Railway Company, has resigned, to take a similar position with the Philadelphia and Western, a new third-rail system between Philadelphia and Lancaster, Pa. Mr. Smith was formerly with the Lake Shore Electric, which operates a line between Cleveland and Toledo, Ohio.

William F. Pfluger of Chicago was among those seriously injured in the boiler explosion on board the United States gunboat Bennington on July 21st in the harbor at San Diego, Cal. Mr. Pfluger,

who was chief electrician of the boat, was 33 years old and was employed as an electrician in Chicago prior to joining the Bennington crew two years ago. His father, Charles A. Pfluger, is also an electrician in Chicago.

Thomas E. Mitten was elected president of the Chicago City Railway Company at a meeting of the directors on July 24th. Mr. Mitten came to the Chicago City railway on March 1st to fill the position of first vice-president. No president was chosen by the directors at that time, and the understanding was that he was to be the operating head of the road. Lawrence A. Young succeeds Mr. Mitten as first vice-president.

George Westinghouse sailed for Europe on July 19th on the Cedric, expecting to be gone three months. Mr. Westinghouse, before leaving, made public a plan which he believes would bring about the desired reforms in the Equitable Life Assurance Society, of the majority stock of which he is one of the trustees. His plan is to put the control of the society in the hands of 5,000 policyholders, and his views are favorably considered by many.

Henry F. McGregor of Houston, Texas, has resigned as vice-president of the Houston Electric Company. He has been with the Houston street-railway company since 1883, most of the time as manager, and during this time it is said of him that he met and successfully overcame more difficulties than any other man with the company. Mr. McGregor was elected president of the Southwestern Gas, Electric and Street Railway Association in 1901. He stands high in the community in which he lives.

Daniel S. Lamont, secretary of war during the second Cleveland administration, died at his summer home, Altamont, near Poughkeepsie, N. Y., of heart failure on July 23d. Mr. Lamont was well known to street-railway men through his connection with the late W. C. Whitney and O. H. Payne, whose surface-railway interests he looked after in New York for a number of years. He favored the consolidation of the lines and was largely responsible for better street-railway conditions in New York. He was also interested in many other large business corporations. Mr. Lamont was 53 years old.

Secretary Thomas R. Mercein of the Northwestern Electrical Association has been appointed by the Milwaukee Bankruptcy Court, at the request of the Wisconsin Trust Company, one of the three appraisers of all the assets of the estate of Frank G. Bigelow. As the Wisconsin Trust Company is trustee for Frank G. Bigelow, bankrupt, this appointment may be considered a compliment to Mr. Mercein's business qualifications. Mr. Mercein, besides having been prominent for years in the executive circles of the Northwestern Electrical Association, is doing a prosperous business in Milwaukee in real estate and investments. He is, too, vice-president and treasurer of the Beaver Dam Illuminating Company.

ELECTRIC LIGHTING.

The Luxora (Ark.) Town Council has granted an electric-light franchise to William and C. B. Wood.

Collins & Shelton have succeeded to the business of the Hubbard Light and Power Company at Hubbard, Texas.

The mortgagee has taken possession of the plant of the Ackley (Iowa) Electric Light, Power and Heating Company.

The local electric-light company of Evanston, Wyo., has applied for a franchise for laying steam pipes to supply heat to business houses.

An election held in Marianna, Fla., to decide as to bonding the town to make improvements, including electric lights, resulted in favor of the improvements.

The new Chicago-Colorado train on the Burlington Route has exceptional lighting facilities. There are said to be 600 electric lights on the train. The company advertises "a light for every passenger."

The city of Fort Gaines, Ga., has granted the Interstate Waterworks and Construction Company of Washington, D. C., a 50-year franchise for the construction of a waterworks and electric-light plant. The work of installing the plant will be commenced at once.

The Pea River Power Company of Elba, Ala., has been incorporated with a capital stock of $400,000 by Charles Henderson, H. D. Boyd, John M. Garrett and others. The object of the corporation is to manufacture electric power for lighting, heating, power and domestic purposes.

The Freeport (Ill.) Railway, Light and Power Company's power house was greatly damaged by a fire a few days ago, and the total loss is estimated at $100,000. The company has been very successful and its electric power has been giving excellent satisfaction among manufacturers and others. Recently announcement was made that the company was about to increase its output by the development of a waterpower and the installation of more machinery. It is hoped the fire will not retard its progress. A. P. Goddard is president of the company and A. J. Goddard, manager.

The Delta Electric Light Company, located along Muddy Creek, in the southern part of York County, Pa., has been purchased by the York Furnace, Pequea and Lancaster Trolley Company. The purchase has doubtless been made with a view of furnishing power for the proposed new trolley extension into York County. It is said that later the plant will be enlarged.

Hydrangeas and geraniums forming a bed of flowers in front of the City Hall in San Francisco have grown much larger than similar flowers in other beds about the city grounds. William Jenning, the gardner, is of the opinion that an arc light burning all night and suspended 10 feet above the first-named bed is responsible for the advanced growth of the flowers.

The city of Kearney, N. J., has spent several months in planning a municipal-lighting plant and had proceeded as far as the receiving of bids for the work and the preparation for an issue of $70,000 bonds; but the state Legislature has on three occasions refused to authorize the bond issue. The Public Service Corporation, against whom the plan was engineered, continues to refuse to reduce its rates for current.

Sealed proposals will be received by the light committee of the council of the borough of South Williamsport, Pa., until August 10th, for lighting the streets, alleys, thoroughfares and parks with the most modern system of electric light all night for periods of one, three and five years from October 1st—bids to state the kind and number of lights to be furnished, the system of lighting, the candlepower and distribution of lights. W. L. Regelman is chairman of the light committee.

The lighting committee of the Dublin (Ireland) corporation issued a report in which it recommended a reduction in the rates for general lighting and for the supply of currents for heating and for motive power. In the case of general lighting the rates are to be reduced on the maximum-demand system from 14 cents and five cents to 12 cents and five cents. For motors and heating currents the rates are to be reduced from 14 cents and two cents to eight cents and two cents, with an alternative flat rate of five cents per unit. The committee is completing an arrangement with one of the large motor manufacturers for the adoption of a system of hire-purchase, under which motors will be supplied at very reasonable rates on the three-year installment plan. It is believed this will satisfactorily affect the demand for power.

ELECTRIC RAILWAYS

Ground has been broken in Clinton, Ill., for the construction of the Chicago, Bloomington and Decatur interurban electric railway.

An extension of the York County Traction Company's York and Windsorville line from Windsorville to Bittersville, Pa. will be made.

Horace E. Andrews of the New York Central-Andrews trolley syndicate, announced in Syracuse, N. Y., that the syndicate had acquired the Rochester and Eastern Rapid Transit Railway, now in operation between Rochester and Geneva, via Canandaigua. The road has 65 miles of trackage.

The Central Kentucky Traction Company of Lexington, Ky., organized recently by local men, has secured a right-of-way and will construct an interurban electric railway from Lexington to Richmond. J. W. Rodes, one of the men interested, says that three or four branches from the main line are contemplated.

It is understood that the commission headed by William J. Wilgus of the New York Central, which is to have charge of the building of the International Tunnel between Detroit and Windsor, has been allowed two years to complete the work. The estimated cost of construction, which will be provided for through the formation of companies subsidiary to the Michigan Central and Canada Southern railroads, is $10,000,000.

The French Westinghouse Company is installing the Westinghouse single-phase electric system on the Bergama-Valle Brembana railway in Italy. The length of the line is 30 kilometers, and it will be served by five 30-ton locomotives equipped with four 75-borsepower Westinghouse single-phase motors, multiple-unit control, and pneumatically operated bow trolleys. The power station will be equipped with three single-phase 500-kilowatt Westinghouse alternators, running at a speed of 500 revolutions per minute.

J. M. Walker, engineer in charge of the construction of the Pennsylvania and Mahoning Valley electric railway of Youngstown, Ohio, has been chosen as engineer-in-chief of the Erie, Cambridge, Union and Corry Railway Company, which will build an electric road from Erie, Pa., to Waterford, with a branch to Cambridge Springs and another to Corry. H. P. Taylor & Co. of Pittsburg have agreed to take $400,000 of the $1,000,000 bonds and with the Knickerbocker Trust Company will finance the road. It will be 40 miles long and will probably cost $900,000.

The Biloxi Electric Railway and Power Company of Biloxi, Miss., has sold its property and holdings to Joseph T. Jones of Gulfport, Miss., for $200,000. The property includes the Biloxi street railways and franchises, the street-lighting contract with the city of Biloxi, the commercial lighting plant of Biloxi and Ocean Springs, together with power plant, cars, etc. The present company will hold the property until October, when it will be turned over to the Gulf Coast Traction Company, of which Mr. Jones is the principal owner. The stockholders of the Biloxi Electric Railway and Power Company realized about 100 per cent. on the amount they had invested and six per cent. annually besides in dividends. The railway will be extended to Gulfport and beyond.

The Nicaragua Finance and Investment Company, a California corporation, which has received concessions from the Nicaragua government for the construction of a large system of railroads about Sabana Grande, Matagalpa, Jinoega and other towns, has an additional concession which gives it the exclusive right to construct an electric railway from Managua, or Masaya, to Tipitapa, with suburban connections. Tipitapa is now connected with Managua by a regular steamboat service on Lake Managua, and, as the entire district has not more than 1,500 inhabitants, and Managua and Masaya have comparatively no suburbs, it is thought that the company intends to attract foreign immigrants to Central America from whom to derive its income. The company has the privilege of generating electricity for use on its railways from the Tipitapa Falls, located on Tipitapa River, whose outlet discharges the waters of Lake Managua into Lake Nicaragua.

PUBLICATIONS.

Gas and Electricity is the name of a neat house organ published monthly by the San Francisco Gas and Electric Company. A copy of the paper is furnished free to each customer. The current issue contains interesting instruction and information to customers on the twin subjects—gas and electricity.

Small generators arranged for direct-current connection are described in the latest bulletin of the Crocker-Wheeler Company of Ampere, N. J. These generators are built to meet the demand for small, direct-connected steam or gas-engine-driven generators for isolated plants or private residences. These machines have an armature which is mounted on a short shaft, the outer end of which is carried by an outboard pedestal upon which is also mounted the brush rigging.

In his presidential address to the Iron and Steel Institute of Great Britain, R. A. Hadfield of Sheffield, England, said: "We often wonder at the marvels of daily journalism, but to me they do not seem to compare with the work done by the technical press, where the matter must be correct and exact. The daily press, however essential to our well-being, does work of a more or less ephemeral nature; that of the technical papers is of a lasting description."

The H. W. Johns-Manville Company of New York has issued a very complete catalogue upon 1,500-10,000-volt fuse devices containing 82 pages of descriptive matter relating to this class of apparatus, besides a general and a code-word index. In this book the well-known Noark enclosed fuses and fuse devices are fully illustrated and described. The 1,500-10,000-volt catalogue is one of a series of three, the other two being devoted to 250 and 600-volt devices. The three books when combined will cover a complete line of fuse devices, suitable for all voltages. Each particular device is illustrated upon one page, either by half-tone illustrations or drawings, on the same page being given also the code word, catalogue number, dimensions, list price, etc. On the opposite page is a general description of the device. This arrangement is at once compact and convenient for the buyer.

W. H. Schott of Chicago, whose work in the design of central-station heating plants is well known, issues from time to time advertising literature which may always be looked forward to as interesting and of an original kind. His latest production in this line is a handsome booklet entitled "Eternal Summer," which sets forth, in the testimony of some of his numerous satisfied patrons, the reasons why the Schott system of heating deserves to be looked upon as a blessing during the cold months of the year. The Citizens' Mutual Heating Company of Terre Haute, Ind., after much experimenting, adopted the Schott system for its plant, which is ultimately to handle 400,000 square feet of radiation. The booklet contains the testimonials of about 20 of the leading men of Terre Haute, who are patrons of this company, together with pictures showing their handsome residences, which are connected to the system. The booklet is finely printed, and the many handsome pictures add much to its interest.

SPACE TELEGRAPHY.

Captain Gearing of the equipment department of the Mare Island navy yard and Master Electrician George Hanscom have left San Francisco for the North to locate the remainder of the cities for the installation of wireless-telegraph stations along the Pacific Coast. A location will be selected either at Cape Flattery or Neah Bay, and another will be located at Bremerton, Wash.

The Board of Trade and the Trinity House in London have concluded a contract with the Marconi Wireless Telegraph Company providing for the equipment of lightships with space-telegraph installations. This arrangement will enable the lightships to communicate with the shore and with one another by space telegraphy for the ordinary purposes of the lightship service and also to report ships in distress.

The government is preparing to install a space-telegraph system throughout the Lower Yukon country to replace the land lines that have proved a failure to a large extent, owing to forest fires, floods, cold weather and other obstacles. Captain Wildman, the government wireless expert, is now on the Yukon, experimenting between Fort Gibson and Nome. He installed a wireless apparatus on the steamer Susie and was in constant communication with St. Michael's on the trip up the river to Fort Gibbon, and St. Michael's in turn was connected with Nome.

MISCELLANEOUS.

The New Orleans (La.) Railway and Light Company has been incorporated with a capital stock of $30,000,000 to operate electric-light and power plants. George Hero is president and William E. Stauffer vice-president.

The Western Union and the Postal telegraph companies will have all of their wires in Grand Rapids, Mich., underground this summer. The Postal company is arranging to bring all of its wires into the city from one direction instead of entering at four points as now.

The Minneapolis General Electric Company has secured a right-of-way from St. Croix Falls, Wis., to St. Anthony Park, where a transformer station will be erected from which the current will be sent to both Minneapolis and St. Paul. Work is progressing rapidly on the company's power plant and dam at Taylors Falls, Minn., and unless plans miscarry, the plant will be in operation by March 1, 1906.

The Illinois and Missouri Tunnel Company has been formed and has for its object the building of a tubular steel tunnel 50 feet below the Mississippi River, between St. Louis and East St. Louis, for handling street-railway and other traffic. The incorporators are E. L. Thomas, G. K. Thomas and John T. Taylor. G. K. Thomas of Belleville, Ill., is county clerk of St. Clair County, Ill.

At the Rockefeller estate in Cleveland Superintendent D. E. Howatt has devised a simple method of ridding the place of all kinds of bugs, moths and insects. Kerosene is placed in a pan under an electric light. The insects have a habit of ducking when they strike an arc light. They fall into the pan of kerosene and that is the last of them. Many kinds of insects which destroy foliage may be caught in this manner, it is said.

On July 8th Sir Joseph Wilson Swan, F. R. S., opened the new Electrotechnical Laboratory at Liverpool University. Sir Joseph delivered an interesting address upon the growth and development of electrotechnical science in Great Britain from the early days of Davy and Faraday down to the present date. The general plan of the new laboratory is simple. All rooms required for experimenting with heavy machinery are placed at the back of the site. The basement on the frontage is set apart for electrical measurements and for purposes of research. The rooms for standards and for meter testing, where the highest degree of accuracy is required, are placed at the end of the building, remote from the dynamos and their vibration. The chair of electrotechnics at Liverpool University, toward the endowment of which Mr. David Jardine gave £10,000 in the year 1903, is filled by Prof. Marchant.

TRADE NEWS.

The American Acid and Alkali Company of Bradford, Pa., is in the market for the following second-hand machinery: One 110-120-kilowatt, 200-220-volt, two-phase, alternating-current generator, direct connected to either a steam or gas engine, preferably the latter.

The Vandalia (Mo.) Union Switchboard Company has been incorporated with a capital stock of $3,000.

The Hibbing Electric Light and Water Company of Duluth, Minn., has changed its name to the Crowley Electric Company. Besides developing electricity for light and power purposes and furnishing water the company will deal in electrical supplies. D. D. Crowley is president and H. A. Liedel, secretary.

Arrangements have been made by G. W. Hill of Monmouth, Ill., for the opening in Monmouth of a branch of the Electric Construction and Machinery Company of Rock Island, Ill. The electric company handles electrical supplies and electrical machinery for all purposes, and makes a specialty of complete factory and building equipment for light, power and telephone service.

It is reported that E. C. Hennis of Sandwich, Ill., has purchased the property of the Illinois Electric Specialty Company of 177 South Canal Street, Chicago, and has moved it to Sandwich, where the recently organized Sandwich Pole-changer Company is to continue the manufacture of telephone apparatus, pole-changers, current-measuring instruments, etc. John Shaw of Chicago, it is said, will have charge of the plant.

Proposals will be received by the South Park commissioners at their office, Fifty-seventh Street and Cottage Grove Avenue, Chicago, until July 31st for the furnishing of 550 or more alternating-current series enclosed arc lamps, and to constant-current transformers or transformers and regulators, with switchboard appurtenances. Specifications and other information may be obtained at the above address. E. G. Shumway is secretary.

BUSINESS.

The St. Louis Expanded Metal Fireproofing Company has issued a folder which contains an extract from the proceedings of the International Railway Congress which goes to show that corrugated steel bars are the most efficient to use in reinforced concrete work. The St. Louis company is general agent for this material.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) July 18, 1905.

794,707. Mercury Pump. Stanwood E. Flichtner, Englewood, N. J., assignor to the Cooper Hewitt Electric Company, New York, N. Y. Application filed October 23, 1902.

The apparatus includes a mercury pump, a mercury reservoir, a mercury circuit and a fall tube included in the circuit. The fall tube is detachable and has four different diameters at different portions of its length, the uppermost diameter being comparatively large, the two next diameters being successively shortened and the lowermost diameter being larger than the contracted portion.

794,727. Controlling Mechanism for Explosive Engines. Joseph F. Merkel, Milwaukee, Wis., assignor to the Merkel Motor Company, Milwaukee, Wis. Application filed February 8, 1902.

A circuit-interrupter consists of a relatively fixed contact piece, a number of contact levers or arms, means tending to hold the levers in engagement with the contact piece, and automatic means for intermittently separating the levers at certain intervals from the contact piece.

794,745. Automatic Starter for Vapor Apparatus. Max von Recklinghausen, London, England, assignor to the Cooper Hewitt Electric Company, New York, N. Y. Application filed December 13, 1904.

The vapor device comprises a movable container and normally separated electrodes in the container and included in the main operating circuit of the device. One of the electrodes is a conducting liquid, and automatic means move the container so as to make and break conductive connection between the electrodes. (See cut.)

794,768. Electrically Operated Keeper Plate for Door Locks. August Arens and Ernest L. Teich, New Britain, Conn., assignors to P. & F. Corbin, New Britain, Conn. Application filed February 20, 1905.

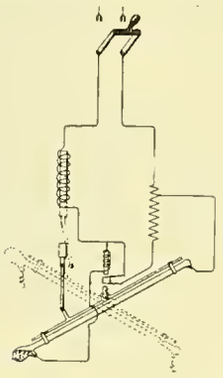
The armature of an electromagnet imparts a hammer blow to the tripping device of the keeper.

794,784. Block-signaling System. Harry M. Coulter, Chicago, Ill. Application filed September 5, 1903.

In a railway block-signaling system are a series of blocks, two signal-controlling devices, each in a separate block and two signal-conveying paths, each path being adapted to convey signals to a different block in a forward direction. Two other signal-conveying paths are adapted to convey signals to a different block in a backward direction. The actuation of the first signal controlling device serves to establish one condition in the first path in the forward direction and in the first path in the backward direction, and another condition in the second path in the forward direction and in the second path in the backward direction. The actuation of the second signal controlling device serves to establish the second condition in the first path in either direction.

794,788. Shield and Support for X-ray Tubes. Leavitt E. Custer, Dayton, Ohio, and David H. Allen, Miamisburg, Ohio; said Custer assignor to said Allen. Application filed April 6, 1903.

The apparatus comprises a stand, an arm journaled on the stand and a shield having a light orifice, supported on the arm.



NO. 794,745.—AUTOMATIC STARTER FOR VAPOR LAMPS.

794,790. Intercommunicating Telephone System. Albert S. De Veau, New York, and Charles Auth, Brooklyn, N. Y. Application filed September 2, 1902.

There is a line common to all of the stations and a home line for each station. Contact-making devices at each station are adapted to complete a talking-circuit to one of the other stations through the home line of such other station and the common line. Additional contact devices at any two stations, which have been connected by the operation of one of the contact devices first mentioned, control the connections of the stations so as to open the connection with the common line and to close connection with the home line of the calling-station and thereby complete a talking-circuit restricted to the two stations.

794,792. Double Controller. Charles I. Earll, New York, N. Y., assignor to the Crocker-Wheeler Company, Ampere, N. J. Application filed April 20, 1903.

The double controller possesses movable contact supporting members, means for locking the members to cause them to move simultaneously and means for automatically disengaging the locking means at a predetermined point.

794,820. Automatic Rheostat. Carson J. Sturgeon, Erie, Pa., assignor to the Federal Electric Company, Erie, Pa. Application filed February 4, 1904.

Combined with a solenoid are series and shunt coils on the rheostat, also lever and brush mechanism in circuit with the series coils, operated in one direction by the solenoid. Mechanism operating automatically cuts the shunt coils out of circuit as the lever and brush mechanism nears the end of its traverse in one direction, and automatically closes the shunt circuit as the lever and brush mechanism reaches the end of its traverse in the opposite direction.

794,839. Electric Arc Lamp. Malcolm H. Baker, New York, N. Y., and Samuel P. Wilbur, Wilkinsburg, Pa., assignors to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed January 10, 1903.

In an electric-arc lamp is a pair of concentrically arranged electrodes in combination with means for limiting the chamber space between the two electrodes near the ends and thereby confine the circulation of air in proximity to the arc. (See cut on next page.)

794,853. Automatic Furnace Feeder. Henry G. Cox, Indianapolis, Ind. Application filed November 14, 1903.

A number of swinging partitions divide the fuel chute into compartments respectively adapted to receive charges of fuel. A latching mechanism holds each of the partitions closed and an electrical apparatus trips the latching mechanism. Each latching mechanism except the last is provided with a contact member which as the mechanism is operated serves to form part of an electrical circuit to the next.

749,864. Electric Battery. Pierre J. Kamperdyk, New York, N. Y. Application filed April 2, 1904.

A porous cup for a primary battery, has its wall formed of carbon and adapted to contain a carbon electrode and a depolarizing agent. A series of wires, embedded in the wall, serves to strengthen the latter and increase its conductivity, the wall serving as part of the positive-pole electrode of the battery.

794,868. Vapor Electric Lamp. Richard Küch, Hanau, Germany, assignor to the firm of W. C. Heraeus, Hanau, Germany. Application filed November 17, 1904.

In a gas or vapor electric lamp are two electrode vessels containing mercury, an illuminating tube connecting the two electrode vessels, and means for passing an electric current through the whole; the two electrode vessels are so proportioned with reference to the size and cross-section of the illuminating tube as to preserve the mercury at a desired low temperature and in accordance with the given characteristic curve of the lamp.

794,871. Device for Increasing the Adhesion Between Wheels and Rails. Robert C. Lowry, Seattle, Wash. Application filed October 19, 1904.

Powerful electromagnets connected to the brake mechanism increase the adhesion.

794,886. Support for Dynamos. Willard F. Richards, Buffalo, N. Y., assignor to the Gould Coupler Company, New York, N. Y. Application filed September 27, 1904.

A pivotal connection between the dynamo and its support is capable of vertical movement on the support.

794,902. Arc-light Electrode. Friedrich O. Vogel, Berlin, Germany. Application filed July 6, 1903.

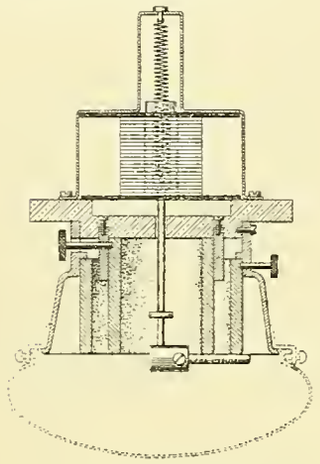
An arc-light electrode has a body containing carbon and a light-emitting substance, the body being provided with a channel in which is located a material capable of evolving free oxygen only when subjected to heat.

794,909. Apparatus for Delivering Mail. Gustav Wolf, New York, N. Y., assignor to Golla Condory, New York, N. Y. Application filed December 23, 1904.

An elevating apparatus for handling mail is operated by an electric motor. A counter weight acts to reverse the motor.

794,924. Application of Electric Lights to Revolvers or Other Firearms. Eugène C. I. Cailliez, Lens, France. Application filed January 6, 1904.

A battery carried in the handle of a revolver furnishes current, upon pressing a button, to a small incandescent lamp located beneath the barrel.



NO. 794,839.—ARC LAMP.

794,935. Electric Switch. Monroe Guett, Hartford, Conn., assignor to the Hart & Hegeman Manufacturing Company, Hartford, Conn. Application filed November 1, 1904.

In an electric switch an oscillating spindle is loosely mounted in the base. A rack having a push button, a pinion secured to the spindle and meshing with the rack, poles, and driving connections between the pinion and the poles are the other features.

794,962. Massaging Implement. Harry F. Waite, New York, N. Y. Application filed January 25, 1905.

The massager is operated by a small electric motor contained in the handle, the whole adapted to be screwed into an ordinary receptacle.

794,964. Attachment for Trolley Poles. Paul H. White, Indianapolis, Ind., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 24, 1903.

An attachment for trolley poles consists of a clip transversely wider at its middle than at the ends. The clip is provided at one end with means for attaching to a trolley-pole, and at the other end adapted to have the retriever rope attached.

794,967. Telephone Support. Edward P. Baird, Evanston, Ill., assignor to the Baird Manufacturing Company, Chicago, Ill. Application filed December 19, 1904.

A hinged transmitter arm is described.

794,981. Time-limit Controller for Circuit-breakers. Edward M. Hewlett, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 22, 1903.

Associated with a number of electroresponsive devices governing different line wires, each device provided with a clutch, are a trip device common to all of the devices in operative relation to the clutch and circuit-breakers for the several line wires governed by the trip device to open the breakers separately or collectively.

794,983. Rheostat. John W. Howell, Newark, N. J., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 23, 1903.

A resistance and means for closing a single circuit or a number of parallel circuits through the resistance, and for varying the resistance of the single circuit or one of the parallel circuits, are the essential features of the rheostat.

794,985. Electrical Fuse. Frank G. Jones, Chicago, Ill. Application filed November 17, 1904.

In a fuse for protecting electrical circuits are a pair of insulating strips, a fuse wire placed between the strips, and conducting-pieces at each end of the strips binding the strips together and forming terminals for the fuse wire.

794,991. Motor Control System. John B. Linn, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 11, 1901.

Several separately actuated contacts are operatively related to a circuit to be controlled. Means are provided for securing a certain time interval between the operation of the successive contacts without interfering with the free operation of the individual contacts.

794,995. Alternating-current Motor. Maurice Milch, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 21, 1903.

The machine comprises a single-phase primary member, a secondary member having its winding connected to a commutator, commutator brushes and short circuiting connections, polyphase cross connections for the rotor winding, and impedances inserted in the cross connections.

794,998. Dynamo-electric Machine. Frederick A. Mott, Erie, Pa. Application filed November 27, 1903.

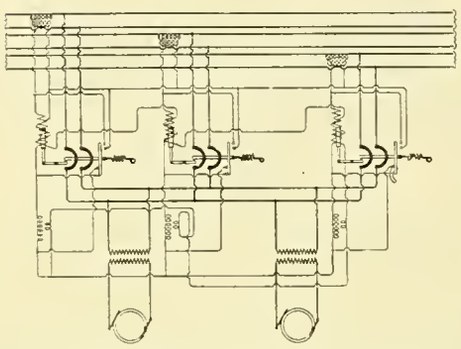
Combined with an armature, are a field comprising a two-part pole piece, the parts being separated by paths of high reluctance, windings for exciting the pole piece and means for varying the current in the windings on one of the parts independently of the windings on the other of the parts.

795,000. Motor-control System. William O. Mundy, St. Louis, Mo., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 20, 1903.

A number of separately actuated contacts form part of the controller for the motor in the circuit, and electromagnetic means operate the contacts. The contacts are mounted upon a single frame forming part of the motor circuit and also part of the magnetic circuit of the electromagnetic means for operating the contacts.

795,016. Trolley Ear. Montraville M. Wood, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed January 15, 1902.

Combined with a retaining member are two like clamping members movable longitudinally of the retaining member into operative engagement with the wire supported thereby.



NO. 795,182.—PROTECTIVE SYSTEM FOR PARALLEL LINES.

795,024. Pneumatic System of Motor Control. Frank E. Case, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 5, 1902.

A series-parallel controller comprises separate reversing and controlling switches, pneumatic means for actuating the switches of the controller, two train-pipes connected with the actuating means, and means for admitting compressed fluid at substantially a constant pressure to the train pipes to operate the switches to give either the series or the parallel position of the controller in either the forward or the reversed direction of movement of the car.

795,067. Plug and Receptacle. Howard R. Sargent, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 17, 1903.

An attaching plug comprise a base of insulating material having at one end two surfaces on opposite sides of its axis in parallel transverse planes. Metallic contacts are secured to the surfaces and electrical conducting means extend through the base to the contacts.

795,072. Cut-out for Telephones. Martin L. Smith, Rutledge, Mo., assignor of one-half to Sherman C. Forguer, Rutledge, Mo. Application filed June 7, 1904.

In an electrical cut-out is a pair of contacts, one of which is movable toward and from the other. A pivotally mounted frame include a pair of parallel arms and a cross-bar, a sheet of insulating material being carried by the cross-bar. Means connect the arms to the movable contact to move the insulating sheet between the two contacts as the latter are separated.

795,112. Safety Device for Elevators. Robert H. Gaylord, Pasadena, Cal. Application filed February 11, 1905.

Magnetically operated means indicate the locked or unlocked condition of the controller of the cage which is also locked by an electromagnetic device.

795,131. Electric-light Fitting. John G. Irving, Nottingham, England. Application filed August 26, 1904.

The supporting device and other details of an electric lamp hanger are described.

795,137. Safety Signal System. Frank V. King, Winslow, Ariz. Application filed December 14, 1904.

In the signal device are a battery, adjustable indicator points connected in series to the battery, a traveling closure arm connected to the other side of the battery, the indicator points being adapted to be moved so as to be engaged by the closure arm upon its travel, a signal in the circuit and means to move the closure arm.

795,170. Electric Brake. William G. Price, Pittsburg, Pa. Application filed August 17, 1904.

A braking mechanism consists of a braking spring, an electric motor for compressing the spring and relieving the brakes and a solenoid operable for holding the motor at various points of its operation.

795,176. Fire Apparatus. Sven A. A. Stenberg, San Francisco, Cal., assignor of 49 one-hundredths to William E. Cumback, San Francisco, Cal. Application filed May 26, 1903.

The fire apparatus described in the patent comprises a fire hydrant having a standpipe connected with the water-main and a casing fixed on the hydrant. An electric motor in the casing operates a pump, the pipe connection leading to the suction of the pump. A dome mounted on the casing has its inlet connected with the discharge or outlet of the pump, the dome having coupling members for engagement by coupling members of the fire hose.

795,182. Protective System for Parallel Lines. Leonard Wilson, Pittsfield, Mass., assignor to the Stanley Electric Manufacturing Company, Pittsfield, Mass. Application filed November 20, 1903.

Combined with a number of parallel transmission lines are a differential device for each line energized by the current in that line and by the sum of the currents in all the lines, and a switch in the circuit of each line and arranged to be operated by the device upon an unbalancing of the opposing forces in the device. (See cut.)

795,197. Self-soldering Protective Apparatus. Frank B. Cook, Chicago, Ill. Application filed December 20, 1904.

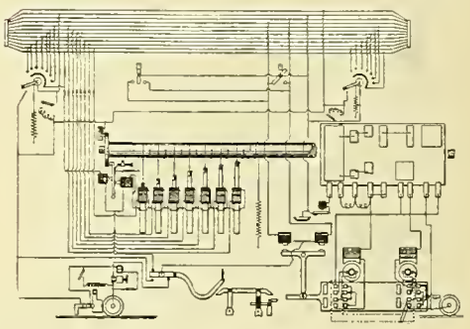
A ground plate carries spring members, a heat coil being suitably mounted on one spring member and normally engaged by another.

795,201. Electrically Heated Handhold. Fred S. Davis, Robertsville, S. C. Application filed December 29, 1904.

The invention is applied to handles of any kind which become too cold to hold comfortably. It consists in putting an incandescent lamp in a chamber within the handle, and feeding current from a battery to the lamp.

795,207. Magnetic Brake. Arthur C. Eastwood, Cleveland, Ohio. Application filed May 2, 1905.

The brake includes a frame supporting a number of bolts, a set of friction plates on the bolts, a shaft, a second set of friction plates connected to the shaft, electromagnetic means for pressing together the two sets of plates and means for releasing the plates.



NO. 795,243.—RAILWAY-BRAKE APPARATUS.

795,235. Electrical Switch and Operating Mechanism Therefor. Willard F. Richards, Buffalo, and William A. Turbayne, Lancaster, N. Y., assignors to Charles M. Gould, New York, N. Y. Application filed April 9, 1904.

Combined with a slide are a reciprocating operating bar for the slide, a single double-nosed pawl connected to the slide, and electrically controlled mechanism for shifting the pawl in one direction to engage one portion of the bar to move the slide in one direction, and for shifting the pawl in the opposite direction to engage another portion of the bar to move the slide in the opposite direction.

795,243. Railway-brake Apparatus. Granville T. Woods and Lyates Woods, New York, N. Y., assignors to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Original application filed December 31, 1902. Divided and this application filed April 10, 1903.

Railway-brake apparatus comprises a controller having contacts fixed upon a common support and adapted to move therewith. Electromagnetic devices are adapted to be actuated in sequence and independently of each other, the armature of each of the electromagnetic devices being connected to the movable support and adapted when the appropriate electromagnetic device is operated to move the support to a predetermined position and to release the armature of the succeeding electromagnet into operative position. (See cut.)

795,247. Current-collecting Shoe. William M. Brown, Johnstown, Pa., assignor to the Lorain Steel Company. Application filed January 26, 1903.

Details are described.

EXPIRING PATENTS.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on July 24, 1905:

386,463. Electric Valve Controller. E. Grah, Toledo, Ohio.
386,512. Electric Railway Car. E. Verstrartr, Chicago, Ill.
386,541. Railway Signal Circuit-breaker. E. B. Ives, New York, N. Y.
386,543. Compound Electromotor for Electric Railways. A. J. Jarman, London, England.
386,580. Storage Battery. J. A. Enos, Boston, Mass.
386,581. Current Receiver for Electric-railway Cars. J. A. Enos, Boston, Mass.
386,597. Electrical Call System. J. C. McLaughlin, Kansas City, Mo.
386,602. Electric Governor. H. W. Parsons and J. Hoduit, Wamago, Kan.
386,646. Electrical Typewriter. J. F. McLaughlin, Philadelphia, Pa.
386,729. Telegraph Key. L. Townsend and J. E. Auten, Evansville, Ind.
386,754. Electromedical Apparatus. J. S. Muir. San Francisco, Cal.
386,767. Watchman's Electric Time Recorder. G. F. Bulen, Brooklyn, N. Y.
386,772. Electric Signal or Alarm. E. Davis, Cambridge, Mass.
386,775. Dynamo-Electric Machine. W. Fritsche, Berlin, Germany.
386,784. Overhead Wire Connection for Electric Railways. W. H. Knight, New York, N. Y.

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Electrical Equipment of a Modern Malt House.

Processes employed in the production of malt have undergone many changes, and in the evolution of the modern pneumatic system from the old system of cellar malting, in which dark cellars were utilized to sprout the grain, methods and means of various kinds have been devised, used and then thrown aside to give way to new ways of stimulating nature's action and at the same time improving the quality of the product.

An example of a modern malt house is that of the Winona Malting Company of Winona, Minn. This is a new plant, equipped with the Saladin system and operated throughout by electric power. In connection with the malt house is an elevator having a capacity of 350,000 bushels of grain.

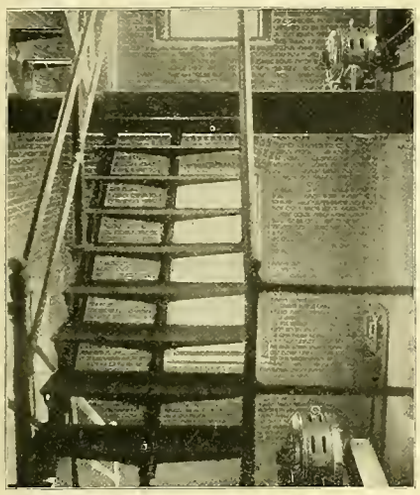

Fig. 1. Compact Motor Installations.

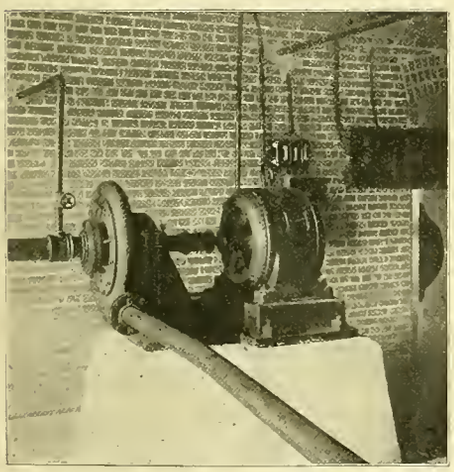

Fig. 3. Motor Operating Barley Circulating Pump.

The plant has an annual malting capacity of 1,000,000 bushels. Without going into the details of malt production, it will be of interest to describe the manner in which electricity is made to play the important part which it does in the working of the plant.

Fig. 2 is a general view of the plant. To the left in the foreground is to be seen the power house. On the right are the 12 steel storage bins, together with the working part of the elevator just behind them. These bins are 20 feet in diameter and are supplied with hopper bottoms. To the left, in the rear of the picture, is to be seen the malt house proper.

Malt, as a product, consists of barley or other grain steeped in water and allowed to germinate until the saccharine principle has been evolved, and then dried in a kiln ready for storage or shipment. It is used in the brewing of fermented beverages, such as beer, and also in the distillation of whisky. In the plant here described the grain is first run into large steeping tanks, each having a capacity of 2,000 bushels, the grain being delivered direct from the elevator by conveyors. After steeping, the grain is delivered to the growing compartments of the germinating house, where the Saladin system of pneumatic malting is used. Each compartment is 12 feet wide by 103 feet long, provided with machines for turning the malt, and also with machinery for unloading the compartments. Fresh air for the germinating rooms is driven by an exhaust fan through an attemperator room, where it is washed and made just the right temperature to assist nature in the germination process. The green malt, when germination has proceeded to the proper stage, is handled by special conveyors to the drying kilns, where it is dried ready for the market.

Fig. 2. View of Power Plant, Elevator and Malt House.

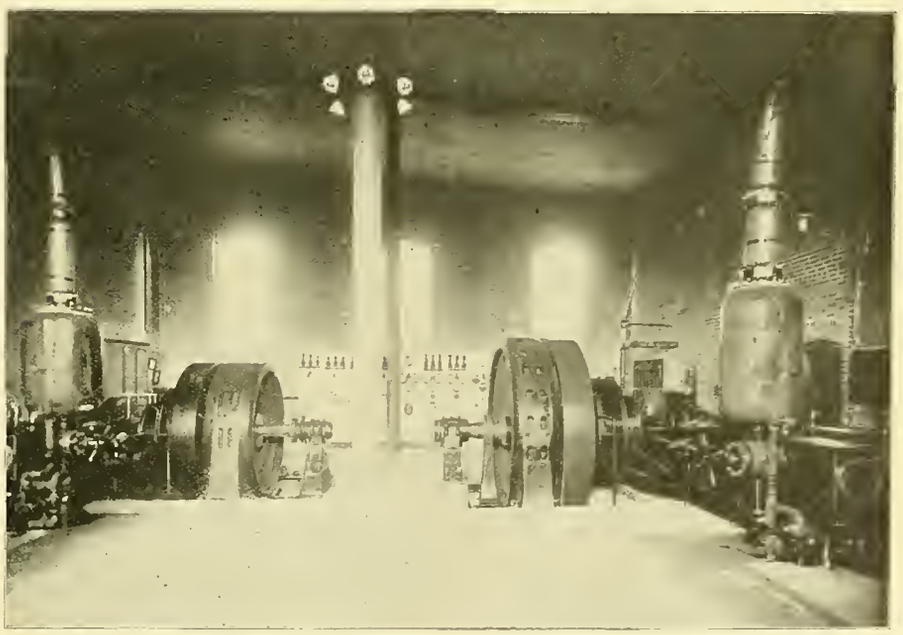

Fig. 4. Generator Room, Showing Three-phase Generators.

ELECTRICAL EQUIPMENT OF A MODERN MALT HOUSE.

From the above brief description of the process of malting it readily will be seen that a considerable amount of power is necessary in handling the grain from the time it passes into the elevators until it is shipped as malt. In the plant of the Winona company everything has been adopted that can in any way reduce the item of labor, and as a consequence an electrical installation of considerable magnitude is one of the interesting features.

A 200-volt three-phase system is employed, the current being generated by two units in the generator room of the power house, shown in Fig. 4. The generators have an aggregate capacity of 335 kilowatts and are direct-connected to Buckeye non-condensing single-cylinder engines. The alternators are separately excited by two exciter sets, one driven by an induction motor and the other by a marine-type steam engine. These may be operated separately or in parallel. The switchboard is constructed of white Italian marble and consists of eight panels provided with the necessary switches and instruments for all the power and lighting service. Westinghouse automatic circuit-breakers on the board protect each circuit as well as each generator.

The boiler room adjoins the engine room and contains two Stirling water-tube 200-horsepower boilers equipped with McClave-Brooks rocking grates. The furnaces are connected to the brick stack, which is shown in Fig. 2, and which is 130 feet in height. The steam-piping system is arranged to furnish quick and easy interchange of supply in case of accident. Coal is brought to the plant over elevated tracks, which allows it to be handled with a minimum amount of labor.

For the operation of the elevator machinery 10 induction motors are used, ranging in size from five to 30 horsepower and aggregating 165 horsepower. These are so arranged that every portion of the elevator machinery may be operated independently. Throughout the malt house the same segregation of units is adhered to as in the elevator. Here are located 12 induction motors of from one-half to 50 horsepower, aggregating 193½ horsepower. Fig. 3 shows a 10-horsepower motor operating a barley circulating pump. This pump is used in order to accelerate the loading of the different compartments. It consists of a centrifugal pump direct-driven by the motor and is connected to the piping system which conveys the steeped barley. The pump acts as a "pusher" and sends the barley through more rapidly than would gravity alone. The whole installation is compactly installed on a substantial concrete foundation.

Fig. 1 is an illustration showing two compact and easily accessible motor installations on two different floors. The motors are all supplied from a system of feeders designed in such a way as to secure as far as possible immunity from shut-downs.

The grounds and buildings are all lighted from the power plant. All the lighting as well as the motor circuits are protected by fuses mounted on slate boards enclosed in iron casings. Oil-tight compensators are used for the control of the induction motors, and all conductors for the lighting and power circuits are enclosed in iron-pipe conduit, which is practically continuous from the switchboard to the motors or lights.

All the electrical machinery, including the generators, exciters and motors, was supplied by the General Electric Company. Charles A. Chapman.

consulting engineer of Chicago, had in charge the design of the power plant and electrical equipment. The officers of the Winona Malting Company are: President, Fred F. Bullen; vice-president, W. J. Head; secretary, A. F. Bullen; treasurer, H. E. Blair.

Electric Wave Detectors.

By D. McNicol.

In the early days of wireless telegraphy (seven or eight years ago) the "filings" coherer was the only form of electric-wave detector in use, and although that instrument is still used there have been invented several different detectors, the satisfactory working of which has made possible the present extensive application of wireless telegraphy to commercial requirements. The success already attained indicates that a little further development along certain lines will result in making wireless operation of very great service to mankind.

Fig. 1 shows a diagrammatic view of the original Marconi filings coherer, the principle of which is quite generally understood. The principal advantage in using this type of detector is that it permits of the operation of a regular Morse sounder or register in the receiving circuit. The most evident objection to its use is that restoration or decoherence is accomplished by mechanical means altogether too sluggish for the rapid receiving of messages.

In Fig. 2 is shown a novel form of coherer where two filings chambers are connected in multiple in one glass tube. This arrangement doubles the responsive capability of the detector, while

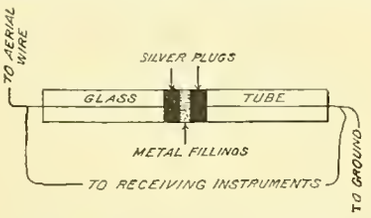

FIG. 1. ORIGINAL MARCONI FILINGS COHERER.

subjecting it to the restoring jar of but one decohering tapper.

During recent years it has been the aim of wireless-telegraph engineers to devise a wave detector which will decohere automatically—in other words, a receiver which will respond only during the passing of a wave and cease action of itself when the wave has ceased. This has been accomplished by several different methods, but as a result in most cases the audible sounder and the registering tape have had to be dispensed with and a sensitive microphone substituted. By this means signals are received as sharp clicks in the telephone, which is placed close to the ear of the operator. On account of its marvelous sensitiveness the telephone receiver makes a very satisfactory and reliable substitute for the Morse sounder. A well-made telephone receiver requires

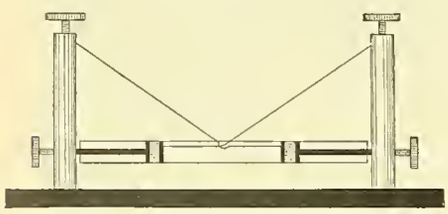

FIG. 2. COHERER WITH TWO FILINGS CHAMBERS.

but 0.00000000003 watt or 0.000000044 ampere to make a clearly audible signal.

Prof. Popoff of Russia was granted a United States patent in March, 1903, on what he described as a "self-decohering coherer." As opening the way to the consideration of the latest types of self-decohering detectors the Popoff invention is worthy of mention, inasmuch as it was simply a modification of the original glass-tube filings coherer. As arranged by Popoff, the end electrodes of the coherer tube each contain a metallic pin, one being placed above and the other below the axis of the tube, but slightly separated. There are three insulating partitions, one at the end of each pin and the third midway between. The chambers thus formed are filled with steel filings, having their surfaces of various degrees of oxidation. When properly constructed this coherer requires no tapping to restore the high-resistance state.

In 1898-99 Neugschwender and Aschkinass, German physicists, conducted a series of experiments dealing with the effects of Hertz radiation upon electrolytic action. In the latter year Dr. Lee De Forest in America experimented along similar lines which resulted in the development of a detector, or, as it is called, a "responder," which has given very gratifying results over both short and long distances, and has done much to build up con-

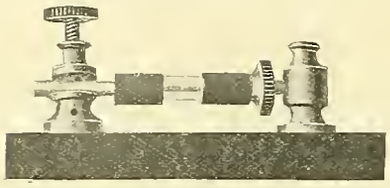

FIG. 3. ORIGINAL DE FOREST RESPONDER.

dence in the feasibility of wireless telegraphy for commercial purposes.

In explanation of the underlying principle of this device it may be best to refer to the original experiment of Neugschwender. The silver plating on the back of a small glass mirror was cut with a keen-edged knife into two sections. Thus, an almost invisible insulating slit separated the two silver sheets. An electric circuit was then made connecting a dry cell, a telephone receiver and a galvanometer in series through the separated silver sections. Of course the circuit thus arranged stood open, but when a film of moisture or drop of

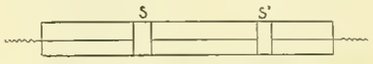

FIG. 4. DIAGRAM OF ORIGINAL DE FOREST RESPONDER.

water was placed on the insulating slit the galvanometer needle was deflected and the telephone receiver gave out a click. This action, however, was gradual, the galvanometer needle being violently agitated for a few moments before coming to rest and the telephone giving a scratching sound for a moment before indicating a closed circuit. With the circuit still closed, Hertz waves generated within range were found to disrupt the electrolytic path, or bridge, formed between the edges of the silver, and indications of the galvanometer and telephone showed that the circuit was thereby opened. But upon cessation of the

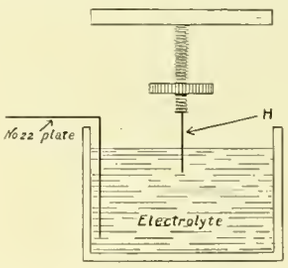

FIG. 5. THEORETICAL FORM OF ELECTROLYTIC RESPONDER.

Hertz wave impulse the circuit again became closed.

Fig. 3 shows a general view of the original responder used in actual practice.

Fig. 4 is a diagrammatic view of the same device. The spaces (S) and (S') are each of one-sixteenth-inch section and filled with a sensitive compound consisting of coarse metallic filings and oxide of lead in equal parts and made into a paste by the addition of glycerine or vaseline with a trace of water or alcohol. The action is essentially of an electrolytic character, current

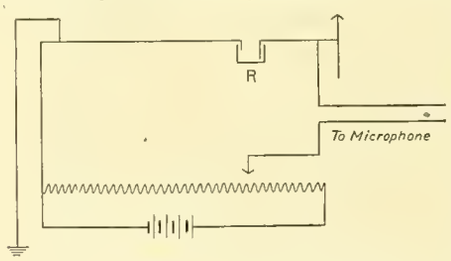

FIG. 6. ELECTROLYTIC RESPONDER IN RECEIVING CIRCUIT.

action from the local battery detaching minute particles from the positive electrode and carrying them across the gap to the negative electrode, thereby building up a conducting path, reducing the resistance of the local circuit. The disruption of these minute conducting threads by impinging electric waves allows the current from the battery to affect the microphone with the characteristic signal click.

Dr. Ives, collaborator with Dr. De Forest, shows a theoretical form of this electrolytic cell as in Fig. 5, and its relation to the receiving circuit is shown at (R) in Fig. 6. The diameter of the holinum wire shown at (H) in Fig. 5 is 0.000038 inch, and the electrolyte giving the best results is a solution of the alkaline salts.

The detector used by Prof. Reginald Fessenden in the system of wireless telegraphy which bears his name is called by him a liquid barretter. There

FIG. 7. FESSENDEN LIQUID BARRETTER.

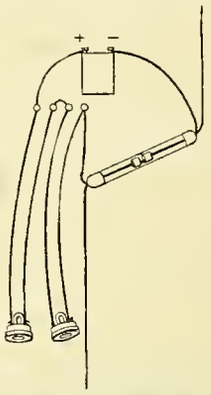

FIG. 8. ROCHEFORT RECEIVER.

are several forms of this detector, one of which is shown in Fig. 7. The operation is evident from its construction. Indeed, one is puzzled to know where the difference is between the barretter and the electrolytic cell of De Forest. Perhaps the chief difference is that of individual opinion regarding the theory involved.

In the Rochefort system, extensively used in France, the Tissot form of coherer is used, several arrangements of which are shown in Figs. 8, 9 and 10. Fig. 9 represents a coherer composed of two electrodes three to five millimeters in diameter, having beveled ends which form a V-shaped

FIG. 9. TISSOT COHERER.

pocket. While the glass is being blown a nipple is made on the side of the tube for the purpose of being filled with carburet of calcium to take up any moisture remaining in the tube after being sealed up.

Fig. 10 is similar in construction, except that the electrodes comprise small concentric soft-iron cylinders, the interiors of which are plugged with glass or ebonite. Referring to the cut it may be seen that the cylinder on the left is connected to one of the leading-in wires, while the leading-in wire to the right is attached to a copper rod of small diameter, which latter is forced through the centers of the insulators inside the soft-iron cylinders, thus forming an annular space for the soft-iron filings which are used. Instead of being placed in a protruding nipple, as in Fig. 9, the

FIG. 10. TISSOT COHERER.

small bag of calcium is placed in the main tube, as seen at the right of the cut. Fig. 8 shows the Rochefort receiver using the Tissot coherer.

Quite recently a number of United States patents were issued to Mr. John S. Stone covering improvements in wireless-telegraph apparatus. The receiver used by Stone consists of an induction balance, one arm of which contains a bolometer. The bolometer is not a new thing to science, however, as it has long been used to measure minute changes of temperature by alterations in its electrical resistance. By its use a difference in temperature of 0.0001 degree Fahrenheit may be observed. When used as a wave detector a wire of microscopic diameter is used in the bolometer. Arriving Hertz waves raise the temperature of the wire, thereby increasing the electrical resistance, and the indicating factors of the bridge record the signals. The action is somewhat similar to that of Prof. Fessenden's "hot-wire" barretter.

Mr. W. W. Massie, a young inventor of Providence, R. I., has recently invented a detector which has some commendable features. A diagram is shown in Fig. 11. Mr. Massie calls the instrument an oscillophone. The normal resistance

is about 43,000 ohms, which is reduced to 700 ohms when under the influence of Hertzian waves, and the telephone receivers used in connection with the detector have their magnets wound to 1,500 ohms resistance. Referring to the cut, it will be observed that a metal bridge (b) represents one of the terminals and also supports the cup (c), which latter is lined with silver and partly filled with silver filings (s). The needle (n) is magnetized and its lower extremity coated with soft iron filings; (t) is the decohering tapper, which operates against the support (b).

Among Mr. Marconi's later technical improvements there is a receiver known as a "magnetic detector," which is used in place of or in addition to the filings coherer in the receiving circuit. The development of this instrument was the outcome of experiments which determined the fact that electric waves have the property of reducing magnetic hysteresis. The detector as constructed consists of a small core of nickel or iron wires surrounded by a coil of fine insulated wire. This coil is connected in series with the aerial wire, which

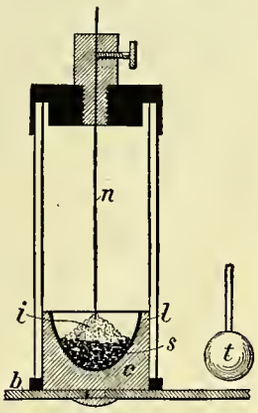

FIG. 11. MASSIE ELECTRIC-WAVE DETECTOR.

gives the waves a direct metallic path through the coil. The action of the waves is to reduce the residual magnetism in the core, which change of magnetic state may be detected in different ways and reproduced mechanically. The usual method is to detect the received signals in a sensitive microphone.

Dr. De Forest has also invented a magnetic detector, United States patent No. 772,878, issued in

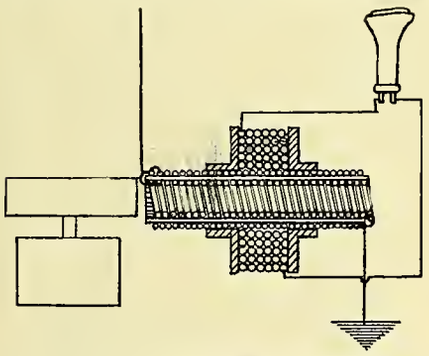

FIG. 12. DE FOREST MAGNETIC DETECTOR.

October, 1904. This detector is shown in section in Fig. 12 and consists of a magnetizable shell and a demagnetizing coil both within and without the shell, one coil to be connected with the aerial wire or antenna and the other coil with the earth.

Sir Oliver Lodge of England has, in conjunction with Dr. Alexander Muirhead, the London instrument maker, perfected a system of wireless telegraphy in which the coherer is a small steel disk which is rotated continuously in contact with a column of mercury, between which is interposed a thin film of oil, the operation being as follows: When the impinging waves set up oscillations in the resonator circuit a difference of potential is created, due to the cumulative effect of the waves, which disrupts the oil film, and at that instant cohesion takes place between the molecules of the solid and fluid metals. The high-resistance state is immediately accomplished by the disk revolving and exposing fresh surfaces. The steel disk is revolved by clockwork. Fig. 13 is a photographic view of the Lodge coherer. In the cut (T) and (T') are the terminal binding posts, (C) mercury cup and (D) the revolving steel disk.

Count D'Arco and Prof. Slaby, German scientists, were early investigators in the wireless-telegraph field, Prof. Slaby in particular having been identified with Mr. Marconi's original experiments. Early in the year 1900 Slaby-Arco apparatus was adopted for use in the Germany navy.

Fig. 14 shows a theoretical diagram of the coherer used, which is of the microphone order and of ingenious construction, being so arranged that hardened steel balls are placed between aluminum disks of small dimensions. This instrument is self-decohering and is connected in series with a single dry cell of battery and a telephone re-

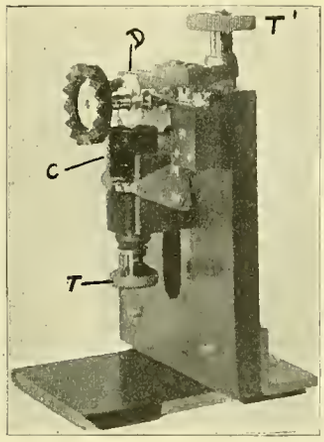

FIG. 13. LODGE AND MUIRHEAD COHERER.

ceiver. Atmospheric disturbances and electric waves emitted by lightning are guarded against by placing the coherer in shunt to the wave system. In principle this coherer is practically the same as the Popoff auto-coherer previously described. It is different in construction, however, as the Slaby type dispenses with the glass tube.

Another system which has gained considerable prominence, especially in Europe, is that known

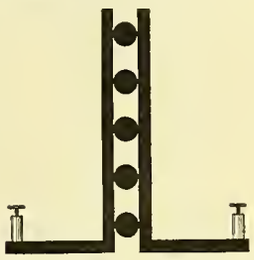

FIG. 14. THEORETICAL DIAGRAM OF SLABY-ARCO COHERER.

as the Branly-Popp system. The coherer used is based upon the simple contact of an oxidized and a polished surface. A small round disk of metal has fixed into it three rods of tempered steel, tapering and pointed at the ends. The points of these small rods are rounded off and given a high polish. The tripod thus formed is placed on a metal surface which has been slightly oxidized. The cohering effect under the action of electric

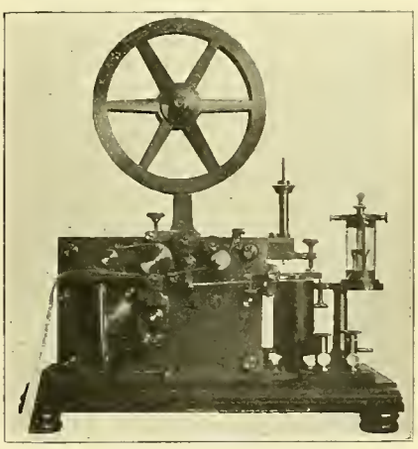

FIG. 15. BRANLY RECEIVER.

waves takes place between the polished and oxidized surface and the polished points, thereby lowering the resistance of the local receiving circuit. Return to high resistance is accomplished in the same manner as with the filings coherer by mechanical jar. Fig. 15 shows the Branly receiver complete, the coherer mounted on an extension of the armature lever shown on the right. The steel tripod is visible resting on the oxidized metal base and enclosed in a glass case. Decoherence is effected by the up-and-down motion of the armature lever.

The foregoing describes the working principle of the wave detectors used in nearly all the systems of wireless telegraphy which have been practically tested. There are, however, other systems, some of them now obsolete, some struggling along in the shadow of infringement, and others yet in the development stage. A fairly complete list of the names of all systems of wireless telegraphy is given herewith:

Marconi, De Forest, Fessenden, Stone, Ducretet, Braun-Siemens, Shoemaker-Giddings, Slaby-Arco, Branly-Popp, Musso, Ruhmer, Artom, Armstrong-Orling, Bull, Mercadier, Lodge-Muirhead, Massie, King, Cervera, Popoff, Pupin, Wildman, Clark, Mendelstam-Braudes and Tesla.

Amount of Light Required for Various Interiors.

[From Question Box of the National Electric Light Association.]

QUESTION.

How many candle-feet are required for satisfactory service in the following classes of interiors: Churches, libraries, bedrooms, hallrooms, etc?

ANSWERS.

A. Peters, Excelsior Springs Light, Power and Water Company, Excelsior Springs, Mo.: I have found the following rule a good one: For fair light, one 16-candlepower lamp for 550 cubic feet; for good light, 1 16-candlepower lamp for 500 cubic feet; for bright light, one 16-candlepower lamp for 450 to 475 cubic feet. A great deal depends upon the color of interior, a blue interior being the most difficult to light.

Douglass Burnett, Consolidated Gas, Electric Light and Power Company, Baltimore, Md.: For rooms requiring a high degree of illumination, such as drafting rooms, try 2.5 watts per square foot; for rooms in which reading is done and goods are well displayed, try two watts; for outdoor service, such as railroad yards, try one watt.

V. R. Lansingh, Holophane Glass Company, New York city:

Churches—A minimum of one candle-foot on a plane four feet above the level of the floor, where an ordinary hymn book is held, will give satisfactory illumination. Great care should be exercised, however, that the lights are so placed that the shadow of the person's body will not interfere so as to cut down this illumination. In other words, the concentration of light in a large chandelier is strictly to be avoided.

Libraries—A general illumination of not less than one candle-foot, and on top of this should be superimposed for desk lighting an illumination of not exceeding three candle-foot. Too much illumination on the desks is strictly to be avoided, as it is tiresome to the eye and is a hindrance rather than an aid.

Bedrooms—The illumination of the bedroom can fall as low as one-half candle-foot at points and still be satisfactory. In places, however, such as over the dresser, tables, etc., the illumination should be raised to two candle-feet.

Ballrooms—An illumination of not less than two candle-feet should be allowed for. The illumination should be uniform and should come from a number of outlets, not being centered in one large center light.

In all of the above cases the effect of the interior decoration, walls, etc., should be strictly borne in mind, and the candle-feet should be reckoned after making due allowance for the reflections.

Central Control for Train Signaling.

Charles F. Hoover of Lockport, N. Y., has been awarded a patent on a railway signaling system, designed to safeguard traffic on electric railways. Mr. Hoover was formerly train dispatcher of the International Railway Company, but is now connected with the freight department. The Hoover system does not do away with the telegraph operators at the various stations, but it gives the new feature of investing the dispatcher at division headquarters with complete control of every signal on the line. A dummy set of signals shows every station and signal on the division, and is electrically connected with the corresponding signal on the line. At any moment the dispatcher can see the position of every signal along the road by the synchronous signals of the model in his office. Thus errors or negligence on the part of any operator will be shown at a glance. Pressing the proper button enables the dispatcher to operate each signal along the line, and the model in the office will show when it has been properly operated. The system of gravity is employed, signals being held "against" approaching trains by a weight, which is released by an electrically operated magnet.

Time-limit Controller for Circuit-breakers.

In governing automatic switches or circuit-breakers it has been the practice for some years to distinguish between a moderately heavy overload, which the protected apparatus could carry for some time without damage and an extreme overload, which should be removed instantaneously to insure the safety of the protected apparatus. This selective property of the switch or circuit-breaker is governed by a time-limit device which is affected by a lower overload, and which is so constructed that if the overload persists for a definite interval the tripping of the circuit-breaker will ensue, but if it does not persist the parts will be restored to their normal condition without operating the circuit-breaker. The time-limit devices commonly employed are wheel trains set in motion when an overload occurs. In modern systems of distribution, and particularly those adapted for lighting or power circuits, a considerable number of independent feeders extend from the generating station or some distributing station supplied thereby. A device especially valuable for systems of this character where a number of feeders are to be protected by time-limit control devices was recently patented by E. M. Hewlett of Schenectady, N. Y., and assigned by him to the General Electric Company.

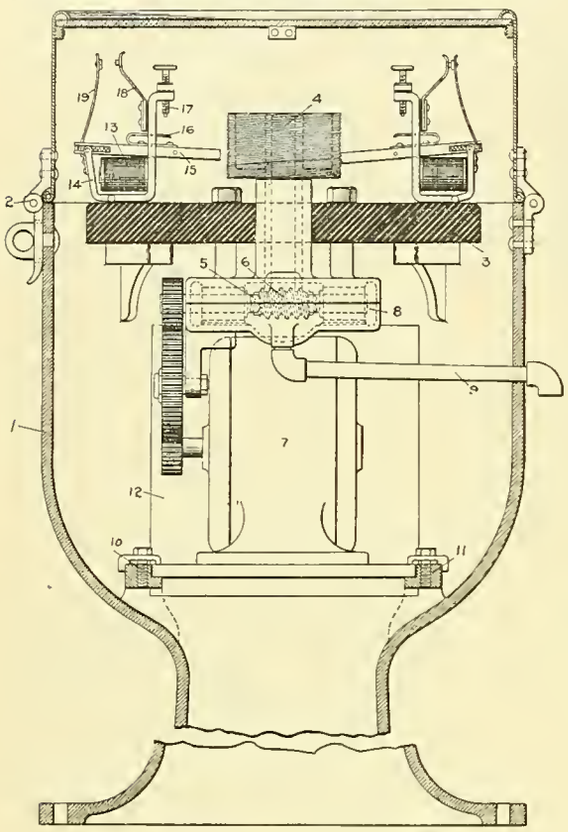

Fig. 1. Sectional View of Time-limit Controller.

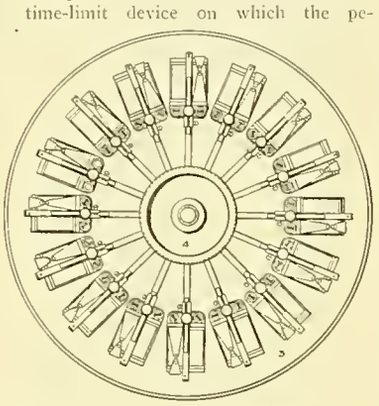

Fig. 2. Plan of Time-limit Controller.

TIME-LIMIT CONTROLLER FOR CIRCUIT-BREAKERS.

One essential feature of the invention comprises a single timing device adapted to co-operate with any of a number of controllers, governing switches, or breakers for different feeders or circuits. Thus the expense of equipping a station with control devices is reduced materially, since each timing device answers for all of the instruments instead of requiring as many timing devices as there are control instruments for the feeders. The timing device is itself novel in construction, comprising a worm driven by a motor, which worm is adapted to engage any of the trip-control devices when an overload exists on any circuit, or all of them if occasion requires, and start a movement along the worm of a circuit-closing arm, which after a definite predetermined range of movement closes the trip circuit.

Referring first to the instrument as depicted in Figs. 1 and 2, a cross-section and plan, (1) represents a casting formed as a hollow casing adapted to rest on the floor of the station and of sufficient height to permit instruments to be conveniently viewed from the glazed cover in the top. On brackets within the casing is mounted an insulating platform, through the center of which extends a shaft on which is mounted a drum (4), the periphery of which is grooved helically with a worm. Motion is communicated to the drum by a worm gear and worm driven by gearing connected with an electric motor (7). The worm gearing is inclosed in a casing which may be flooded with oil. The motor circuit may be arranged so as to be permanently closed or may be closed at the time a relay operates responsive to an overload in one of the circuits. Arranged in circular order around the drum as a center is a group of trip-control devices, each comprising a magnet (13) and armature (14), the several magnets being in local circuits controlled by relays responsive to overload conditions in the several protected circuits. The armature governed by a retractile spring is connected by a yielding elastic connection with a hinged bar (15) carrying a yielding circuit-closing contact (16). This is effected by slotting the end of the bar and mounting it on a pivot in the forked end of the armature, a helical spring nesting behind the pivot. The extremity of this bar has a groove edge adapted to mesh with the screw thread on the drum to the end that when the magnet (13) is energized the bar (15) will be thrust into active relation to the worm drum, and the revolution of the latter will gradually feed the bar upwardly until the contact (16) engages a back-stop (17). This back-stop is mounted on the end of a long screw, the contact point being of silver or similar inoxidizable material. By adjusting the screw up or down the range of motion necessary before contact is completed will evidently be varied, and this constitutes a time-limit device on which the period of time may be varied and may be predetermined with great accuracy. As will be evident from Fig. 2, these devices may be grouped within a small space radially around the drum, each bar being in operative relation to the worm on the periphery of the drum, ready instantly to be dropped into clutch. It will be evident, moreover, that the motion of any one or more is absolutely independent of the motion of the others, since all are carried by a motion of translation parallel to the axis and any one may be thrown into clutch or disconnected without interference with the others. Each trip-control instrument carries also an insulated spring contact (18) co-operating with another spring contact (19), mounted on the armature, these two being brought into engagement when the armature is operated and the clutch bar (15) shifted into active relation to the worm drum.

Electric Elevators Rising 249 Feet.

In the new Majestic Theater Building on Monroe Street, Chicago, there are in process of installation four electric elevators of considerable interest. The building is 20 stories high, with comparatively small ground dimensions, so that it has the appearance of a lofty tower, the exterior walls being of white glazed brick and enameled terra cotta. The elevators are exclusively electric. They have a travel of 249 feet, the highest rise of any electric elevators in Chicago. The elevator mechanisms are installed on the roof, above the shaft, instead of below it. Each one is equipped with a 35-horsepower direct-current electric motor, having an armature speed of only 62 revolutions per minute. The diameter of the armature is 27 inches. Each elevator mechanism weighs 7½ tons and is very heavy and substantial. The car speed is 475 feet a minute. The cars are operated by a sheave, not by a drum.

Electrical Apparatus for Taking Fish.

The accompanying illustrations show a device for catching fish by the aid of electricity. Judged from the standard of sportsmanship, the apparatus is objectionable, but as a proposed application of electricity it is of some interest, although it may be doubted whether it will ever be put to extensive practical use.

This electrical fish catcher or killer was recently patented by Michael Ward of Pittsburg, Pa. In carrying the invention into effect a suitable boat is provided with an electrical battery on board. Suspended from the sides of the vessel is a netting composed partly of electric conductors, which are placed in circuit with the battery, so that the fish coming in contact with the netting will be submitted to a shock of electricity, which will have the effect of stunning them and causing them to float on the top of the water, where they may be gathered up in hand-nets.

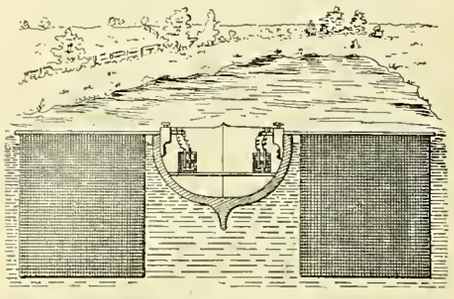

FIG. 1. CROSS-SECTION OF BOAT AND WATER, SHOWING ELECTRICAL FISH CATCHER.

Fig. 1 is a view showing, in transverse section, a boat provided with the device.

Fig. 2 is a diagrammatic view illustrating the peculiar construction of one of the nets which are employed, the net in this figure being in several separable sections.

On each side of the boat is mounted a spar or boom, extending out laterally from the boat to any desired distance. The source of energy is so connected to the net that the vertical strands, which are bare or uncovered wires, will constitute terminals of conductors leading from the source. Vertical strands of the net are alternately connected to the positive and to the negative poles of the battery, the wires leading from the positive pole of the battery and those leading from the negative pole of the battery being insulated one from the other. The vertical strands of the net are united by cross-strands at suitable intervals, these cross-strands being composed of suitable insulating material, so that the vertical metallic strands of the net are electrically insulated from one another. The bottom of the net is provided with weights, which assist in sinking the net and maintaining it in a vertical position in the water.

In carrying the invention into effect the boat is brought to a narrow portion of a stream or body of water and the nets are spread transversely across the water, so as to cut off a considerable space of water on each side of the boat. The fish upon being frightened will naturally take to flight and endeavor to leave the narrow place, and in so doing they will come into contact with the nets. As soon as a fish touches any two of the vertical strands of the net it will establish a circuit between the strands, and as these strands are alternately connected with the opposite poles of the battery the current from the battery will be transmitted from one strand to the other through the body of the fish, with the resultant effect that the fish will be stunned by the passage of the current, and will rise to the surface.

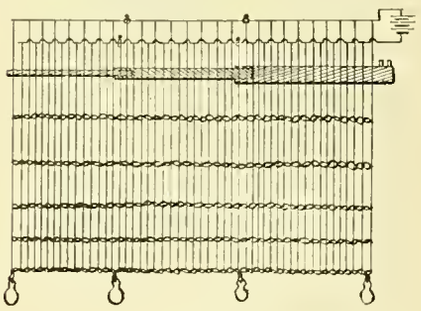

FIG. 2. NET OR SCREEN FOR ELECTRICAL FISH CATCHER.

Electrical Exports for Fiscal Year 1904-1905 Over $12,000,000.

Electrical exports from the United States for the month of June amounted to a total value of $1,101,410, a decrease of $135,984 from May and an increase of $128,312 over June, 1904. Both classes of electrical goods—electrical appliances and electrical machinery—show a gain over June, 1904. The figures are as follows: Electrical appliances—June, 1904, $374,557; June, 1905, $472,154. Electrical machinery—June, 1904, $598,541; June, 1905, $629,256.

Considering electrical machinery only the following-named countries were the largest importers from the United States for the month of June: British North America, $253,585; Japan, $106,711; Mexico, $81,914; United Kingdom, $64,806; British Australasia, $29,661; France, $24,035; Philippine Islands, $10,913; British East Indies, $9,379; Germany, $9,311; British Africa, $6,038; Argentina, $4,963; Cuba, $3,274; Hongkong, $1,203.

For the 12 months ended with June the total electrical exports from the United States reached a value of $12,253,904. This compares with $10,507,013 for the corresponding period ended in 1904, and $9,986,076 for that ended in 1903. The most noticeable gain in the export of electrical machinery to any one country during the year ended with June is that to Japan, whose imports of this class of goods for the last three fiscal years was: 1903, $428,427; 1904, $884,792; 1905, $1,391,877. For the year ended June 30, 1905, Japan's figures in the import of electrical machinery were exceeded only by British North America, $1,711,981. The United Kingdom, which in previous years has been the largest buyer of our electrical machinery, has fallen off from $2,256,062 for the year ended June 30, 1903, to $1,323,019 in 1904, and $1,088,961 for the corresponding period ended this year.

By classes the electrical exports of the United States for the fiscal year 1904-05 were as follows: Electrical appliances, including telegraph and telephone instruments, $4,962,972; electrical machinery, $7,290,932; total, $12,253,904.

Incandescent Lamps in Coal Mines.

It is well known that the ordinary incandescent lamp radiates an appreciable amount of heat. This is a fact to be borne in mind always by window dressers and others who are tempted to place the lamps in juxtaposition to combustible material. There is, according to the London Times, another possible danger, and that is in coal mines. Experiments by M. F. Holliday of the Littleburn Colliery have shown, it is said, that a 100-volt 16-candlepower lamp is capable of causing smoke to rise within three minutes when embedded in coal dust, or may cause flame within 25 minutes when laid on the top of coal dust. Again, the investigations recently conducted by H. Hall, one of the British inspectors of coal and metalliferous mines, proved, it is asserted, that when a 16-candlepower lamp was placed upon and partly covered by coal dust an explosion of the bulb occurred at the temperature of 450° F. within four minutes. These experiments further showed that when the heat had increased to a certain point spontaneous combustion began to operate and the temperature continued to rise until the coal caught fire, although the lamp had been removed for some time.

A Recent Swiss Type of Mountain Locomotive.

By C. Smith.

There has been placed in operation recently on the Jungfrau Mountain railway in Switzerland a novel and interesting type of electric locomotive. Fig. 2 of the accompanying illustrations shows this locomotive, while Fig. 1 is a view of the older locomotive used on this road.

Before describing the new locomotive it might be well to go over a few of the details of construction of the older type. The two motors with which it is equipped are supplied with three-phase current at 500 volts pressure, the frequency being 38 cycles. Each develops, at a speed of 760 revolutions per minute, 150 horsepower. The driving wheels have a diameter of 700 millimeters and make 65 revolutions per minute. A constant speed of 8.1 kilometers per hour is maintained, the weight of the locomotive being 13.8 tons. An ammeter, lightning arrester, and tachometer are provided for each locomotive.

On the down grade the car could be run independently of the overhead line and power station, but the variation of speed was rather limited, and varied between the ordinary number of revolutions per minute and one-half that number, the non-synchronous motors, in this latter case, acting as generators, resistance coils being used to absorb the current.

The more recent type of locomotive was constructed with a view to the fact that they would first be used in transporting material from the tunnel now being excavated. They are all equipped with two three-phase motors supplied with a current having a tension of from 450 to 600 volts and a frequency of 38 cycles. They develop 150 horsepower at a speed of 760 revolutions per minute. Two ammeters, one voltmeter, a transformer, a lightning arrester and two main circuit breakers are provided, the total weight of the locomotive being 16.8 tons. A tachometer connected with the rear motor is also utilized.

A single controller of the type shown in Fig. 3 is situated in the front of the car and controls all the apparatus, including the electric braking resistances. It contains a four-point switch, two being used for reversing the locomotive, one for applying the electric brakes, and the fourth for stopping. There are also devices for starting and forward movements which are utilized in going up grades, the retrograde movement being used in the descent. The operating handle can only be removed when the switch is at the off position. A constant speed of 8.1 kilometers per hour is maintained during the ascent and during the descent as long as the motors are connected with the overhead line this speed remains the same, but on running independently a special device is provided to regulate the speed between eight kilometers per hour as a maximum and 0.4 kilometers per hour as a minimum speed.

When the controller switch is in the braking position the motors are disconnected from the supply circuit and act as generators developing current during their descent, their rotors being in circuit with adjustable resistances which regulate the amount of power absorbed.

An electromagnet placed within the controller acts upon the main steering wheel when the current exceeds a predetermined limit, caused by a sudden diminution of the resistance, the motorman being thus unable to change the speed too abruptly during a descent.

On one side, the motors are provided with three collecting rings and brushes for connecting the starting resistances in the circuit, while on the other side an ordinary collector is used. Several levers of special design, operated by a three-phase magnet device, raise the brushes from the collectors when the motors receive current from the overhead line. The starting resistances are also utilized to absorb power generated by the motors on a down grade, and are designed to absorb 170 kilowatts for a considerable time without very much overheating. In order to cool these coils quicker and so render them more efficient, an electric fan is used which is driven by a small three-phase motor mounted on the locomotive.

Three brakes are employed. The first or automatic brake works as soon as the speed of the car exceeds 10 kilometers per hour, operating a safety switch which disconnects the motors from the main circuit. The handwheel of the controller must then be brought back to its starting position before the safety switch can again be closed. This prevents the locomotive being started in motion without having all the resistance in circuit. The brake proper is a centrifugal device, operating upon the hand brakes placed on the motor axles. The two hand brakes used act upon the friction wheel of the automatic brake and a pulley mounted on the shaft of the rack pinion, respectively.

Both the old and new types of locomotives use the same method for keeping the pinion against the rack. The mechanical equipment of both is also about identical, the more recent locomotives having, however, a more substantial construction.

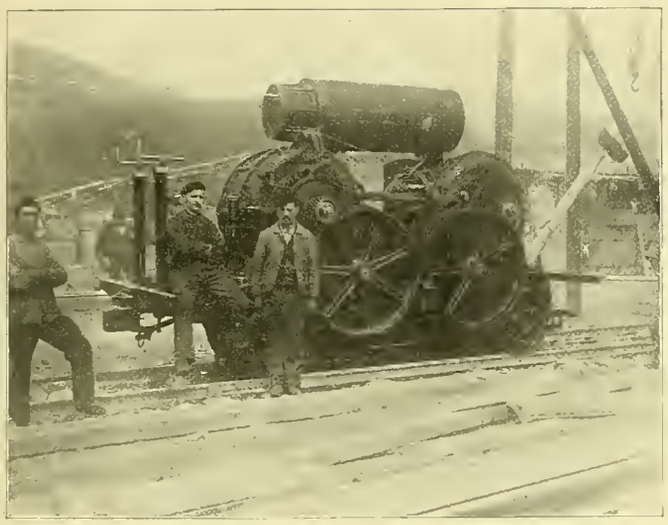

Fig. 1. Older Type of Jungfrau Locomotive.

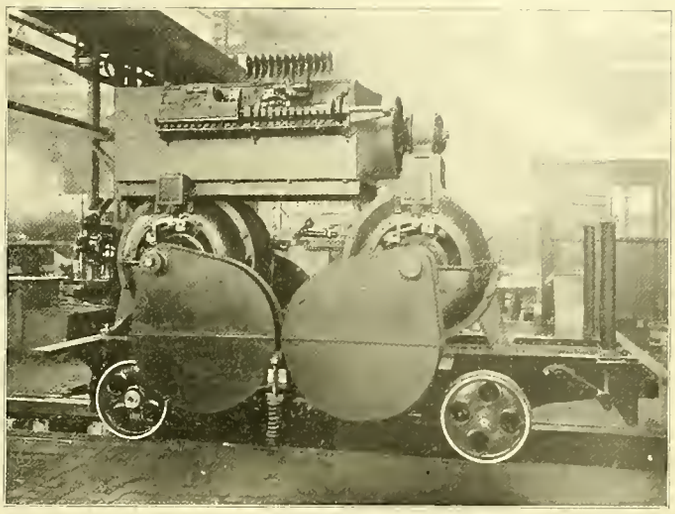

Fig. 2. New Jungfrau Locomotive.

A RECENT SWISS TYPE OF MOUNTAIN LOCOMOTIVE.

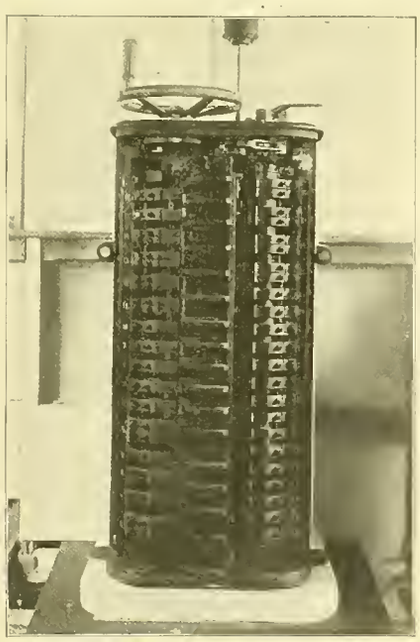

FIG. 3. CONTROLLER ON NEW JUNGFRAU LOCOMOTIVE.

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DATES AHEAD.

Central Illinois Independent Telephone Association (third quarterly convention), Coliseum, Peoria, Ill., August 6th and 7th.

Ohio Electric Light Association (annual convention), Hotel Victory, Put-in-Bay, August 16th to 18th.

International Association of Municipal Electricians (annual convention), Reed House, Erie Pa., August 23d, 24th and 25th.

Old Time Telegraphers' and Historical Association (annual meeting), New York city, August 29th to September 1st.

Colorado Electric Light, Power and Railway Association (annual convention), Glenwood Springs, Colo., September 18th, 19th and 20th.

American Electrochemical Society (general meeting), Bethlehem, Pa., September 18th, 19th and 20th.

American Electrotherapeutic Association (annual meeting), Academy of Medicine, New York city, September 19th, 20th and 21st.

American Street Railway Association (annual convention), Bellevue-Stratford Hotel, Philadelphia, September 25th to 29th.

BATTLE CREEK, MICH., does not devote its attention exclusively to breakfast foods and sanitariums, as some persons may have supposed. It is alert, also, in other directions. The Business Men's Association of that city has ascertained that the electric railways running into the city have been responsible for a large increase in business. Over 2,800,000 people were carried for the year ended July 1st by the Battle Creek and Jackson and the Battle Creek and Kalamazoo electric railways. The association will do all in its power to encourage the building of three proposed lines into the city—one from Coldwater, one from Lansing and the third from Grand Rapids, through the lake region of Barry County and Hastings. More power to it!

ONE RESULT of the long series of Japanese victories is that information as to the tactics used in the various engagements is now more freely granted than in the early stages of the war. The mikado's fighting men seem to have disregarded no modern method or appliance which science and invention have placed at their disposal. Especially was this true in the matter of range-finding on the battlefield. Before the shooting began the soldiers were informed of the distances and were enabled to sight their guns accordingly. This preliminary work was accomplished by men with range-finders, who were sent out with collapsible extension ladders. They popped up all over the battle ground, took measurements and telephoned to the men who were to do the shooting. Each range-finder operator had telephone receivers strapped to his ears and a transmitter in front of his mouth, and he never took observations beyond the end of his coil of insulated telephone wire. This range-finding work was done not only for artillery, but for infantry as well. It is this kind of thorough preparation, even more than physical bravery, that has made the war, so far, a continual string of triumphs for the Nippons.

ARTIFICIAL profiles are to be used, according to report, on the new third track of the South Side elevated railway in Chicago and also on the new Englewood extension. The new work gives an opportunity to use this plan of accelerating and retarding trains by placing each station platform at the summit of a rise in the track, the grade retarding approaching trains and accelerating departing ones. The idea is not new, but is best adapted to tunnel or elevated railways, where it is more practicable and less expensive to build the artificial profiles than on the surface. By the adoption of this device a very considerable saving in power is effected. In a paper read before the American Institute of Electrical Engineers in 1898 Mr. A. H. Armstrong considered this subject at some length, and concluded that, with a perfectly symmetrical artificial profile, the energy consumption for a given run might be reduced as much as 40 or 50 per cent. from that required on a level track. Of course, as Mr. Armstrong pointed out, the ideal profile would provide for a down-grade at starting sufficient to do the work of acceleration and for an up-grade to do the entire braking required, thus leaving only the friction energy to be supplied by the motive power. But artificial profiles may be impracticable in many cases, and it is to be considered, where they are practicable, whether the increased construction cost is offset by the saving in power which is effected.

GERMAN activity in cable laying in the Pacific is more pronounced than persons not acquainted with the situation might suppose. According to the Financial Times of London, it appears from the first report of the German-Dutch Telegraph Company that a joint subsidy of £95,000 per annum for a period of 20 years has been granted to the company to the extent of £76,250 by the German government and £18,750 by the Dutch government, although 90 per cent. of the cable receipts will be reckoned toward the subsidy during the 20 years. The company is engaged in the establishment of submarine cables from Menado, in the Celebes, via Jap, in the Carolines, to the United States island of Guam, where a connection is being formed with the American-Pacific cable, and from Jap to Shanghai, where a junction will be effected with the German cables between Shanghai, Tsingtau and Chefu, and thence with the network of the Great Northern Telegraph Company, whose lines run over Siberia to Europe. Cable-landing rights for 40 years have been granted for Jap and Menado, while similar privileges have been secured from the Chinese government for Shanghai, and, it is said, from the United States government for Guam, where the Commercial Pacific Cable Company will work the cables by virtue of an agreement with the German-Dutch company. The latter has also arranged with the Great Northern Telegraph Company to maintain and repair the cables for a fixed sum during the first 10 years' working.

IT IS certainly gratifying to record the continued growth of the electrical export trade of the United States. For the fiscal year ended June 30, 1905, the total value of these exports was $12,253,904, and was the largest in the history of the country. This is to be compared with $10,507,013 for the year ended June 30, 1904, and $9,986,076 for the corresponding period ended in 1903. Of the electrical exports of 1904-05 $7,290,932 in value was classified as electrical machinery and $4,962,972 as electrical appliances. The four countries which were the leading buyers of American electrical machinery in 1904-05 were: British North America, $1,711,981; Japan, $1,391,877; United Kingdom, $1,088,961, and Mexico, $925,065. These four customers took 70 per cent. of all the electrical machinery exported from the United States during the last fiscal year.

Now that the electrical exports have reached the average value of over a million dollars a month, it is hoped that there will be no decline, but that, on the contrary, the good work may go on until the two-million mark is reached and passed. In the great Chinese Empire, in the South American countries, in Siberia, in European Russia, in Cuba, in the Philippines and in many other parts of the world there is bound to be an increasing demand for electrical goods, and the far-seeing American manufacturer should redouble his efforts in these markets, so that within a few years what has been already accomplished may be looked back upon merely as a good beginning.

AUTOMATIC telephone apparatus has reached its greatest development in the hands of Independent manufacturers and engineers, but nevertheless the Bell company has not entirely neglected this very interesting and modern development. This is attested by the records of the Patent Office and by the further fact, as related in the Western Electrician of July 15th, that a Bell automatic telephone is on exhibition for the first time at the Portland Exposition. It may be noted, too, that Mr. Edward E. Clement, in an article on "The Development and Future Tendencies of the Telephone Art," prepared for the recent National-Interstate telephone convention in Chicago, says: "There are conditions today which manifestly call for automatic service, as, for instance, in office buildings, apartment houses, hotels and the like, where a branch exchange is a necessity but operators are a nuisance from every standpoint. I think there is no question that for exchanges of this kind, giving service to 100 lines or less, the Bell company will soon use the automatic extensively."

The Independent companies making or using automatic apparatus give it a far wider range than this, asserting boldly that the automatic can do everything the manual does, and do it bettter, with the exception of selective party-line service. But it appears that, so far as the Bell company is concerned, the automatic is considered to have a limited field, being practically an ancillary contrivance, which, while interesting and satisfactory when applied to the use for which it is intended, is hardly to be considered as characteristic Bell equipment. This view of the scope of the automatic is, of course, widely divergent from that entertained by the automatic people among the Independents, but coincides in general terms with that held by the Independent makers and users of manual switchboards.

Mr. Dalrymple's Views on a Chicago Municipal Railway.

Mr. James Dalrymple of Glasgow, who came to Chicago recently to advise with Mayor Dunne in relation to a municipal-railway system for Chicago, left this country with no very favorable view of the advisability of such a scheme. The impressions that he received in the United States relating to municipal ownership under conditions existing here are well brought out in a recent interview with him by a representative of the Tramway and Railway World of London.

"The object of my visit to Chicago," said Mr. Dalrymple, "was to explain to Mayor Dunne and the citizens of that great and important American city the tramway work that we have carried out in Glasgow, and to see if possibly the lessons we have learnt in Glasgow could in any way be applied to the benefit of that city. But I ought to explain that the local government system, the social and physical conditions, the climate and circumstances generally there are so entirely different from what obtains in this country that great care has to be exercised in instituting comparisons. In fact, in many respects, accurate comparison is impossible, because everything is so different—law, habit and ideas—but of course the actual problem of locomotion, the giving of mobility to the people, is in principle the same."

When asked whether or not he thought that Chicago offers a good field for modern railway enterprise he replied: "Indeed I do. There are no gradients; the city is perfectly flat. There is an enormous population, immense trade, and an almost feverish activity. The streets are wide and straight, and there will be no need to spend money on widenings. But against that must be set the bad condition of the roads; the road surfaces are very inferior and a considereable sum of money will have to be spent to have them made up; and of course the whole of the track must be reconstructed. You see, in respect of street formation, Chicago differs from English cities in having been designed and built in comparatively recent times. There is no congestion of the population as there is in most of our big towns. No doubt this is partly due to the fact that the tramways of even an inferior type have been operating for some years, and partly also to the methods of living and the habits of the people themselves. They do not crowd together; they prefer to spread out and have plenty of room. An idea of this condition can be gathered from the significant fact that while Glasgow embraces abont 19 square miles, Chicago embraces about 194 square miles. You see in America they have more land. Taking all these factors into consideration, I believe, in fact I am convinced, that Chicago provides a really magnificent opportunity for cheap and profitable tramway working. Looked at altogether, it really has the making of the finest tramway system in the world, provided it is all electrified and brought thoroughly up-to-date. I should propose to do away with the cable system and substitute the overhead system throughout the whole city. The City Council has hitherto objected to the adoption of the overhead system in the central parts, the consequence being that in the more central parts they have the trolley, the cable and the horse system. The whole system has gradually gone from bad to worse. This, in a modern enterprising city like Chicago, is remarkable."

An important phase of the question upon which Mr. Dalrymple expressed himself quite freely was the local-government system in American cities and its bearing upon municipalization. He said:

"The problem will be an exceedingly difficult one to solve. But I do not think that solution will be altogether impossible, because public opinion will be at the back of the movement, and public opinion must win in the long run. There exists a right to buy up the franchise or concession, and the municipality is thought to have powers under the Mueller law to issue certificates on the security of the undertaking for the equipment of the municipal system. But it is not plain sailing, for I should explain that although this law exists it has never yet been tested in practice. They have the law, but whether it is constitutional has yet to be proved. Doubtless there will be a long and hard fight in order to test this law, but I would be much astonished if the city could afford to purchase the undertaking including the value of the unexpired portion of the franchise. If the contention of the companies is upheld, that they have this period of 50 years still to run, it will be a very difficult matter indeed for the municipality to purchase the undertaking at a figure that will allow it to work profitably. Although ultimately the city will be able to obtain possession of the lines, it will take a number of years, because I do not suppose that the companies are going to give away their rights without fighting for them."

As to the relative merits of street-railway administration in the United States and Great Britain, Mr. Dalrymple remarked: "Well, you see, conditions there are so different that it is difficult to answer precisely a general question like that. There is no doubt that in regard to maintenance of plant, cleanliness, and general attractiveness, they have a very great deal to learn from us. So far as methods of management go, there is nothing very much to find fault with. But I do not know that the discipline of the men is quite so good as it is here. The men in most American cities are more thoroughly organized, they are a bit more independent, and I believe, on the whole, have got more power than they ought to have. The men there are well treated. I spoke very strongly to the Chicago people of our own staff in Glasgow, of their discipline and behavior. I explained how they were satisfied with the conditions and service, and believed it best to work under a municipality, whose service was a guarantee that they would be well looked after, and be fairly, and even generously, treated."

Chicago Street-railway Situation.

Mayor Dunne's plan of building a municipal street-railway system of 240 miles in Chicago is not to be carried out apparently without a struggle on the part of the existing traction companies. Last week the Chicago City Railway Company, which asserts the right to operate all its lines until 1958, appealed to the federal court for an injunction against interference by the city. It asks to have the latter restrained from taking any steps to disturb its occupation of any streets which it now occupies, and also from granting any franchise to any other company—the proposed municipal street-railway company, for example—to operate cars in any of those streets. The motives behind the move are not entirely clear, but at least it will tend to make the tangled situation still more complicated. The city's legal department, however, makes light of the suit.

Mayor Dunne has been visiting the East, and in an address at Boston expressed his loyalty to municipal ownership, although somewhat discouraged with the "immediate-ownership" idea for Chicago which inspired him a few months ago. He spoke of the obstacles in the way of acquiring the street-railway lines, but said: "The cause of municipal ownership in Chicago, instead of lagging or dropping by the wayside, is being furthered vigorously and steadfastly."

Variations from the National Electrical Code.

Some attention has been attracted in New York and vicinity by the recent action of some of the local underwriting organizations in adopting electrical rules which conflict with or supplement the National Electrical Code of the Underwriters' National Electric Association. This action has caused much criticism by both electrical engineers and underwriters as being a policy tending to weaken the enforcement of the standard of the National Conference on Standard Electrical Rules. Fortunately, there is no trouble of this sort in the West, the action taken in New York state having no effect west of the Allegheny Mountains. In this section the recently organized Western Association of Electrical Inspectors has a number of committees appointed for the purpose of making a more equitable and systematic apportionment of the labor incident to carrying on the work of the association. Thus, the committee on uniformity in rulings shall decide all questions relating to the interpretation of the National Electrical Code concerning which there is a general difference of opinion. It shall promulgate to each member of the association its decision on the questions submitted and if approved by a two-thirds vote of all members the decision shall be considered as sustained and binding upon the association membership. There is also a committee on National Electrical Code which shall receive and prepare for submission to the association all proposed amendments to the National Electrical Code, which are to be forwarded in the name of the association to the electrical committee of the Underwriters National Electric Association for consideration at the annual meeting held in December of each year.

The grievance in New York is set forth in the New York Journal of Commerce, in an interview with a person said to be thoroughly conversant with the situation. This authority says:

"Within a short time there has been considerable irritation in electrical circles, which has reached a measure of tense condition arising from alleged deviations in the methods of inspectors in enforcing the same rules. Later one of the larger insurance associations has issued a leaflet amending the electrical rules of the Board of Fire Underwriters by introducing numerous changes of detail and some of great moment, particularly in the requirements of construction for currents from 550 volts down to 300 volts. These, if obeyed, would require different classes of supplies, material and connections for the weaker currents, which, it is claimed, have not given any trouble to the underwriters by being a cause of fire under present conditions, nor have they been a source of physical injury to the people.

"At the meeting of the National Electrical Contractors' Association at Boston Mr. McCleary of Detroit, the president, referred to this state of affairs in his opening address, and declared that if the National Board of Fire Underwriters was unable to enforce its rules it should withdraw from the field. He believed that it should exercise its authority, but if it could not, it had no right to legislate.

"Mr. McCleary in speaking for himself and his associates expressed most loyal opinions toward those rules, and therefore the sharp criticisms were all the more weighty coming from a source which had full knowledge of the practical details involved in the proposition.

"It is claimed from other sources that these local organizations in making demands for methods of construction and installation apart from those of the National Board are endeavoring to penalize compliance with the rules of the National Board by increasing insurance rates. If these deviations from the rules are initiated by subordinate bodies of underwriters, in what way can the insurance interests expect compliance with expensive restrictions and conditions on the part of those engaged in the construction or operation of electrical plants?"

Heat-insulating Material for Electric Furnaces.

Despite its technical importance in electric-furnace working, the matter of the heat conductivity of fire brick and other materials for furnace linings has never been gone into very thoroughly. In some notes recently prepared for the Faraday Society by Messrs. R. S. Hutton and J. R. Beard, some interesting observations are recounted:

These gentlemen carried out a number of determinations, chiefly with granular materials, such as magnesia, carborundum, sand and firebrick. By adopting an apparatus devised by C. H. Lees and J. D. Chorlton, they were able to measure the heat conductivity of such powders at various temperatures. The chief results are summarized in the following table:

	Conductivity.
Sand (white calais)	0.00060
Carborundum	0.00050
Firebrick	0.00028
Lime	0.00029
Magnesia (fused)	0.00047
Magnesia (light calcined)	0.00016
Infusorial earth	0.00013

In order to compare the heat-insulating power of these materials under conditions more nearly approaching those met with in practice, a small electrically heated tube furnace was surrounded with the various granular powders. Measurements of the power expended and the temperature attained in the individual cases clearly showed the comparative value of the insulating materials examined.

From these experiments some idea of the saving in heating costs may be obtained whether these are incurred in providing fuel or electric energy, which could be effected by a suitable choice of a furnace-jacketing material. Some of the best insulators are not suitable for really high temperatures on account of their shrinkage. Even under these conditions, however, they can often be used to advantage in conjunction with some more stable but less good insulator which serves for an internal lining of the furnace.

Electrification of Long Island Railroad.

The regular passenger-train service on the electrified portion of the Long Island railroad was operated for the first time on Wednesday morning of last week, and 12 round trips accommodating 5,000 passengers were made during the first day. Three trains, each made up of seven cars, were used, and each train made four round trips, the average time for the 16-mile journey from Rockaway Park to Flatbush Avenue, Brooklyn, being five minutes less than the steam cars. This time will be decreased in the near future. The opening of the service was not marked with any official ceremonies. It is expected that the line between Woodhaven Junction, Jamaica and Springfield will be operated in a few days.

British Association in South Africa.

The British Association meeting this year will be held in South Africa, and from all accounts the number of papers of electrical interest will be small. Among the popular lectures to be delivered are one on "Wireless Telegraphy," by Sir William Preece; another on "Distribution of Power," by Prof. W. E. Ayrton, and a third on "Electric Power Distribution in the Rand," by Mr. Robert Hammond. The members left England on July 22d and 28th, but the expenses of the tour are heavy and only a comparatively few are reported to have gone. As already noted, Prof. H. S. Carhart of the University of Michigan is a leading American delegate.

The Central Telephone Company of Broken Bow, Neb., is installing new switchboards in its main office, and the pole line is being extended and improved.

Underwriters' Scheme of Wire Inspection.

The Wire Inspection Bureau of 32 Nassau Street, New York, affiliated with the Underwriters' Laboratories, has issued a circular letter explaining the object of its existence and a new plan for inspecting rubber-covered wire. The circular recites that on May 22, 1905, a conference was held at the rooms of the National Board of Fire Underwriters. The purpose of the meeting was to devise ways and means of testing all rubber-insulated wire manufactured under the rules of the National Board of Fire Underwriters, of testing all rubber-insulated wire manufactured and to prevent the introduction into commercial use of any such wire which would prove inferior to the standard demanded by the National Board of Fire Underwriters—this to protect reliable manufacturers against unfair competition, and practically preventing any further use of wire with defective rubber insulation.

At this meeting a joint committee was chosen, consisting of six members, to form the "Wire Inspection Bureau." This bureau was to draw specifications for testing rubber-insulated wire, manufactured under the rules of the National Board of Fire Underwriters, to decide on such tests, and when and how they are to be made. It was also to appoint the necessary electrical inspectors, three being considered sufficient at present, which inspectors shall from time to time visit the testing laboratories of any factories making rubber-insulated wire, and make, supervise and verify tests specified by the bureau.

The expenses of these inspectors are to be paid by fees collected from the manufacturing companies whose product is tested, each company paying its share in proportion to the amount of wire manufactured.

For the purpose of collecting the money to cover these expenses, stamps will be issued by the Wire Inspection Bureau and sold to the different manufacturers at a charge of one cent per hundred feet of wire tested. These stamps are to be attached to the coils of tested wire by the manufacturers themselves, and to serve as a guaranty that wire so stamped has successfully withstood the tests specified by the Wire Inspection Bureau.

The majority of the rubber-covered wire manufacturers have recently agreed that on and after October 1, 1905, all National Code wire manufactured by their companies shall be made up under the new specifications and duly tested and shall bear the identification mark of the Wire Inspection Bureau. It is understood that a reasonable time will be allowed after this date for the disposal of code wire not bearing the stamp of approval of the Wire Inspection Bureau, on all such wire manufactured before October 1, 1905, and with this understanding the October list of electrical fittings will contain the names of all rubber-covered wire manufacturers agreeing to the tests of the Wire Inspection Bureau on their products and to the use of identification stamps of the bureau guaranteeing that these tests have been properly made.

The Wire Inspection Bureau will supply identification stamps to the rubber-covered wire manufacturers as may be required by the latter. These stamps will be for 250-foot, 500-foot and 1,000-foot coils, and will cost at the rate of one cent per 100 feet. No wire will be considered as having been tested which does not contain an identification stamp. Stamps are to be of linen paper and to be securely fastened to the shipping tags attached to wire coils. All stamps are to be canceled by manufacturer when used, the date of manufacture of wire also being plainly shown.

The governing committee of the Wire Inspection Bureau consists of William H. Merrill, Jr., C. M. Goddard, J. C. Forsyth, Ira W. Henry, William M. Habirshaw and George A. Craigin. The secretary of the bureau is Hugh T. Wreaks.

Bids will be asked by the electric-light commission of La Grange, Ga., for the construction of an electric-light plant.

Electric Railway Extension in Central and Western New York.

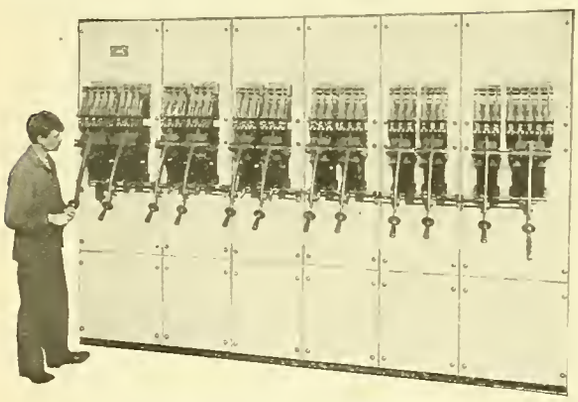
New York state affords an active field at present for the extension of electric railways. The work of installing electric traction on the West Shore railroad of the Vanderbilt system has been commenced, contracts having been let, it is reported, for all the construction necessary on the portion of the road between Syracuse and Utica. It is understood that the same company which has already built between Oneida and Canastota will be interested in the work. It is possible that Syracuse may at some time in the future be the dividing point between the zones using Niagara and Hudson River power. Announcement is made that the Vanderbilt-Andrews syndicate has already signed contracts with the Niagara, Lockport and Ontario Power Company to take power from that company for the trolley lines. The power company, which will not have a plant of its own for several years yet, has contracted with the Ontario Power Company to take the first 60,000 horsepower it generates.

Another proposed extension of considerable importance is that of the property of the Honeoye Falls-Lima Electric Railway Company which has been sold to William J. Connors of Buffalo, who, it is said, will arrange to transfer the title to the property to the Rochester and Southern Construction Company. The price of the property, which consists of a little more than four miles of track, power house, depots and electric-lighting apparatus for Lima, was $16,000.

The Rochester and Southern Construction Company is building the Rochester-Elmira electric road. The power house and possibly the repair shops and main barns of the road will be located at Dansville. The line of the Honeoye Falls-Lima road will be extended in either direction so as to eventually complete a loop with the proposed main line.

Large Motor Controller for Steel Works.

The picture shows what is undoubtedly the largest capacity electric motor controller ever built, it being one of two designed and constructed by the Cutler-Hammer Manufacturing Company of Milwaukee for the Carnegie Steel Company of Pittsburg. The panels are of white Italian marble, their total dimensions being 11 feet long and seven feet eight inches high. The first and last switches have a continuous capacity of 10,000 amperes and the intermediate switches a continuous capacity of 6,000 amperes. The levers with which the switches are operated are a trifle over three feet long, but by means of a toggle-joint action they can be easily thrown into contact.



LARGE MOTOR CONTROLLER FOR STEEL WORKS.

NEW FUSELESS ROSETTE.

Before these two controllers were built there was but one extra-large capacity controller in the United States, that being installed over a year ago in the plant of the Pittsburg Reduction Company at Massena, N. Y. That apparatus was of 6,000-ampere capacity on first and last switches and 3,500 amperes capacity on intermediate switches, and was installed on a 500-volt circuit. Those for the Carnegie Steel Company will be installed on a 250-volt circuit.

The resistance for these starters is composed of steel rails arranged in a rack 19 feet high, 30 feet long and 14 feet wide.

New Fuseless Rosette.

A new specialty that has been placed on the market by the Peru Electric Manufacturing Company of Peru, Ind., is its fuseless rosette, illustrated herewith. The novel feature in this rosette is its simple design, as it will be noted there are no brass parts other than the terminals. The screws used in fastening the rosette to the ceiling hold the cap and base together, doing away with a half-turn connection.

The Peru fuseless rosette is a National Code Standard device. It is neat in appearance and the cap is provided with a cavity to accommodate the knot in the cord. The cuts show how completely the porcelain base protects the terminals and the ease with which this rosette can be wired.

The Gas Turbine as a Prime Mover.

In Leeds, England, experiments have been going on some six years with a form of gas turbine, but not much has been heard from it of late, which is partly attributable to the limited resources of those engaged in the work. The recent rapid development of the steam turbine and also of the gas engine have combined to arouse interest in the gas turbine as a commercial possibility. "One of the most significant facts," says Mr. E. Kilburn Scott in the London Electrical Review, "which came to the writer's knowledge during a recent visit to the United States was that both the large electrical concerns (at Schenectady and Pittsburg) were experimenting with gas turbines. It is only within recent years that either of these firms, or, indeed, anyone in America, has seriously considered turbines, but when they did take hold of the steam machine, they lost no time in developing it, with the result that one has now to go there to see the latest and largest practice. It is all the more interesting, therefore, to find them at work on the gas-turbine problem."

Mr. Kilburn then went on to say that the paper read by Mr. R. M. Neilson before the Institution of Mechanical Engineers on the possibilities of gas turbines was especially important on account of its bearing on the theoretical principles which must be borne in mind in constructing these machines. It was shown in this paper that when working on Carnot's cycle, between 1,600° and 17° C. the greatest possible efficiency is

$$\frac{T_1 - T_2}{T_1} = \frac{(1{,}600 + 273) - (17 + 273)}{1{,}600 + 273} = 85 \text{ per cent.}$$

A reciprocating gas engine working on the Otto cycle with compression to 60 pounds per square inch, combustion at constant volume, and expansion to atmospheric pressure, gives at most only 37 per cent. An important point to note is that it is relatively more important to have the lower temperature low than to have the higher temperature high. Thus an ideal gas engine working on Carnot's cycle between the limits of temperature 2,000° C. and 300° C. absolute, will lose as much by an increase of 100° on the lower temperature as it will by a decrease of 500° C. from the higher temperature. This is good, because it is clearly much easier to build a turbine for a low temperature than for a high one; indeed, it is doubtful whether turbines can be water-jacketed effectively to withstand an initial temperature of 2,000° C.

Of course, in any form of motor using gas, a large amount of heat must necessarily be lost in the water, and the higher the initial temperature the greater will this amount be. It has been suggested to utilize this heat by raising the water to boiling point, and then passing the steam along with the gas through the turbine, but clearly a better way would be to utilize the steam in the gas producer, and thus dispense with separate boilers.

One of the principal difficulties which has to be met in turbine design is to fully utilize the full velocity of the steam or gas. Thus saturated steam at 300 pounds absolute, expanded adiabatically from a De Laval nozzle, has a velocity of over 4,000 feet per second, and with gas the velocities which will have to be dealt with, are likely to be still higher. Now, such velocities as these are far greater than the peripheral speed at which metallic bodies can be run.

One advantage which gas has over steam in a turbine, is that there cannot be any water present with the former, and therefore liability to cut the blades, as well as friction in the nozzles, etc., is reduced.

It is, however, not so much the steam turbine as the gas engine, that the gas turbine will eventually have to reckon with. The usefulness of steam machinery is limited by the wasteful method of burning coal on a fire grate, and also because steam-boiler units cannot be built much larger than 1,000 horsepower. Therefore, however much the steam turbine itself may be perfected, it will always be handicapped by the boiler side of the proposition.

In order more fully to understand the chances of the gas turbine as the coming prime mover, Mr. Scott draws these comparisons between the gas engine and the gas turbine:

(a) It is clear that one great advantage of working with gas, is that in a turbine it can have practically a continuous flow, whereas in the engine it must be cut off at every working stroke—usually one in four—with a liability to back firing, which is absent in the turbine.

(b) The turbine is able to do its own scavenging automatically, by the mere fact of the gas entering at one end, and the products of combustion leaving at the other. With an engine the charge may be, and generally is, compressed in the cylinder, but in a turbine it must be compressed separately. This can be effected in a remarkably simple manner by the turbine rotary pump, which has been developed with such success in connection with colliery ventilation, etc.

(c) Perhaps the greatest difference between the gas engine and turbine, is that in the engine the metal surface with which the gas comes in contact is small compared with a gas turbine, especially

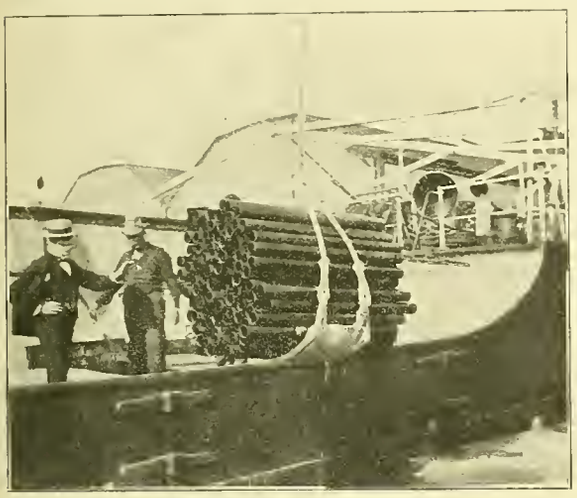
if multiple expansion is attempted, because almost every particle of gas must necessarily slide along a metal surface as it passes through the vanes. Fortunately, however, the rotating and fixed portions do not come into intimate contact, as is the case with the piston and cylinder of an engine, and, therefore, the metal surfaces may be worked at much higher temperatures.

(d) As with engines, so gas turbines will require to be water-jacketed, the extent of such jacketing depending on the method of working. For example, if the temperature is below 1,000° C., it is probable that jacketing the outer casing may meet the requirements. For 2,000° C., however, it will be necessary to have water circulating through the spindle, and the rotating wings and blades. At first sight this may be thought somewhat difficult, but after all it is much less of a mechanical problem than providing a water supply in the piston of a large gas engine, which latter is necessary to prevent back-firing.

(e) Regarding the governing, there is on the face of it a distinct advantage in favor of the turbine, because of its not having any dead center, and the regulation can be so simply effected by shutting off more or less nozzles, as in the Curtis steam turbines. The gas engine, on the other hand, requires a heavy flywheel, and if economy of gas is aimed at by using the hit-and-miss form of governor, then the flywheel becomes exceedingly heavy.

Loading Fiber Conduit for Export.

The accompanying illustration shows the manner of loading fiber conduit on board steamer at New York for foreign shipment. About 100 five-foot lengths of the three-inch socket-joint type of conduit are swung from the car ferry to the steamer in one load and arranged in bulk in the hold of the steamer. This shipment was consigned to the Manchester corporation at Manchester, England, for use in constructing the underground system for the accommodation of its lighting circuits. About 180,000 feet of fiber conduit was required for the construction work, and the breakage of the material from all causes from the factory of the Fibre Conduit Company at Orangeburg, N. Y., to Manchester, England, was less than one per cent.



LOADING FIBER CONDUIT FOR EXPORT.

Combination of Car Builders.

After repeated denials, it is now announced that all the manufacturers of street-railway cars and trucks in the United States have entered into a combine which has a stock and bond issue of $54,000,000. In the words of John J. Cummings, president of the McGuire-Cummings Manufacturing Company of Chicago, the company will "sell to anybody who wants cars and can pay for them." "The history of combinations in this country," said Mr. Cummings, "shows that there is plenty of capital to go into competition with a combination that does not deal fairly with the trade. There has been no talk from anybody in this new combination about refusing to sell equipment to cities that may want supplies for municipal lines. On the contrary, there was a good deal of talk in New York about the possibilities of sales to such customers."

Every company making street-railway cars or trucks is included in the new company, the name of which has not as yet been decided upon.

The combination is to have $11,000,000 of five per cent. bonds, $15,500,000 of preferred stock and $27,500,000 of common stock, making the total of stocks and bonds $54,000,000. A full list of the companies included is as follows: J. G. Brill Company, Philadelphia; Kuhlman Car Company, Cleveland; Laclede Car Company, St. Louis; St. Louis Malleable Casting Company; St. Louis Car Company; Cincinnati Car Company; Wason Manufacturing Company, Springfield, Mass.; Osgood, Bradley & Sons, Worcester, Mass.; McGuire-Cummings Manufacturing Company, Chicago; Cummings Manufacturing Company, Paris, Ill.; Jewett Car Company, Newark, Ohio; J. M. Jones' Sons, Troy, N. Y.; Laconia Car Company, Laconia, N. H.; Peckham Manufacturing Company, Kingston, N. Y.; and the Niles Car Manufacturing Company, Niles, Ohio.

W. G. Brunt and J. C. Stewart, both of New York, are talked of for the office of president. J. C. Cummings will probably be vice-president.

Trade of the Philippine Islands.

The trade and commerce of the Philippine Islands shows a marked improvement, especially in the matter of electrical equipment. The imports of cars for electric railroads in 1902 were valued at $8,927, of which Germany supplied the major part, valued at $6,550. During the year 1903 the total value declined to $3,791, the United Kingdom in the lead with $2,788. In 1904 it had jumped again to $18,041, Belgium securing the major part of the trade, its value being $14,400.

Under the classification of telephone, telegraph and other electrical instruments, the import value in 1902 was reported at $76,646, the United States in the lead with a total value of $63,883. In 1903 there was a decided falling off in these imports to a total value of $49,088, the United States still maintaining the lead, but there was an increase during the calendar year of 1904 to $52,394, in which the United States again stood at the head of the list, with a value of $36,156.

Under the heading of incandescent lamps, there has been a steady decline during the three years named from $8,182 in 1902 to $6,925 in 1903, and still further to $6,364 last year. Through all the time the United States has enjoyed the major part of the trade, the values for 1902 being $6,595, in 1903, $4,634, and in 1904, $2,982.

Electrical machinery shows very satisfactory advancement in the import values. In 1902 the total value was only $3,530, the United States share amounting to $2,116. In 1903 the value had increased to $15,560, the United States still leading, with $11,484. During the year 1904 there was a total increase to $19,439, and the supply was received from the following sources: United States, $13,446; United Kingdom, $2,328; Germany, $2,466; France, $1,162; Hongkong, $36, and Japan, $1. While this is not a large trade, it shows that there is a steadily awakening interest in more modern methods of manufacture and enterprise.

Mexico's New Tariff.

The new tariff recently enacted by Mexico, and which goes into effect on September 1st, includes the following articles, the old rates being inserted in parentheses: Incandescent lamps, commutators, extinguishing devices, circuit closers with handles, fuses, cut-outs, rosettes and safety pieces, per gross kilo (10 cents), 11 cents; arc lamps, per gross kilo (five cents), six cents; wire, of copper, brass, bronze, or white metal, covered with any substance, per gross kilo (five cents), 10 cents; wire, bare, of copper, brass, or white metal, not exceeding two millimeters in diameter, per gross kilo (eight cents), 10 cents; wire, bare, of copper, brass, bronze or white metal, exceeding two millimeters in diameter, per gross kilo (five cents), six cents; wire, iron or steel, more than one millimeter in diameter, per 100 gross kilos (five cents per kilo), $5.50; wire, iron or steel, one millimeter or less in diameter, per gross kilo (eight cents), nine cents; rails, iron or steel, when the weight of the linear meter does not exceed 10 kilograms, per gross kilo, two cents; rails, iron or steel, when the linear meter does not exceed 10 kilograms, and switches, turtles, ties, frogs, spikes and fishplates, for laying rails, per gross kilo, two cents.

Meeting of American Steel and Wire Company's Salesmen.

Salesmen of the American Steel and Wire Company of Chicago held their annual convention in the Auditorium Hotel, Chicago, July 27th, 28th and 29th. About 200 salesmen of the company were present from all parts of the country. Mr. F. Baaches, vice-president and general sales agent, was the chairman. The main object of these conventions is to get the salesmen together in order that they may become acquainted with one another. The interchange of ideas and experiences among the members is found by them to be of great value in educating them along their chosen line of work. Three very enjoyable days were spent by those in attendance at the convention.

The city of Ashland, Ore., has voted to issue $500,000 of bonds for an electric-light plant.

District Heating.[1]

Nearly all the old Edison plants, and, in fact, all direct-current plants, are located near enough to the center of distribution to warrant district heating. For a central station which is a mile or more away from the center of the city, district heating is generally out of the question. On the other hand, a plant located near the center of the city may, under certain conditions, supply customers within a mile radius.

As a general proposition, cities of 20,000 population or over have well-defined and thickly settled business centers. This is also sometimes true of cities down to 10,000 population, but below this size it often happens that vacant lots, one-story buildings or temporary structures are so numerous that the income per foot of street main does not warrant the investment. It is evident that the farther away from the plant the customer is located, the poorer will be the service he receives; if steam is supplied, the more moisture will it contain, and if hot water is used the lower will be its temperature when it reaches him.

The number of customers and the quantity of heat that they require, or, in other words, the density of the load, is an important factor which must be taken into consideration. This is largely governed by the class of business, whether residential or commercial. As a general rule, the commercial business is the better in every way, since not only is the income derived from it greater per foot of main, but the amount of heat required per cubic foot of space so used is less proportionately, for the reasons that the buildings are not used at nights, are less exposed, and usually have thick masonry walls. Residences are generally exposed on all four sides, have large window area, and require heat 24 hours per day. The service runs for commercial business are almost invariably shorter than those for residences, and in many cases one such service can be arranged to serve two or more customers.

Changes in the population of his city should receive the manager's closest scrutiny, for if the city is growing rapidly it is essential at least to keep pace with its growing demands. On the other hand, it is a pretty safe rule that in a city which is at a standstill, or is falling off in population, one's investment should not be increased unless valuable economies can be effected thereby.

An element of extreme importance is the relation of the cost of steam coal to that of domestic coal. The greater the difference between the two in any given locality, the greater the profits to the company from the business, and the stronger the inducements to the consumer to use the district heat. In cities where steam coal costs from $1 to $2 and where domestic coal runs from $4 to $9, the company has much in its favor, and should be able to make rates that are at once attractive to the public and profitable to itself. With 40 companies that report that they are doing a satisfactory business, the average price of steam coal is $2.18, while the average price of domestic coal is $5.74. Among these same companies, where the hardest operating conditions exist, steam coal is quoted at $1.17 and domestic coal at $1.50. On the other hand, one company reports that it pays but $4 for steam coal, whereas domestic coal costs $10 per ton.

It is a noticeable fact that most of the district heating plants in this country are located in the great middle belt. For obvious reasons, district heating systems are not required much to the south of Ohio, Indiana, Illinois, Missouri and Kansas, while in these states and to the east and slightly to the north they seem to flourish.

The length of the season is a factor to be considered, especially when heat is furnished on any flat-rate system, i. e., per square foot of radiating surface per season, per cubic-foot contents per season, etc. When on a meter basis, however, the length of the season is of much less importance. It is well to avoid, in general, the making of contracts requiring heat during the summer months.

What to do with his exhaust steam is a question for the manager to decide. Which is best—to install condensers and thereby increase the efficiency of the engines 20 per cent. or more, and the capacity as well; or to sell this by-product as it is, in the form of heat? If the rates obtainable are fair, that is, if the heat can be sold nearly on a live-steam basis, the plant should receive from the latter course at least three-quarters of the original value of the steam: while a condensing outfit would save but one-quarter to one-third of its value. If water for condensing is not available, the argument for district heating is strengthened. Very many plants have short and sharp winter peak loads: and it would seem that under such conditions their managers might be warranted in installing some inexpensive, simple, non-condensing engines, the exhaust from which would be well utilized for heating purposes; or it might even prove to be best, under proper conditions of load and fuel costs, to install condensing apparatus which would be run during the summer, but which in

1. Abstract of a committee report to the National Electric Light Association at the Denver-Colorado Springs convention June 8, 1905. The committee was composed of W. H. Blood, Jr., of Seattle, Wash. (chairman), R. S. Wallace of Peoria, Ill., and C. R. Maunsell of Topeka, Kan.

the heating season would be cut out, the exhaust steam being then utilized on the heating system. The use of the exhaust steam for heating will necessitate the carrying of some back pressure on the engines, thereby reducing both capacity and efficiency, a point not to be lost sight of.

The returns that we get from steam-heating plants indicate that it is safe to figure for ordinary conditions about 0.20 pound of water per hour per square foot of radiation (varying from 0.05 to 0.50). As all the consumers are not using the steam at the same time, particularly if on a meter basis, the load factor should be no more neglected than in the lighting business. Naturally, with the heating business this is higher; and if we use the figure of 85 per cent. we shall probably be on the safe side.

Together with the above must be figured the interest charges on the total underground installation and that portion of the central-station plant which is used for heating purposes; and, lastly—depreciation—an item that is often neglected, but which should nevertheless be estimated. From the best evidence at hand the last item seems to be about five per cent. per annum on the total cost of the investment. It is a well-recognized fact that a district heating system has often enabled a company to secure contracts for light and power which it would not otherwise have obtained. These then produce an increase in load, which in turn supplies more exhaust steam to sell for heat.

The problems of management properly begin with the inception of the enterprise, but it may be assumed for present purposes that the plant has been installed in accordance with the best practice of the day. It is probable that the heating plant owes its existence primarily to the fact that there is available a quantity of exhaust steam which it is proposed to utilize for heating buildings, thereby deriving some revenue from the heat otherwise wasted. To the facts that any revenue received from this source is looked upon as net gain and that managers fail to properly estimate the real value of the service to the consumer, are due most of the reports of unsuccessful ventures. Whether rates be by meter or per unit of heating surface or of space, the tendency is to estimate the cost of the service and its value too low. The consequence is that the heating account, if charged with its due proportion of expenses, shows a deficit. The evident remedy is to raise the rates, but if done sufficiently to put the business on a paying basis at once, this is an unpleasant task, although undoubtedly better than if done piecemeal.

It is essential that rates be carefully fixed at the beginning of operations, and that the cost of generating and distributing heat, plus proper investment, depreciation and dividend charges, be the basis of such rates. While it may be possible to compare with the daily and monthly load curves of the central station, a hypothetical curve representing the amount of heat required by buildings of given dimensions, and thus estimate how much of the available exhaust steam can be utilized and how much live steam must be added, the result is at best an approximation. The only safe and reasonable rate is that based on the cost of supplying heat direct from the coal pile, or, in other words, on a live-steam basis. Any exhaust available with rates thus fixed can, of course, be used to advantage.

It is advisable to limit the service connections made in street mains to the fewest possible, making extensions, wherever practicable, from service pipes in adjacent buildings, with due regard, however, for the capacity of the service from which the extension is made. For this and other reasons, it is essential that all service pipes, extensions of same and service valves should be laid and owned by the central station.

In the interest of satisfactory and economical operation from the consumer's point of view, all interior piping and connections to radiators should be installed so as to give complete and positive circulation, with minimum friction losses and without noise of any kind. To this end, it is well to publish standard regulations governing the character of the installations, and to give the prospective consumer all the assistance possible in the way of advice, sketches and specifications for the installation of his apparatus.

The same liberal policy should be followed in caring for complaints received from consumers, for by so doing it is easier to keep in touch with the character of the service and to remedy any defects, even if some troubles are thus taken care of which might properly have been referred to the plumber or steam fitter.

A careful inspection of all interior appliances, to make sure that everything is in proper condition and that the installation is made in accordance with the requirements before the heat is turned on, is the best means of securing a satisfied customer and a minimum number of complaints.

The question of making the heating business a department by itself, with a separate system of accounting, is largely a matter of local conditions and of the size and importance of the enterprise. If made a separate department, the system of accounting would naturally parallel the existing system.

Using the data at hand, an effort has been made to answer the following questions in regard to steam-heating rates:

(1) Can a definite relation be established between a meter rate and a flat rate under the same conditions of service?

(2) Should this rate be based on the number of square feet of radiation, or cubic feet of space heated, or the equivalent cubic feet of space heated?

(3) Should customers be charged the same flat rate, independent of the kind of service, or should they be classified and charged accordingly?

Before examining the data, it seems advisable to consider certain general relations.

Theoretically, a meter rate is the only equitable method of charging, but practically it may be found that a flat rate will answer the purpose fully as well. The previous failures to produce a reliable meter had until recently prevented the general adoption of this system of charging, but from the success of the past year, with new meters, and with the assurance from the manufacturers of still further improvements, it is probable that the meter basis of charging will become more popular.

When electricity is sold on a flat-rate basis, the consumer invariably leaves lights burning at times when they are not needed, simply because it adds somewhat to his comfort, for, generally speaking, too much light is impossible. On the other hand, too much heat is not only possible, but is nearly as bad as too little, and the consumer naturally takes pains to shut off the steam when the room begins to be uncomfortable. Although there is a wide difference of opinion in regard to the amount of light required for proper illumination, it is generally conceded that the temperature of a room should not be far above or below 75 degrees Fahrenheit. This would seem to form a strong argument in favor of a flat-rate system.

If a flat rate is established, it is necessary to decide whether the rate shall be based on the square feet of radiation installed, or on the cubic feet of space, or on the equivalent cubic feet of space heated, which latter case takes into consideration, windows, doors, masonry, walls, etc.

Numerous formulæ have been worked out to give approximately the number of square feet of radiation that should be installed to heat various-sized rooms under different conditions of service. It stands to reason, however, that the quantity of steam used to heat given spaces under similar conditions will be approximately constant and independent of the amount of radiation installed, provided that enough or more than enough radiation is supplied to take care of the coldest days. This would appear to be an argument in favor of basing the flat rate on the number of cubic feet or equivalent cubic feet of space heated.

Following is a summary of the information which we have collected: it is divided into three groups, and all data are from meter customers:

Class of Service.	Condensation Per Sq. Ft. of Radiation Per Day.			Condensation Per 1,000 Cu. Ft. of Space Heated Per Day.			Ratio Cu. Ft. Space to Sq. Ft. Radiation.	Av. Temp. Degrees F.
	Av.	Max.	Min.	Av.	Max.	Min.		
Residences	3.83	5.20	1.79	51.3	75.2	27.4	76	34
"	2.49	2.49	2.49	34.6	34.6	34.6	72	44
"	1.69	3.22	0.54	.....	.....	.....	.....	.....
Stores	4.48	10.1	1.01	29.0	50.2	11.4	115	34
"	2.61	4.03	1.18	17.1	37.0	9.2	181	44
"	1.94	3.77	0.64	.....	.....	.....	.....	.....
"	2.32	3.4	1.8	20.0	28.5	13.6	136	40.5
Offices	5.02	7.94	2.13	51.5	78.0	24.9	81	34
"	2.92	3.70	1.73	25.1	32.2	19.7	120	44
"	1.56	1.83	1.10	26.0	30.4	19.8	60	43.5
"	2.27	3.62	0.89	.....	.....	.....	.....	.....
"	2.97	3.8	1.8	29.0	49.7	14.9	111	40.5

Note—While there is a large variation between maximum and minimum, it was found when making the tabulation that most of the figures ran very close to the averages given above.

The table shows that the steam consumption, as would be expected, is greatest where the average temperature is lowest and that this is an important factor to be considered in arriving at the rate to charge; that the kind of service makes very little difference in the steam consumption, although residences seem to have a greater condensation per cubic foot of contents and a less per square foot of radiation than either stores or offices; that the results, although varying widely, are near enough to justify the establishment of a flat rate, this being on the assumption (correct or incorrect) that customers will use practically the same amount of steam whether on a flat or meter rate; and, finally, that if a meter rate is established, a corresponding flat rate would vary according to the length of the season and average temperature, and may be easily approximated from the figures given.

Electrical Plowing.

In the Northwest, where steam is used to some extent in plowing, some attention is now paid to the old idea of using electrically propelled plows. A Minneapolis company is making a large gang plow which is to be operated by electricity generated by a traction engine. Many of the prosperous farmers have threshing engines, and these can be used to drive the dynamos. By a simple method the feed wires are carried to any part of the field. Steam plows are now in use, but they are so heavy that they are unwieldy and cut into the field. It is said that the new electric plow will run about four times as fast as one of the same size pulled by horses. A similar idea as that used for the plow is to be tried, it is said, for working harvesters, mowers and cultivators.

The Electrical Industry in Lynn.

An interesting lecture on "Personal Recollections of the Development of the Electrical Industry" was recently delivered before the apprentices of the General Electric Company in West Lynn by Prof. Elihu Thomson, the widely known electrician of that company. The address was reprinted in the Engineering Magazine, and the following is an extract from it:

"The first appearance of this electrical industry in Lynn was in the fall of 1883. We then had only factory 'A.' The lower floor we had for the heavy work, such as dynamos; the upper floor was for lamps, and the middle floor for development work, pattern work and drafting. Everything was packed into factory 'A,' and Mr. Pevear thought—this is a story which he laughs about nowadays—that we should not need all of this building. He said: 'Well, this business may not need the whole of factory "A," but anyhow the upper floor can be used for drying skins.' It was but a few months before not only did we want all the floors there were in 'A,' but more room. 'A' was loaded down from cellar to roof with all sorts of machines packed in closely everywhere, until it became doubtful whether the floors would withstand the weight, and I remember calling Mr. Baker's attention at one time to the floor weakening in 'A' on account of overload. This was later on. But in these early days that was the condition—almost a serious risk from the weight there was in that building. This soon led, in 1886, to the building of factory 'B,' which gave considerable relief. Then we thought we had a great deal of room. It was not very long, however, before that building filled up, too. The top floor was the incandescent lamp factory, the middle floor the pattern shop, model room and office, and the lower floor was used for dynamo testing for some time. Factory 'A' was given up to manufacturing parts almost entirely. Further on factory 'C' was built, and that was very soon filled; we kept on, as you know, and have now got pretty well along the alphabet, to factory 'R.'"

Present Status of Edison's New Storage Battery.

Thomas A. Edison says that his new ferro-nickel storage battery, upon which he has been experimenting for some years, will be ready to put upon the market in perfected form by October 1st. First one obstacle and then another has confronted the great inventor in his work, but he has stuck to the task with his usual persevering energy, and now he promises a cheap and trustworthy storage battery of one-half the weight of one with lead cells of equal output. A large new factory is in course of erection at Menlo Park, N. J., for the manufacture of these batteries. During the course of his experimental work 14,000 of these cells have been built. Some of these have been applied to delivery-wagon work, and 160 such wagons are now being operated in various parts of the country at a cost, it is said, of 58 per cent. of that of horses.

Equipped with these cells, Mr. Edison says that a vehicle could be run from Philadelphia to New York without recharging. In company with his son Charles Edison and Frederick Ott, one of his expert assistants, Mr. Edison recently traveled from Menlo Park to Philadelphia in an automobile equipped with the new battery.

International Association of Municipal Electricians.

The convention of the International Association of Municipal Electricians, at Erie, Pa., August 23d to 25th, will be characterized by an important list of papers. The papers already promised are as follows: "The Effects of Electrostatic Influence in Telephone and Telegraph Circuits," by H. R. Allensworth of Columbus, Ohio; "The Advisability of Fusing Fire and Police Telegraph Boxes," by C. E. Diehl of Harrisburg, Pa.; "Electric-light Engineering," by A. S. Hatch of Detroit, Mich.; "Erection and Maintenance of Electrical Lighting Plants," by C. L. Williams of Meridian, Miss.; "Suggested Improvements in Fire-alarm Telegraph Systems," by Captain William Brophy of Boston, Mass.; "The Necessity of a Rigid Inspection by the Municipality," by T. C. O'Hearn of Cambridge, Mass., and "Underground Construction," by Louis Gascoigne of Detroit, Mich.

The Reed House is to be the headquarters of the convention. Hotel rates ranging from $1.50 to $4 per day may be obtained at the numerous hotels in the city. The secretary of the association, who is prepared to give any information concerning the convention, is Mr. Frank P. Foster of Corning, N. Y.

BOOK TABLE.

THE COPPER HANDBOOK. (Vol. 5.) By Horace J. Stevens. Houghton, Mich.: Horace J. Stevens. 1905. Pp. (5¾ by 8½ inches), 882. Price, $5.

The fifth annual edition of the "Copper Handbook" contains 16 chapters, devoted to the history, uses, terminology, geology, geography, chemistry, mineralogy, finances and statistics of copper. The major part of the book is occupied by the chapter devoted to detailed descriptions of the copper mines of the world, 3,849 in number. These descriptions range from two lines to 12 pages, each, according to importance of the property.

In the five years of its issue the "Copper Handbook" has grown from a strictly local publication, the first issue having been devoted exclusively to Lake Superior mines, to a standard reference book.

AMERICAN STREET RAILWAY INVESTMENTS. (Vol. 12). New York: McGraw Publishing Company. 1905. Pp. (9½ by 12⅞ inches), 415, with 16 maps. Price, $5.

The twelfth annual edition of "Street Railway Investments" contains 415 pages of statistical matter, which represents an increase of 53 pages over last year. Many new roads have been built during the year and a number of roads hitherto furnishing no balance at the end of the year have supplied a balance sheet this year. Hitherto only names of companies reported have been included in the index. This year the index includes names of all underlying companies having bonds outstanding, even though the company has no corporate existence. Reports of interurban roads appear as a rule under the name of the largest town they serve. Forty-three companies reported for 1904 receipts of over $1,000,000 each.

FINANCES OF GAS AND ELECTRICITY MANUFACTURING ENTERPRISES. By William D. Marks. Philadelphia: Published by the author. 1905. Pp. (five by 7⅛ inches), 125. Price, $1.

In planning an electric railway—city, suburban or interurban—the very first question which arises is, will it pay? Though for obvious reasons this question cannot be answered with certainty from an inspection of results obtained from other railways of a similar character, it is still true that taking an average of the various factors entering into the problem as shown by the roads now operating will go a long way toward determining at the outset what it might be supposed that the proposed road will earn, taking into consideration the tributary population and the approximate cost of construction. The same holds true of gas and electricity manufacturing enterprises, and in this book the author has presented much data as to the actual results which have been obtained in such enterprises, with the aim to show how much ought to be charged by a gas or electric plants, and what net income electric railways should expect in order that they may be reasonably certain of success.

MODERN ELECTRICAL CONSTRUCTION. By Henry C. Horstmann and Victor H. Tousley. Chicago: Frederick J. Drake & Co. 1905. Pp. (4¼ by 6½ inches), 243, with 138 illustrations. Price, $1.50.

With the object of providing the beginner in electrical construction work with a reliable and practical guide, the authors have gone about preparing this book in an original manner, but one which appeals to the reader as, after all, a logical one. They have taken the National Electrical Code of the National Board of Fire Underwriters and used it in full as the foundation text of the book. Interspersed in the clauses of these rules are explanations regarding the work to which each of the rules applies. These explanations are amplified by numerous diagrams and pictures, which will be found of much value to the electrician. This method of teaching and explaining practical electricity resembles very closely the one by which the most successful practical workmen have learned the trade. Since the rules of the National Electrical Code are standard, one who follows the course outlined in the book will have the assurance that work done in conformity with it will be first-class. There are also given some tables in the back of the book which have been specially prepared for this work and which add materially to its value for practical men.

Wireless Tests on the Brooklyn.

A report of the space-telegraph tests made on board the U. S. S. Brooklyn by Lieutenant Kaiser on the recent trip to France and return showed that the longest distance at which wireless messages were read during the daytime was 540 sea miles, and at night 1,100 sea miles, while a wireless signal was heard at a distance of 1,780 sea miles. The message received at a distance of 1,100 miles came in strong and doubtless could have been heard at a still greater distance, it is said. These messages were from shore stations.

Sealed bids for the construction of a system of waterworks and electric lights for the town of Marksville, La., will be received by the mayor and Board of Aldermen until August 24th.

Telephone Train Dispatching on Indianapolis and Eastern Electric Railway.[1]

BY WALTER L. PEARSON.

The dispatcher's office is furnished with train sheet and train-order book, which are adapted to all requirements. All train crews are furnished with train-order blanks, also time-table showing all regular trains operated. Passing points are marked with heavy black-face type, also train number of all trains passed at each passing point.

All train crews report at terminals for orders and compare their time with Western Union clock at the dispatcher's office. Train crews reporting on schedule time are given their time-card rights and will meet trains as per time table. Train crews reporting late are given orders, which are written down by the conductor on a form provided, and the order is then repeated to the dispatcher, but is not in force until his "correct" has been received. Conductors then read and deliver the order to the motormen, who turn in the order at the dispatcher's office at the conclusion of run. The dispatcher then compares orders with his copy in the order book, and if correct the orders are destroyed; otherwise they will be held for investigation.

Copies of orders in the order book are retained and all order books are filed at the superintendent's office.

Train crews are allowed but one minute grace at passing points, and must meet trains within one minute of schedule-passing time, or report before train from the opposite direction is due at regular passing point. Under this condition the dispatcher never has to say, "Can you see them coming?" or "Call again in a minute or two," but knows exactly what order to give when he hears from a train crew. And in the writer's opinion this is the best and safest way to operate.

Train crews which have become late and are running on train orders must maintain running time or report in time to advance trains from opposite direction.

All cars are provided with a portable telephone, and we have a "drop" provided for these telephones every half mile. Each train is listed on the train sheet and has a column by itself, and in case trains are late a record is kept on the train sheet as well as the order book. For instance—a train has an order to pass a certain train at a certain switch. It is marked in its column, opposite the switch, "Pass No. 101," or whatever train it may be. And if a crew has an order to report at a certain point it is marked on the train sheet in the same manner as just mentioned. The object of this is that the dispatcher may always have a record of his orders before his eyes, and also that he can leave the desk at any time and another man take his place without any complications whatever.

In case a regular train becomes late and is being followed by a limited train, and the limited train passes around the regular train at other than a regular passing point, the regular train notifies the dispatcher at once, so that he may know that the limited train is ahead and is making schedule time; and trains may be operated in opposite directions accordingly.

All train men are under the immediate instruction of the chief dispatcher in the absence of the superintendent.

All second-class trains, including freight, construction, work and line cars are run as extras and display signals accordingly. Said trains have no rights except those given by the dispatcher and must be in the "clear" four minutes before arriving time of all first-class trains. In case telephone line is out of service, east-bound trains have the right-of-way over west-bound trains five minutes after schedule passing time.

All conductors are supplied with a tin box containing all the necessary signals. Conductor must have this box on his train at all times when on duty.

Green flags by day and green lights by night are known as caution signals, and all trains must be under full control while passing over a section of track where these signals are displayed. Green signals are also used on front of trains running in two or more sections, and denote that the second section of such train is entitled to the same rights as the first.

A motorman running first section of train in two or more sections, passing a train in a siding, must salute the train in siding with one long and two short blasts of the whistle, which signifies that there is another section to his train, and he must not pass the train in siding until he has been answered by two short blasts of the whistle, which signifies that the train in siding is aware that train on the main line is running in two sections.

Red flags by day and red lights by night are known as danger signals, and when displayed on the track that point must not be passed until cause of danger has been ascertained and signal removed.

A book of instructions covering all the points mentioned above is furnished each of the employes of the Indianapolis and Eastern railway.

1. A paper read before Indiana Electric Railway Association at Indianapolis on June 8, 1905. The author is chief train dispatcher of the interurban road named.

Indiana Telephone Items.

The Richmond Home Telephone Company is putting in a new exchange at Boston, Ind. The new system starts with 44 subscribers.

The Central Union Telephone Company, which recently completed a new exchange in Brazil, has filed a mortgage with the recorder for $25,000. This company is erecting a new system in Frankton to cost $10,000, and it proposes, in competition with the Home company, to drop the rate to 50 cents a month for each telephone. Since the headquarters of the Central Union were moved from Chicago to Indianapolis two years ago many outside plants have been entirely rebuilt, toll plants have been rearranged and pole lines have been overhauled and many hundred miles of new copper wire strung. Indiana has received 11 complete new common-battery exchanges, one each at Auburn, Brazil, Crawfordsville, Elkhart, Garrett, Lafayette, Mishawaka, New Castle, Peru and Shelbyville. The Indianapolis improvements include a complete new branch exchange at Irvington and also at Broad Ripple, where the subscription lists have been doubled. The farmers' lines have also been extended until a farmer can send and receive messages all over the state.

The effort to obtain such a modification of the ordinance under which the Citizens' Telephone Company of Kokomo is operating as would permit that company to enter into a contract with the Bell telephone company for long-distance service has failed. Realizing that the amended ordinance which the Citizens' company had before the council was doomed to defeat, if put upon its passage, the local company, at a regular meeting of council, withdrew the ordinance. This is a victory for the New Long-distance Telephone Company, it having persuaded the council to the belief that the real purpose of the proposed change in the ordinance was to enable the Bell company to obtain control of the local company's plant.

At the same meeting of the council it was announced that the records do not show that the Bell company has a franchise to do business in Kokomo. The council took the position that the Bell company was a trespasser, and if it refused to take out a franchise the company's property would be moved from the streets. A few days later the Bell company produced a franchise granted to the Western Telephone Company 22 years ago, which was transferred to the Bell company, and the city clerk neglected to make a record of the ordinance. The franchise has no restrictions as to time or rate.

The New Long-distance Telephone Company of Indianapolis has asked for a franchise in Frankfort, and an ordinance has been introduced, by the terms of which the company is to be given a franchise for 25 years, giving it the right to maintain poles, wires, etc., within the city limits, and in the event that the company is denied connection with the Bell company, it is to have the right to establish and maintain four toll stations within the city, one of which is to be located in the courthouse. The ordinance has passed its second reading. The New Long-distance company has an agreement with the Central Energy company by which connections are made through the local office, but the officials state that, as the Bell company now owns the plant, they are expecting to have their wires cut out at any time, and in such event they desire to be in a position to carry out the business in Frankfort. The company will not attempt to exercise any rights under the new franchise until it is cut out or discriminated against by the Bell company, now in control of the situation. S.

Ohio Telephone Notes.

The employes of the Cleveland Telephone Company had a picnic at Cottage Grove Lake, below Akron, one day last week. Over 600 of them went on two special trains over the Baltimore and Ohio road. They took part in games, had a nice lunch, and enjoyed the time generally.

William J. Bryan while at Lima a few days ago submitted to an interview in which he placed himself on record as favoring municipal telephone systems. He gave for a reason that one system is enough for any town, and that more than one works a hardship upon the people. Further, he said, there should be but one rural system in the country, and it should be owned by the counties.

It is reported that the strike of the linemen of the Black River Telephone Company at Lorain has been settled satisfactorily to all concerned. For a time it looked as if matters would become serious.

The plant of the Lancaster Telephone Company of Lancaster will be almost completely rebuilt by the Everett-Moore syndicate, a large part of the stock being held by the Federal Telephone Company. The plans include a new switchboard that will accommodate 2,000 telephones, the installation of cables that will do away with the wires and cross-arms in the downtown district, and a conduit to carry the wires into the rear of the Trout Building, where the exchange is located. About $75,000 will be spent on the city plant and $15,000

will be used in the improvement of the country service. Several gangs of men are now at work and others will be added. The company has a waiting list of 500, and it is believed these will all be supplied within a few weeks. C.

Telephone News from the Northwest.

The Tri-State Telephone Company has been granted admission to Eden Valley, Minn., for its toll service.

The Shakopee Telephone Company of Shakopee, Minn., has installed a bulletin board in the central office, and gives patrons the daily market report.

The Northwestern Telephone Exchange Company will install a local exchange at Minot, N. D.

Edward McClintock of St. Paul has invented a device for steam and electric cars which gives automatic warning of open switches. A telephone system for communicating between trains is included in the invention.

The council of Rushford, Minn., has granted a franchise to the Tri-State Telephone Company for toll connections.

The Farmers' Consolidated Telephone Company of Renville County, Minn., has been incorporated with $50,000 capital stock.

The Deerwood and Bay Lake Telephone Company of Deerwood, Minn., has been incorporated with $3,000 capital.

The Mississippi Valley Telephone Company will install an exchange at Columbus Junction, Iowa.

A long-distance telephone line is being built into Shannon City, Iowa. D. N. Smith has charge of the local exchange.

The Beeman Telephone Company has been voted a franchise at Batavia, Iowa. R.

TELEPHONE MEN.

E. J. Ellis, manager for the Pacific States Telephone Company in Oakland and Alameda counties, Cal., has resigned his position and has been succeeded by John Kearns, assistant division superintendent for the company at Oakland.

Frederick P. Fish, president of the American Telephone Company, has returned to Boston from a trip of several weeks to the Pacific Coast and intermediate points. Mr. Fish is thus reported: "On every hand I saw evidences of normal, healthful growth. Business in the West and Northwest is very good. There are no evidences of an unnatural boom, but business men and farmers are all talking confidently regarding the general business situation. I found that our western telephone managers are displaying the same energy in the development of their fields as is shown in the East. Of course, I found competition in various parts of the West. This is, of course, annoying, but not disturbing."

Howard M. Post has been appointed advertising manager of the Kellogg Switchboard and Supply Company, Chicago. Mr. Post is well known in the telephone-engineering field, having been connected with the engineering department of the Kellogg company for nearly four years prior to his taking hold of the advertising. Before going with the Kellogg company Mr. Post was connected with the Western Electric Company and was engaged in installing telephone switchboards all over the country. Mr. Post's thorough knowledge of the technical side of the telephone business will enable him to discuss intelligently with prospective users of telephone apparatus the merits of the Kellogg company's product. He will have full charge of all catalogue work, etc., in addition to his duties as advertising manager. While engaged as an engineer with the Kellogg forces, Mr. Post made several valuable inventions which are now in use in the system put out by the Kellogg people.

HOWARD M. POST.

NEW COMPANIES.

Among the recently incorporated telephone companies are the following-named: Farmers' Union Telephone Company, Winneton, Neb.; Carl Junction Telephone Company, Carl Junction, Mo.; Geuda Telephone Company, Geuda Springs, Kan.; Callaway and Arnold Telephone Company, Calloway, Neb.; Mulberry Telephone Company, Mulberry, Kan.; Citizens' Telephone Company, Mantell, Texas.

The Philippine Telephone and Telegraph Company has been incorporated at Reno, Nev., by J. Kearns, H. M. West, G. S. Tulloch and others, with a capital stock of $200,000, for the purpose of building telephone and telegraph lines in the Philippine Islands. It is understood that the company is controlled by the same interests as the Sunset and Pacific States telephone companies of San Francisco.

The Development and Future Tendencies of the Telephone Art.[1]

By Edward E. Clement.

The development of the telephone art as such has now extended over a period of 30 years, which, for purposes of comparison, divides itself into several distinct periods. In the first, extending from 1876 to 1880, the known art began with a wire running from one end to the other of Machinery Hall at the Centennial in Philadelphia, with a very crude magnetic telephone, such as we now call a receiver, at either end. During the five years that followed, the microphone was produced, the switchboard was born, and the forerunners of modern operating methods were evolved. This period was of historical interest only, a significant fact, however, being that almost every important departure of the next decade was then foreshadowed. There were no telephone engineers, the amount of business was too infinitesimal to permit the training of men, and so the first apparatus was rude and cheap, and in perfect keeping with the methods of operating, wherein the subscribers' operators shouted directions, or sent tickets around by boys.

The second period extended from 1880 to 1890. This was full of rich and interesting developments, and may be spoken of as the time of mechanical signals and magneto currents, or the local-battery period. In the earlier days, and, in fact, in some of the very first installations, batteries at the central office were employed for talking and signaling, but the primary battery, being then the only source commercially available, the magneto generator was adopted of necessity to signal with certainty over the gradually lengthening lines, and the talking battery, was put at the sub-station, where, with an induction coil, the efficiency was incomparably higher than when working through the line resistance.

The greatest and most significant feature of the local-battery period was the development and introduction of the multiple switchboard. This was rendered possible by the invention of the Warner spring jack, and in part by that of the tubular drop annunciator. Test circuits were worked out to such an extent that it is even now hardly possible to find or utilize a change in conditions for testing which was not thought of and tried before 1890 in some shape or form. The self-restoring annunciator came as a necessary and inevitable corollary, the best and simplest form having a heavy block held up by a hook on the end of a rod carried by the armature, and acting when released by falling forward and raising a thin aluminum shutter to uncover the number. When itself attracted, by the energization of the restoring magnet, the heavy block was pulled in and the aluminum dropped.

It was during this period also that the first serious attempts were made to lay cable underground, and in saying this I do not forget that the use of the lead-covered conductor goes back to the first telegraph line ever built. Morse and Vail dropped their lead pipe in the ground behind a plow, however, and it got punctured, so they ripped the lead off and put the wire overhead, after all.

It is correct to say that by 1890 the art of telephone engineering had been born, and Bell or no Bell, the men who made that possible, by giving their best years and their best energies to the work, deserve to be honored for the thoroughness with which they wrought, and the safe foundation they have given us upon which to build the magnificent superstructure of modern telephony. Many of them, like J. J. Carty, are still in the harness, and some of them are connected with Independent enterprises.

In the decade beginning with 1891 what I may call relay control came in. The common-battery system superseded the old magneto, or made great strides toward doing so, and what I have called the mechanical signal began to be replaced by the incandescent lamp. This latter was first used in Chicago in 1890, in connection with the trunk lines, and it needed very little experience to determine its superiority over any other form of signal.

In the spring of 1893 it was proposed to re-equip a large multiple board in the Chicago company's exchange with self-restoring drops, and the success of the lamps used for disconnect signals on the trunk lines caused it to be seriously considered, but it was not actually adopted until the Sabin "express board" was brought out in 1894. This board was designed, as its name indicates, to meet the wants of metallic-circuit subscribers whose telephonic business was large, and it was equipped throughout with lamp signals worked by relays energized by battery current controlled by the subscriber's hook. Nearly all the large boards built by the Bell people after 1895 were equipped in this way.

In the middle of this decade the Bell patents expired, soon followed by other fundamental patents, and the bars were at once thrown down for everyone who desired to get into the telephone field, I have tabulated the issue of telephone patents by sub-classes since 1876, and this irruption of new blood does not seem to have been productive of a very marked increase in the number of inventions recorded. Allowing for the abnormal discharge of the Kellogg accumulation of over 100 patents in 1897, the increase appears to have followed systematic lines, although it is noticeable that the banner year up to 1904 was the year 1897, with 1896 a close second. A resume of the patents granted each year may be of interest. In the five years from 1876 to 1880 there were 248 patents granted, of which 146 came out during the year 1880 alone, leaving only 102 for the first three years of the art, of which 30 were for microphone transmitters, and 29 for receivers. In the year 1881 there were 52 transmitters and 25 receivers patented, and up to that time there had been 24 step-by-step devices for party lines already evolved and 13 switchboards. From 1881 to 1885, 866 patents were issued, of which 306 were for transmitters and receivers, while about 100 were for switchboards. Taken year by year after that we find: 1886, 158; 1887, 107; 1888, 105; 1889, 70; 1890, 110; 1891, 70; 1892, 117; 1893, 145; 1894, 126; 1895, 160; 1896, 223; 1897, 259; 1898, 94; 1899, 132; 1900, 180; 1901, 193; 1902, 106; 1903, 188; 1904, 280; 1905, 74.

The increase in 1895, 1896 and 1897 is significant for this, that those matters which necessarily engrossed the immediate attention of the Independents jumped in the number of patents to double or treble for those years. Thus it will be remembered that everyone was casting about for some way of making a good transmitter, that being a sine qua non for conducting telephone business. Accordingly we find that the number of granular transmitters suddenly jumped from six in 1893 to 16 in 1894, 20 in 1895, 28 in 1896, and 19 in 1897. There have been 84 microphone patents granted since, of which 25 came out in 1904, which, for some reason, seems to have been a very productive year all along the line. The number of transmitters other than granular has been small, but I should say that over 90 per cent. of all these patents have been issued to the Independents.

The settling down of the Independent engineers, or, perhaps, I had better say the settling down of the Independent companies to the employment of engineers, did not come until near the close of the decade and of the century. As the movement solidified and it became apparent that there was no more danger of bankruptcy in the Independent than in the Bell ranks, many superior men left the older companies, and as they brought their crystallized ideas of practice with them, they hastened the process of evolution which was already going on.

We may say, therefore, that with the year 1900 the entire practice of the art had arrived at maturity, and its features may be reliably determined. We find the subscriber's apparatus practically standardized. For all large plants this was, of course, common-battery type, without any generator or battery, depending upon the switch hook for signaling, just as it does today. For smaller installations and party lines the series and bridging magneto telephones were on practically uniform lines. I might here remark that, among other things, this decade produced the commercial bridging bell telephone, although its origin dated back into the earlier magneto period.

In passing into the present decade all engineers found themselves confronted in designing by the following requirements: Common battery must be employed; multiple switchboards must be employed, with lamp signals, double supervisory signals, etc.; four-party selective service must be possible either on all lines or on a given proportion of the lines; pay-station and toll-line service must be provided for, and the operator's duties reduced to a minimum. The lock-out principle had been tried, but was generally discarded.

Another production of the lamp-signal period was the commercial automatic exchange, although its possibilities were denied most strenuously by the leading engineers, even after 1900. This, which had always been considered more or less chimerical, was made reasonably practicable through the efforts of a group of men who really deserve a great deal of credit. I refer to Messrs. Keith, Lundquist, Erickson, Dunham and others. The principles of this I would like to go into, but time forbids. I will merely state briefly, therefore, that the automatic system of today, of whatever design, is substantially and essentially a transfer system. A subscriber's line, through its individual switch or through a switch momentarily appropriated to its use, is trunked to the thousands group required, thence to the hundreds group required, and thence is connected with the wanted individual line terminals in that group.

Since 1900, and in what I might call the modern period of telephony, we cannot consider the art without giving serious study to the automatic. Its gravest defects so far have been that it fell short of meeting the requirements which I have mentioned in connection with the manual systems. It could not be worked with common battery, it could not give party-line service, and it would not permit the use of automatic pay stations. These defects, however, have apparently been reme-

1. Abstract of a paper prepared for the convention of the National-Interstate Telephone Association in Chicago on June 20th to 22d, 1905. The autbor is a patent expert in Washington, D. C.

died. Within the last year I have examined three different systems, all of which give common automatic service, two of them make party-line selective work profitable, and one of them includes means, not only for the ordinary pay-station operation, but more. According to this system, several nickels may be put in the box, and one call after another may be made. For each call the machine will test, and if the line wanted is idle, it will take one nickel; if the line is busy it will return it. After all the calls are made, and the proper nickels taken in, if there is any change the machine will return it.

I am bound to say that, while the common-battery feature above is perfectly practicable and has been commercially tried, the other features are still in experimental form.

The question in concrete form resolves itself into this: Is automatic apparatus likely to be produced which will materially lower cost without restricting the classes of service, or shall we have only improvements in existing systems and apparatus. In other words, is it to be manual or automatic? I believe the answer to this is that neither manual nor automatic apparatus and systems will be used exclusively.

Adhering to the stated requirements of standard practice, we find that some principles of the automatic can be, and, in fact, are, being combined with manual systems. For instance, there have been evolved several plans for semi-automatic operation. According to one, the subscriber sets up the number wanted on a mechanical sending device, which is tripped and runs down when the operator plugs in at central. The impulses transmitted serve to set up guiding signals before the operators on a manual-transfer board, which is bad, because the service must be slowed down. According to another, incoming calls are distributed by automatic switches among the different operators, automatically selecting idle operators.

A number of different inventors have worked out schemes for doing this, the subject having been agitated for a number of years. There will be choice between different systems, and if they get into commercial use competition will doubtless perfect them. Just what percentage of increase in the number of lines an operator can handle will result from these arrangements is somewhat problematical, and they will not substantially reduce the cost of a switchboard unless this percentage is so high as to greatly reduce the number of multiples; and in that case it would appear that the present distribution of lines on a board is more than ordinarily faulty.

According to a third plan, the operator receives her calls direct on answering jacks, as at present, and connects each calling line to a trunk leading to an automatic switch, which is controlled by the subscriber to complete the connection. This is my own plan, for which patents were granted some years ago. By its use the number of lines an operator can handle is greatly increased and the cost of installation and maintenance, as well as of operation, are greatly reduced, since the switches take the place of the multiple jacks. This plan can be applied to existing switchboards without changing their circuits, retains all their advantageous features, such as double supervision, and gives the possibility of raising a human operator at central if things go wrong. The worst feature of the full automatic system is that if you cannot work the machine you are hung up, and can only go to another telephone.

Another semi-automatic plan has recently been mentioned by Mr. Dean, and I have no doubt will be adopted by many companies. It does not change existing common-battery manual equipment, but has for its object to disconnect lines the instant the connected subscribers have hung up, thereby leaving both of them free to make fresh calls without delay. The method adopted makes no change whatever in the switchboard equipment, and adds very little in the way of apparatus.

So far I have referred only to improvements at the central office. The subscriber's station, in my judgment, will not be changed materially. In point of design, workmanship and materials, some of the telephone instruments put out this year are almost beyond criticism, and while there will doubtless be a normal progression, it will not amount to radical change.

With regard to the cable plant, and long-distance and toll lines, there are several problems to be met, but the solutions are not yet announced. The possibility of bringing a long-distance line through cable into or through a city without serious loss of efficiency is to be considered. According to the Pupin-Cambell method of the Bell people, a system of inductance-sources is introduced into the cable, tapered so as to lessen the liability to reflection. So far the Independents have nothing like this, although several schemes have appeared on paper; but it is probable that a working design will soon be announced.

Until the long-distance connections among our Independent companies are more nearly complete we will not be interested in repeaters or telephonic relays, but these also must come, and within the last few weeks a patent has been issued to the Bell people for a repeater which will work on composite circuits. This means New York and Chicago and beyond.

Valuation of Telephone Property in Indiana.

The Indiana State Tax Board has made public its preliminary assessment of telephone property in the state. The report indicates that the board yields to the plea of some of the larger companies for a reduction. Among the 350 telephone companies doing business in Indiana, perhaps the most noticeable decrease was made in the return of the Central Union Telephone Company's assessment from $54 to $40 a mile, making a total decrease in value of that company of almost $813,000. Another large decrease was made in the case of the Indianapolis Telephone Company, which was listed last year as the New Telephone Company at $160 a mile, and this year is dropped to $100 a mile. The assessment for the New Long-distance Telephone Company was increased from $30 to $40 a mile, while the American Telephone and Telegraph Company, carrying the long-distance business of the Central Union, remains the same, $40 a mile.

Some Independent companies, however, came in for an increase. As examples, the United Telephone Company of Bluffton was increased from $70 to $110 a mile; Delaware and Madison County, Muncie and Anderson, from $105 to $135 a mile; South Bend Telephone Company from $90 to $100 a mile; the Logansport Home Telephone Company from $30 to $35 a mile. Many other companies remain the same as last year. The assessment of the Cumberland Telephone and Telegraph Company (Bell), doing business in Southern Indiana, was decreased from $60 to $50 a mile. The mileage during the year has been greatly increased, and many plants have been rebuilt with better material and equipment.

GENERAL TELEPHONE NEWS.

The Wilson-Lyon Construction Company of San Francisco has secured a contract from the Pacific States Telephone Company for the construction of a new telephone building at Martinez, Cal.

The Home Telephone Company of Los Angeles, Cal., is putting in a long-distance line between Los Angeles and San Diego. The same company has let a contract for the construction of a line between Los Angeles and Pasadena.

The Board of Education in Cleveland, Ohio, will install microphones in the Willson Avenue School for the Deaf to instruct children who are able to distinguish sound in a slight degree. The plan was suggested by its success in an institution for the deaf at Rochester, N. Y.

The Independent Telephone Company has succeeded in obtaining a foothold in Ypsilanti, Mich., in spite of the strenuous opposition of the Bell company. An exchange has been established in the Batchelder Block and the common-battery lamp-signal system has been installed.

The first annual picnic of the employes of the Cuyahoga Telephone Company of Cleveland is scheduled for Luna Park, on August 5th. The festivities will commence at noon and will last until the park closes in the evening. The company will not shut down its plant, but the committee has so arranged the schedule that every one of the 600 employes will be present for a part of the program, either in the afternoon or evening. The general offices will be closed for the afternoon. The general committee is composed of O. F. French, W. B. Woodbury, F. B. Schrader and J. P. Boylan. F. S. Dickson, J. B. Hoge, R. W. Judd, W. L. Cary, Jr., B. H. Lang, M. B. Overly, C. Y. McVey, O. F. French and the Misses Tuttle, Marshall and Weaver constitute the reception committee. G. W. Keeley, J. P. Boylan, C. H. Nichols, Isaac Campbell, F. B. Schrader, D. B. McIntyre, P. C. Davis and R. C. Criswell have charge of the entertainment and sports.

The Central Illinois Independent Telephone Association will hold its third quarterly convention at Peoria, Ill., on August 7th and 8th. A matter of importance to be considered is the organization of the Independent telephone companies of the state into a state association. Manufacturers and dealers in telephone apparatus and material will exhibit at the meeting. The following-named papers will be read at the sessions: "City Exchanges and Underground Construction," by D. R. Craig of Aurora; "The Outcome of Telephone Competition," by W. F. Schwerdtfeger of Lincoln; "Rural Exchanges and Line Construction," by E. S. Sterrett of Henry; "Value of Independent Telephone Securities as an Investment," by O. F. Berry of Carthage; "Things that are Necessary to Make Independent Telephone Business a Success," by C. W. Buffum of Louisiana, Mo.; "Toll Rates," by E. W. Murray of Aurora. The Question Box is to be given special attention. Abundant entertainment is promised. Albert Schuler of Peoria is secretary of the association and G. H. Glass is president.

CORRESPONDENCE.

Great Britain.

London, July 19.—The report of the Royal Commission on London Traffic which has been made public is, as a matter of fact, only the first of eight volumes, but it contains the main report of the commission. Some dissatisfaction is being expressed with the report in that it is in no way definite or conclusive. The most ambitious portion of the report is that which deals with street improvements, for it is suggested that it would be advisable for somebody at some date to provide for two new main thoroughfares across London, one from east to west and one from north to south. Inasmuch as the estimated cost of these would be $120,000,000, it is not surprising to read the statement that this scheme is not anticipated to be taken up in the near future. Each of these avenues would have a width of 140 feet and would provide for four lines of electric tramways on the surface, as well as tube railways beneath the surface. Other recommendations are for a great extension of the tramways of London, especially in the direction of linking up north and south. The creation of a traffic board is also recommended, with limited and special powers, having the general control of measures affecting locomotion and transport, such a board to be appointed by the government. The absolute abolition of the "veto," in respect of tramways, which is now in the possession of local authorities, is recommended, while the further development of railways in shallow subways is favored in preference to tubes, on account of the high cost of the latter. Finally, it is reported that if private enterprise will not construct the necessary railways, the local authorities shall be empowered to give assistance by the remission of rates or direct contribution. A large number of new tramway routes are suggested by the board of engineers which advised the commission.

London's supply of electric power still continues the main topic of interest here. The big scheme is now under consideration by a committee of the House of Commons, the proceedings before which have been somewhat enlivened by the announcement that the promoters have succeeded in making terms with several of their hitherto keenest opponents, both local authority and company. In one case—a local authority—terms have been arranged that, beyond the capacity of the present generating station, all supply shall be taken from the big company at 0.66d. per unit. In another instance—also a local authority—the company, should its bill pass, will buy up the whole undertaking, and in still another local authority's case, the generating station will be purchased and the authority supplied in bulk. With the companies not quite so much progress has been made, but sufficient has been done to stay their opposition for the present.

On the other hand, one local authority, St. Pancras, is fighting the company more keenly than any opponent. This authority has been more successful than any in London and has now reduced its charges to the same as those proposed under the big scheme. It certainly looks at present as if the scheme will be passed, and, prima facie, one sees no reason why it should not, with proper safeguards. Certain it is that no similar concern has ever come before Parliament placing itself under such restrictions. On the other hand, such important interests are at stake that it may, after all, have been best to refer the question, for special consideration and report, to a special committee.

The general electrical exhibition which is to be held in London during September and October has already secured about 150 exhibitors, and the affair promises to be a success. The president is Sir William Preece, and it is said that various schemes are under consideration for popularizing the exhibition with the general public.

The committee on the acquisition of the National Telephone Company has now finished hearing evidence. The final evidence was provided by the employes, who asked to be given a guarantee that they should all be taken over in 1911. The postmaster-general refuses to give any definite guarantee, but verbally promises to take over all that he requires, which, he says, implies that the whole of the staff will be acquired. Therefore the only hope that the employes now have of a guarantee is that a recommendation will be made by the committee to this effect as a condition of passing the agreement.

The surface-contact tramways in Wolverhampton—Lorain system—continue successful, and the "trolley" company outside the city has agreed to equip some of its cars with the surface-contact equipment in order to provide a through service. G.

New York.

New York city, July 29.—The recently opened extensions of the subway are working satisfactorily, but there has been an undue crowding of passengers at stations in the Bronx. The Interborough Rapid Transit Company has therefore built an additional temporary platform at One-

hundred-and-forty-ninth Street and Third Avenue, which is at the point where north and south passengers transfer. The company reiterates its old argument, however, that the problem of dealing with the ever-growing Bronx traffic will not be solved until it is allowed to add another track to its Second Avenue elevated line.

A powerful electric winch is being used by the Thompson-Starret Construction Company in the work of erecting the framework of a new steel structure at 176-178 Broadway. Current is taken from the street mains by means of a specially armored cable, and the winch can be moved about the site according to requirements.

Fire, accidentally started by a kerosene lamp, caused damage at the boiler and engine house at One-hundred-and-forty-third Street and East River on the site of the proposed power house for the New York Central and Hudson River railroad. The contractors for this building are D. C. Weeks & Co. The outbreak, which did damage amounting to $2,000, will not materially retard their work.

Following complaints of some guests at the St. Louis Hotel, the police have on two occasions this week interposed late at night to stop the drilling work of the Manhattan end of the Pennsylvania-Long Island railroad tunnel.

While some track repairs were being made on the Myrtle Avenue elevated line in Brooklyn last night a gasoline torch was exploded by a spark from the third rail and two men were badly hurt.

The Niagara Falls and Lockport Electric Railway Company proposes to operate 20 miles of electric railway between Niagara Falls and Lockport, N. Y., and has accordingly been incorporated this week with a capital of $200,000. The directors of this enterprise are: E. C. Lufkin and J. N. Bradford of Buffalo, and S. P. Franchot of Niagara Falls.

The Williams Terminal Railway Company was incorporated at Albany today for the purpose of building and operating a new electric surface road in Brooklyn as an adjunct to the tracks of the New York Dock Company on Bowne Street. The capital of the corporation is $10,000 and the first name on the directorate is that of William C. Redfield.

The Dallas Electric Corporation of East Orange, N. J., has increased its capital from $2,000,000 to $5,000,000.

The Merchants and Miners' Telephone Company of Jersey City, N. J., has been incorporated with a capital of $500,000. The incorporators are S. R. Peary, James L. Stewart and Joseph Gales, Jr.

The Parker Clark Electric Company, with a capital of $500,000, has been incorporated, with headquarters in Jersey City. The directors are Kenneth K. McLaren, Thomas F. Barrett and B. S. Mantz. D. W. W.

Southeastern States.

Charlotte, N. C., July 29.—The Southern Power Company, which is planning extensive electrical development in the Carolinas, has already started construction work at the Great Falls, one of the large properties which have been secured. It is estimated that the new plant will have electric power in Charlotte within 18 months.

The town of Southport, N. C., is considering the question of a municipal electric-light plant and several bids have been received.

Under the consolidation of the two electric interests of the city of Columbia, S. C.—the Electric Street Railway, Light and Power Company and the Columbia Water Power Company—under the name of the Columbia Electric Street Railway, Light and Power Company, a new mortgage has been executed and the entire bond issue placed, except certain reserve bonds for future improvements. Extensive improvements in the near future are permitted by the available funds of the merged concern.

The Winston-Salem Power Company, with $125,000 capital, has been chartered in North Carolina and will develop electrical properties, etc. F. H. Fries and others are the incorporators.

The Coddle Creek Manufacturing Company of Cabarrus County, N. C., is chartered with a capital of $100,000 to manufacture cotton goods and electricity. R. M. Miller, Jr., of Charlotte is among the stockholders. L.

Ohio.

Cleveland, July 29.—The obstacles in the way of securing an entrance into South Lorain for the Avon Beach line of the Lake Shore electric is causing the officers of the company much annoyance.

The Sandusky, Mansfield and Norwalk has been almost completed between Norwalk and Plymouth, a distance of 25 miles. The difficulty in crossing the Baltimore and Ohio road having been adjusted, a two-hour service has been arranged between the points named.

L. E. Myers & Co. of Chicago have been awarded the contract for grading the roadbed of the Lima and Toledo Traction Company, the work to be completed within three months.

A meeting of the representatives of the bondholders of the Miami and Erie Canal Transportation Company was held in Cincinnati this week and arrangements for keeping the property together were gone over. The bondholders will resist the attempt to sell a portion of the southern end of the canal for traction terminals in Cincinnati as proposed.

For the first six months of the year the surplus for stock of the Lake Shore Electric is $57,498.06.

It is said that the details of the merger of the Pennsylvania and Mahoning Valley, the Youngstown and Sharon and the New Castle and Sharon electric roads have about been completed and that the proposition will be voted upon separately by the stockholders of each company within a short time.

The National Automatic Fire Alarm Company of Cincinnati and the National Automatic Fire Alarm Company of Ohio have signed leases that make them subsidiary companies of the American District Telegraph Company. The first will receive $6,000 a year, or 12 per cent. on its capital stock, and the latter $3,500 a year, or seven per cent. This will be paid into the treasuries of the companies and they may declare whatever dividend they see fit.

Mayor Johnson of Cleveland and President Andrews of the Cleveland Electric Railway Company have agreed upon the terms of a franchise for the cross-town line to be built on Doan Street and Woodland Hills Avenue. It will not extend the franchises of any of the roads it crosses. This line is badly needed, as a long ride is necessary for a person in the east end of the city to reach a point either north or south.

F. O. Olson, general manager of the Sandusky Southwestern, has returned from New York and announces that the portion of the road between Lima and Bellefontaine will be constructed.

It is intimated that the sale of the Springfield, South Charleston, Washington and Chillicothe road, now in the hands of a receiver, to Mr. Patterson, who promoted it, will amount almost to a reorganization. He is one of the heaviest stockholders.

The Oberlin Gas and Electric Company of Oberlin has been incorporated with a capittal stock of $10,000 by W. B. Whiting, A. J. Sperry, F. S. Whitcomb and C. E. Saunders.

W. H. Sharp, secretary of the Columbus Public Service Company, refused to testify as to rates charged by his company for lights in a hearing of the suit to compel the Columbus Railway and Light Company to furnish current at a five-cent rate. He said that such testimony would be divulging business secrets to competitors.

Judge Taylor of the United States court, in dismissing the injunction suit of the Alliance Gas and Electric Company against the city of Alliance, stated that the right of a municipal corporation to fix the price of public services does not amount to authority to make the figures so low as to result in confiscation, but only to make reasonable prices.

C. F. Smith, general manager of the Toledo, Bowling Green and Southern, is quoted as saying that the report regarding the sale of the road to the Elkins-Widener syndicate is unfounded. When the link between Findlay and Lima is completed, he says, the road will have a through route to Cincinnati, and, as it is now yielding a good profit, it is not for sale.

Dr. Roland A. Case of Cleveland has suggested that emergency surgical outfits that can be handled by laymen be carried on all electric cars and automobiles.

Captain D. H. James of Toledo has prepared articles of incorporation for the Toledo Southern Railway Company, with the purpose of building a through line from Toledo to Columbus. The nominal capital stock is to be $10,000.

O. M. C.

Indiana.

Indianapolis, July 29.—The Evansville and Newberg Railway Company has begun the work of constructing a branch line to Boonville from Woodmere. The right-of-way has been secured and all the preliminaries completed.

The commissioners of Vanderburg County have granted the Evansville and Mount Vernon electric railway the right-of-way from the boundary line to the Evansville city limits. The company shall have the privilege to furnish light, heat and power to the residents of the county.

The general manager of the Evansville and Princeton Traction Company is asking for bids for the construction of a large brick building at Ft. Branch for the housing of big transformers.

Indications are favorable that three new traction lines will be in operation out of Evansville by December 1st, being the Evansville and Mt. Vernon, Evansville and Henderson and the Evansville, Newberg and Boonville electric lines. Work on all are progressing rapidly.

The interchangeable mileage books in use on the traction lines in Ohio have been adopted by the Indiana Union Traction Company. This is the first road in Indiana to adopt the mileage book, but several other lines are considering the advisability of doing so. The books are similar to the interchangeable books in use on steam roads.

Work on the interurban line between Indianapolis and Greencastle is progressing rapidly. The Indianapolis and Western Traction Company has definitely decided to locate the power house on Big Walnut Creek, east of Greencastle. The power house and plant will be much larger than is necessary for present needs, as it is the intention to build a branch line to Rockville next year.

The first car of the Kokomo, Marion and Western Traction Company was run into Marion on June 26th. The line from Kokomo to Greentown has been in operation for a year, but the extension to Marion has just been completed. The line is 30 miles in length and has the latest equipment. The company will next build to Van Buren and Bluffton.

The city of Greenfield has passed an ordinance prohibiting the Indianapolis and Eastern Traction Company from using the streets for loading and unloading freight. This move will force the company to build a spur and a freight station.

The electric line between Terre Haute and St. Marys was completed this week. It is the intention to extend the line to Paris, Ill., at once.

C. B. Brinker of West Lebanon has invented a device that will automatically close any ordinary switch as soon as the engine or interurban car of an oncoming train comes within 120 feet of it.

Indianapolis liverymen say it is well enough for people to say that the automobile will never do away with the horse, but certainly it and the interurban car have almost put liverymen out of business. As a rule, the men who formerly rented a rig to go to the country for an outing now take an interurban car.

The Hawks Water Power Company of South Bend has been incorporated for the purpose of constructing dams in the Elkhart River for generating electricity for power purposes. The capital stock is $31,000, and Frank C. and Edwin W. Hawks and C. H. Gortner are the incorporators.

S. S.

Michigan.

Detroit, July 28.—The striking employes of the Bay City and Saginaw street railway are still out and all attempts at an adjustment are in vain. On June 4th the strike began and has been the means of a great loss to the street-car companies, the men and to the business interests of the Saginaw Valley. A labor league has recently been organized in Bay City as a result of the strike and it will enter politics by next election. Municipal ownership will be one of the main issues of the league.

The Detroit Common Council has returned to the Edison company its $1,000 check which was deposited by Alex Dow for an inspection of the city's light plant. The council says the check was refused because Mr. Dow would not allow the same kind of an investigation into his company's books.

The St. Joseph Valley Traction Company is to use the roadbed of the old steam road of the Coldwater and Mansfield Railroad Company. This company quit after everything was ready for the rails about 30 years ago. It was graded from Mansfield, Ohio, to Benton Harbor, Mich.

The Hastings Gas Company has sold its plant, recently installed, to the Thornapple Electric Company and will be known hereafter as the Thornapple Gas and Electric Company. A reduction in rates will be made.

The electric-light and telephone plants of Dundee have been put out of commission by a bad fire, which destroyed a large part of the business portion of the town. It is expected that the light and telephone service will be resumed in a few days.

State Game Warden Chapman is promoting a new electrical railway to run between Sault Ste. Marie and Cedarville in the Upper Peninsula. The line will be 35 miles long. The franchises have all been secured for the route outside of Sault Ste. Marie and an application is now before the council of that city.

The Murphy Heating Company will expend $200,000 additional capital in the extension of its system in Detroit. About $35,000 will be expended in a subway less than three blocks long to carry main supply pipes for the east side of town across Woodward Avenue. The tunnel will be seven feet high and six feet six inches in width. The chief difficulty in this construction is to find out what is now underground in this district, as no definite information can be had of the city except from the water board. A large number of drains and pipes will be encountered and will have to be provided for as the work progresses.

The Detroit and Cleveland Steamship Company is installing a new space-telegraph system on the steamer City of Detroit. Instead of a pole to elevate the antenna on its dock the Solvay Process Company's chimney, 300 feet high, will be used for an experimental trial.

The figures compiled by the Detroit Board of Commerce show there are 8,000 people employed in that city in the automobile business. The yearly output is nearly $12,000,000. Forty-two different styles of machines are made, running in price

from $450 to $7,500. The use of the gas engine is almost universal and the large amount of capital invested in this line of business before the advent of the automobile is responsible for this city becoming the automobile center of the country.

C. G. W.

Northwestern States.

Minneapolis, July 29.—It is announced that work will be started at once on the new street-railway system at Sioux Falls, S. D.

A preliminary survey has been made for the proposed interurban railway from Madison, Wis., through Janesville to Rockford, Ill.

The Central Railway Company of Des Moines, Iowa, has been incorporated and proposes to build a trolley line from Des Moines to Ames. The company is capitalized at $25,000 and is headed by T. J. Wilcox of Clinton, Iowa.

J. H. White has succeeded A. G. Mosher as manager of the Winona (Minn.) Railway and Light Company.

It is understood that the long-standing controversy between the Duluth-Superior Traction Company and the city of Duluth, Minn., will be settled shortly. Negotiations are now pending whereby the company will grant most of the improvements in the service asked for by the city, and in return the city will drop pending litigation. R.

Pacific Slope.

San Francisco, July 28.—The Siskiyou Electric Power Company of Yreka, Cal., has taken over the plant of the Yreka Electric Lighting Company, and E. T. Osborn of the latter company has been made vice-president of the former company. The Siskiyou Electric Power Company has now absorbed the six original power companies of Siskiyou County, and is distributing electricity for power and light over 90 miles of territory.

The Bay Counties Power Company of San Francisco has secured rights-of-way for a single-pole electric railway running from Marysville to Grass Valley.

The extensive franchises of H. H. Griffith for electric railways in Stockton, Cal., will be forfeited by the expiration of the time limit on August 16th. So far no work has been done.

The Yosemite Short Line Railway Company, which is preparing to construct an electric railway between Jamestown, Cal., and the Yosemite Valley, will begin work this week. Contracts were signed on July 25th for 50 miles of steel rails, delivery to begin in September.

E. A. Forbes of the Marysville and Yuba City Railway Company of Marysville, Cal., states that arrangements have been made to rebuild the company's line. Electricity will be employed throughout the system. The tracks will be made standard gauge, and new cars will be put on.

H. B. Kinney of Point Richmond, Cal., has purchased an electric franchise at Modesto, Cal.

Chief Engineer J. B. Robinson of the Northern Electric Company of Chico, Cal., states that contracts will be let at once for the Chico-Oroville branch of the company's system.

The Eel River Power and Irrigation Company of Eureka, Cal., has applied for a franchise along the public highways of Mendocino County from Potter Valley to Ukiah. Bids will be received for the sale of the franchise by the county clerk at Ukiah up to September 6th.

A preliminary arrangement has been effected at Los Angeles, Cal., for the consolidating of the pole lines in that city. All of the lighting, street-railway and telephone interests are arranging to use a single-pole line. This will do away with about three-fourths of the poles now in use on the streets of the city.

The Marysville and Nevada Power and Water Company has removed its headquarters from Smartsville to Marysville, Cal. W. W. Waggoner of Nevada City has been elected president and J. E. Ebert, secretary of the company. W. W. Waggoner will also act as chief engineer. The company will construct a large dam across the Yuba River, near Smartsville.

H. A. Dyer of the Butte City Hotel, Butte City, Cal., has put in a small power plant for the purpose of lighting his hotel, and is now arranging to sell the surplus for lighting and power purposes, having secured a franchise from the county authorities to erect poles and run a power line for a mile each way along the county road. He is also planning to pump water by electric power.

The San Francisco Electric Protective Society has asked for a 50-year franchise to install and operate a messenger and signal-box system. A.

PERSONAL.

W. W. Grant, vice-president and general sales manager of the Fibre Conduit Company of Orangeburg, N. Y., spent a few days in Chicago this week visiting the western office of his company and Chicago electrical companies and engineers.

Linden P. White, according to report, will soon retire from the position of assistant superintendent of the Columbus Railway and Light Company, Columbus, Ohio, to become general manager of the Columbus Structural Steel Company, a new corporation, which is just completing its plant. Mr. White will retain a connection with the railroad company as consulting engineer.

E. C. Folsom, general superintendent of the lines of the Fort Wayne (Ind.) and Wabash Valley Traction Company, has resigned to take a position with a New England traction company. He had been with the Indiana company two years.

W. E. Robertson, manager and treasurer of the Oklahoma Gas and Electric Compayn, has left Oklahoma City and gone to Tulsa, Okla., where he has taken charge of the Tulsa Electric and Gas Company, which has just installed a fine new plant.

G. A. Berry has been appointed assistant to W. H. Knowlton, principal assistant engineer of the electric zone of the New York Central and Hudson River railroad, with headquarters at the Grand Central Station, New York city. C. P. Marsh has been appointed bridge engineer to succeed Mr. Berry.

L. D. Mathes, general manager of the Union Electric Company of Dubuque, was in Chicago early in the week on business connected with his company, which does the electric-light and power and street-railway business of Dubuque, and which has one of the most modern and best-equipped power plants in the West.

F. L. Mowry, who resigned as superintendent of the Newark and Granville (Ohio) electric road a few days ago, has been made manager of the Stark Electric Railway Company of Canton, Ohio, of which Charles R. Morley has until this time been both the president and general manager. Mr. Mowry was originally from Boston.

Jacob Chester Chamberlain, an electrical engineer, died of pneumonia on July 28th at his home at No. 1 West Eighty-first Street, New York city. Mr. Chamberlain was formerly one of the officers of the Electric Launch Company of New York. He was also at one time a business associate of Isaac D. Rice, former president of the Electric Storage Battery Company. He was a member of the American Institute of Electrical Engineers, the American Historical Association and the Columbia Yacht Club, and was a graduate of Rutgers College.

Wallace M. Probasco, formerly assistant manager of the Westinghouse Companies' Publishing Department and organizer of the Westinghouse exhibits at the St. Louis Exposition, has become connected with the Searchlight Publishing Company of New York as vice-president. The Searchlight is a weekly paper and belongs to the class of weekly and monthly reviews of the progress of the world. The company also engages to look after the publishing and advertising interests of large manufacturers, engineering firms and railroads and has still other departments. Mr. Probasco has many acquainances among electrical men who will watch his career with friendly interest.

On July 14th there was an interesting ceremony at Clifton, Bristol, England, when William Marconi unveiled a tablet which the Clifton Improvement Association proposes to place on 3 Rodney Place, Clifton, where Sir Humphry Davy, Dr. Thomas Beddoes, Thomas Lovell Beddoes, and his aunt, Maria Edgeworth, formerly lived. Mr. Marconi said that the name of Sir Humphry Davy would ever live in the minds of men, for he was more than a genius. Few men had ever combined with such marked success the qualities of scientist and philosopher. It was appropriate that Clifton should, by means of the tablet, perpetuate the name of Humphry Davy, for it was here that he entered upon his public career.

ELECTRIC LIGHTING.

The town of Wilson, La., contemplates installing an electric-light plant and waterworks.

The proposition to issue bonds for a modern electric-light plant carried in Pontotoc, Miss.

The city of Asuncion, capital of Paraguay, is to have an electric plant, for furnishing light.

The Roswell Electric Light Company of Roswell, N. M., is arranging to replace its present electrical equipment with new machinery.

The plant of the Krebs Co-operative Ice, Light and Power Company at Krebs, Indian Territory, has been advertised for sale by the creditors.

Leon L. Stewart of Omaha, Neb., has been granted a 25-year franchise to build and maintain an electric-light and power plant in Sumner, Iowa.

The Clark Electric Power Company of Salt Lake City, Utah, has been granted a franchise for the establishment of an electric-light plant at Grantsville, Utah.

The York Electric and Power Company and the York Gas Company of York, Neb., have consolidated under the name of the York Electric Light, Gas and Power Company.

The Roodhouse Light, Heat and Power Company intends to construct an electric-light, heat and power plant in Roodhouse, Ill. The company has just been incorporated with a capital of $30,000 by E. C. Kreider, Sr., W. J. Kreider and Nellie C. Kreider.

The Oakdale Light, Heat and Power Company of Peru, Ind., has been incorporated with a capital stock of $50,000 by Rawley H. Bausing, Aaron N. Dukes and Richard A. Edwards.

Sealed bids will be received by the city clerk of the city of Waukegan, Ill., until August 7th for lighting the city with 200 arc lights for terms of three, five or 10 years, at option of the City Council.

The finance committee of the council of Escanaba, Mich., has recommended that the people vote bonds to the amount of $60,000, five-sixths of the amount to be used for the improvement and enlargement of the lighting plant.

The Hawaiian Electric Company of Honolulu has contracted for two 1,200-kilowatt, three-phase, 2,200-volt Westinghouse engine-type generators, two 125-kilowatt exciters and seven 500-kilowatt oil-insulated, self-cooling, transformers.

Tawas City, Mich., is to have a complete lighting plant for street and commercial lighting, and work is already under way upon the installation, the contract for which was obtained by the Thorne Electric Company of Bay City, Mich.

A contract to build and equip a new electric-light and power plant at Pittsburg, Kan., has been awarded to the Westinghouse Machine Company of Pittsburg, Pa., by the Home Heat, Light and Power Company. The plant will cost $60,000 or more.

The Luz Electrica de Tuxpam has been organized at Tuxpam, Mex., for the purpose of constructing a new electric-light plant. The company has an authorized capital stock of $35,000. Van Voorhis Bros. of Monterey, Mex., have secured the contract for the work, which will be begun early in September.

The Canadian steamship Arctic, which is at present under the command of Captain Bernier and preparing for an extended Arctic voyage, is to have a novel electric-light plant. Since fuel to generate steam cannot be obtained, and as the ship will have to spend many months in darkness, it has been decided to install an air-compressor plant to be operated by a windmill. The compressed air will then be used to operate the generators, which will furnish current to charge the storage batteries supplying the light.

Later reports indicate that the damage to the plant of the Freeport (Ill.) Railway, Light and Power Company was not quite as serious as was stated in the Western Electrician last week. A. J. Goddard, manager of the plant, had experts on the spot in a few hours repairing the damage, and current for lighting was to be had in 40 hours and 45 minutes after the fire; the street cars were out of service only a little over four hours, after which they began operation, using current from Rockford, at great expense.

The City Council of Racine, Wis., has refused to accept bids of the Milwaukee Electric Railway and Light Company for illuminating the streets of the city for a period of five years, referring the report of the committee favorable to the bids to the council as a committee of the whole. The bids were $56 for one o'clock light and $72 for all-night lights. All members of the council expressed themselves in favor of municipal ownership of both waterworks and electric-light plant. The contract with the company expired July 1st and the company accommodated the city, furnishing light at old prices.

ELECTRIC RAILWAYS

J. B. Titus, W. A. Steele and S. W. Wright, Jr., have incorporated as the Southern City Railway Company to build a street railway in Sullivan, Ill.

Contracts for an electric line from Oklahoma City to Sulphur Springs have been closed and the line will be completed inside of a year.

If reports are true, the Belvidere (Ill.) Gas and Electric Company will furnish power for the proposed Belvidere-Elgin interurban line, which would mean the erection of a large power house in Belvidere.

The Kankakee (Ill.) electric street-railway system and Electric Park have been sold to R. A. McCracken and E. D. Risser of Paxton and C. O. Patton of Chicago. The reported purchase price is $100,000.

The Oklahoma Electric Railway Company of Tecumseh has been granted a charter, capitalized at $250,000. The company will build an electric railway out of Shawnee. Alfred Hare and E. H. Milburn head the incorporators.

An electric railway to connect with the Chicago and Oak Park Elevated and extend through the various towns to McHenry, Ill., is to be built if the plans of the Illinois and Wisconsin Railway Company are carried out. The company has just

been incorporated by G. M. Stevens, Henry Lutzenkirchen, G. W. Bryson, C. E. Crafts and H. K. Crafts. The length of the road will be about 45 miles and it is said the right-of-way is practically all secured.

It is said that a syndicate has been formed at Brussels, Belgium, for constructing a direct line from that city to Berlin. It is to use electric locomotives of high power, and the trains are to cover the distance between the two cities in seven hours. This will require a speed which exceeds 90 miles an hour.

The Chattanooga (Tenn.) Electric Railway Company has raised the wages of its employes who have been with the company over one year. Each succeeding year of service hereafter will bring to the employe a specified raise in pay, thus affording an inducement for the best men to remain with the company.

The Las Vegas (N. M.) Street Railway Company has voted $100,000 for extensions and improvements of the system. A new power house is included in the plans. W. A. Buddecke, president of the company, has been elected president of the Northern New Mexico Fair Association, which will hold its annual fair at Las Vegas.

The Detroit, Monroe and Toledo Short Line electric railway tendered a banquet at Monroe Piers to 50 interurban railway men, newspaper men and friends a few days ago. President Slush of the company predicted that there would be a new central interurban depot in Toledo, Ohio, within a year or a little longer.

The McKinley syndicate, which is developing an extensive electric-railway system in Illinois, proposes to construct an electric belt railway around the city of Springfield. The road is to touch all the steam and electric roads entering the city and will serve as a means of handling freight for the mines, manufacturing plants and jobbing institutions about Springfield.

Thomas A. Combs, mayor of Lexington, Ky., has been elected vice-president of the Central Kentucky Traction Company to fill the vacancy caused by the resignation of John McClintock. The vacancy caused by Mr. McClintock's resignation on the board of directors was filled by the election of John Skain. Contracts for supplies for the Versailles road have been let. The board of directors propose building a sub-station at Fort Spring, the current to be transmitted from the Blue Grass Traction Company's wires.

Assessment of interurban traction lines in Indiana has been nearly doubled, the increase made by the board raising the total to $26,378,366, compared with a valuation of $13,702,398 last year. A close examination of the assessment schedule shows that while the aggregate assessment is much greater, there is no marked general increase in the individual assessment per mile, the increase being due both to the extension or increased mileage of old roads and the building of new roads. Railroads have been increased from $165,863,367 in 1904 to $177,660,857.

Important interests in Paducah, Ky., consisting of the properties of the Paducah City Railway Company, the Paducah Gas and Fuel Company and the Paducah Steam Heating Company, were sold recently to Stone & Webster of Boston and a number of Louisville people. The local stockholders of the concerns named will retain 30 per cent. of the stock, but will resign their positions. The purchase price was $1,440,000. It is the intention of the purchasers to improve all three systems to a considerable extent, and $300,000 or $400,000 will be expended to that end. The railway company has 16 miles of track already laid.

Th St. Louis, St. Charles and Western electric railway, running from Wellston to St. Charles, was sold at trustees' sale at Clayton, Mo., a few days ago. The road was bought in by a syndicate of St. Louis capitalists, headed by Festus J. Wade and Thomas W. Crouch, for $495,000. It is reported in financial circles that the syndicate will turn over the line to the United Railways Company. The men in the deal would not confirm this nor would they deny it. Another report was that the Suburban system had bought the line. Captain Robert McCulloch, general manager of the United Railways, was a bidder at the sale.

POWER TRANSMISSION.

Stockholders of the Vernon Okaragon Land Company of Vernon, B. C., are preparing to organize a company to utilize the waterpower of Shuswap Falls in the developing of electrical power. An electric railway will be built from Vernon to Lumby. It is planned to organize a company with a capital stock of $150,000.

What is known as the Fife electric power scheme is for the supply of electrical energy over about 500 square miles and to about 50 local authorities in Scotland. The parliamentary powers were obtained by the company in 1903. There are to be five power stations—at Dunfermline, Leven, Markinch, Comrie and Cupar—and the first-named is now in course of completion, but the company has power to erect more generating stations as may be required. A beginning is being made at Dunfermline, because there are numerous works and collieries in the vicinity, and also because its industrial importance is expected to increase as the new naval base at Rosyth, in the near neighborhood, is developed.

The Rumford Falls Power Company of Rumford Falls, Me., will install one 550-kilowatt and one 800-kilowatt alternating-current Westinghouse generator, both of which will be direct connected to waterwheels. The order includes two 450-horsepower variable-speed induction motors, and 120 transformers for use on the distributing lines.

SOCIETIES AND SCHOOLS.

The Colorado Electric Light, Power and Railway Association will hold its annual convention at Glenwood Springs, Colo., September 18th to 20th.

The fifteenth ordinary meeting of the Faraday Society was held on July 3d at the Institution of Electrical Engineers in London. Mr. W. R. Cooper presided. The papers read were: "Some Notes on the Rapid Electrodeposition of Copper," by Sherard Cowper-Coles; "The Use of Balanced Electrodes," by Prof. W. W. Haldane Gee, read in abstract by R. S. Hutton; "Electrolytic Oxidation of Hydrocarbons of the Benzine Series," by H. D. Law, read in abstract by Dr. F. M. Perkin; "The Electrolytic Analysis of Antimony," by H. D. Law and Dr. Perkin; "Notes on Heat Insulation," by R. S. Hutton and J. R. Beard; "Storage Batteries and Their Electrolytes," by R. W. Vicarey, and "Alternate-current Electrolysis," by Prof. E. Wilson.

PUBLICATIONS.

Extra copies of the "Question Box" and "Wrinkles" of the Denver convention of the National Electric Light Association may be purchased by addressing the secretary at 136 Liberty Street, New York city.

Bulletins Nos. 56 and 57 of the Crocker-Wheeler Company of Ampere, N. J., supplementary to bulletin 55, describe Crocker-Wheeler generators connected respectively to Case and Forbes engines. The former are 1½ to 17 kilowatts capacity and the latter two to 21 kilowatts.

The latest catalogue issued by Mathias Klein & Sons of Chicago, covering linemen's and construction tools, will doubtless prove of interest to every user of these products. Everything known in the line of tools can be supplied by this long-established house. The company will be pleased to mail its new catalogue on request.

A neat booklet describing the Robert volt-ammeter has been issued by the Robert Instrument Company of Detroit, Mich. The instrument is of convenient pocket size, containing no delicate springs or intricate movements. It is especially valuable for testing the igniting devices on automobiles, gas engines, electric launches, etc.

The Dayton Manufacturing Company of Dayton, Ohio, has issued a bulletin which is designed to educate storage-battery users to the advantages of the Silvey storage-battery system for isolated plants and private residences. A good deal of valuable information concerning such installations in general is contained in the bulletin, and those interested in this subject will find much in it which will be of assistance.

The Chicago House Wrecking Company of Chicago recently issued a catalogue containing a complete list of the electrical material which it secured through the purchase of the St. Louis World's Fair. Everything electrical used at the Fair came into the possession of this company, and as a consequence the company says it is in a position to offer many exceptional bargains. The company will be glad to mail its catalogue on request.

Th Century Electric Company of St. Louis describes its line of single-phase alternating-current motors in a bulletin just issued. These motors are self-starting under load, the only starting device being a double-throw single-pole switch. They are adapted to the operation of any kind of machinery not requiring extremely frequent stopping and starting or speed variation through the motor. Full details as to the installation of these motors are contained in the bulletin.

Accompanying a little book of rhymes, entitled "'Light' Reading to Brighten a Dull Half-hour," the Edison Electric Illuminating Company of Brooklyn is sending out a quantity of convincing literature in support of its contention that electric light is the best artificial light known. Since July 1st this company has reduced the price of current to retail customers to 12 cents per kilowatt-hour for light and 10 cents for power, the latter finding extensive use in connection with fans, sewing machines, chafing dishes, curling irons, etc.

MISCELLANEOUS.

A German chemist by the name of Erfeurt has succeeded, it is said, in transmitting the qualities of radium to a substance he calls radiopher. This substance possesses the qualities of the original radium and may be injected under the skin for medical purposes.

The New York Central railroad has filed plans with the Bronx building department, New York city, for seven buildings to be erected in the company's yards at Sedgwick Avenue, High Bridge. The plans include a one-story frame electric locomotive shed 24 by 176 feet, a roundhouse of irregular dimensions to cost $24,000, a sand house, shops and offices.

A London inventor named Whitehouse is said to have made successful tests on the English Channel of an electrically operated device which overcomes the motion of a vessel at sea and thereby prevents seasickness. A swinging berth is supported by four cords. These cords are operated by the electrical device to counteract the motion of the boat.

In the Federal Court at Indianapolis the Western Union Telegraph Company is asking for a perpetual injunction to restrain the Vandalia Railway Company from removing the wires, molesting, or in any way interfering with the telegraph lines along the right-of-way of the steam road. The railway company notified the telegraph company last January that it must cease using the right-of-way.

A daily newspaper has discovered a "young doctor" who in turn has discovered the "electricity habit," which, in contrast with the drink habit and drug habit, he says, is usually beneficial. "The electricity habit is contracted just like any other habit. A few currents are administered during an illness; they strengthen and stimulate, and the first thing the patient knows he finds the tonic indispensable. Even after he gets well he craves the treatment. Not all the electricity fiends are invalids, by any means. Many of them are now as well as they ever were, yet they have become so addicted to the habit that they require the weekly, semi-weekly or possibly daily electric thrills to tone them up." And thus it was for many a day!

Conditions governing the laying of underground conduits in the City of Mexico are very peculiar, and they necessitate a method of construction quite different from that employed in a more stable soil. In that locality earthquakes are comparatively frequent and the soil is permeated with water a few feet under the surface. The conduits used are made up of round cylinders of cement about three feet long and having ducts running through them. The end of one section fits into a recess in the end of the next, forming a thimble joint like the ordinary drain pipe. The joint is then caulked and filled with hot asphalt. This makes a water-tight joint which has a sufficient degree of flexibility to lend itself to the slight undulations of the earthquakes.

TRADE NEWS.

The Eureka Electric Lamp Company of Cleveland, Ohio, has been incorporated with a capital stock of $10,000 by William Rothschild, G. B. Harris, Ethel M. Close, Fred Desberg and Joseph J. Klein.

Dispatches from Cleveland are to the effect that the old United States Carbon plant there has been purchased by interests identified with the Standard Oil Company and that the plant is to be repaired at the cost of $100,000 and opened for business.

The city of Iquitos, Peru, is showing commendable public spirit and enterprize. The following public works are projected in that city: A hospital building to cost $50,000, an electric plant for lighting a space-telegraph station to communicate with Puerto Bermudez, and a railroad between Cerro de Pasco and the river Marannon.

The Barriett Electric Manufacturing Company of Cincinnati, Ohio, has been incorporated with a capital stock of $25,000 by C. H. Haddrell, Mrs. L. K. Behrens, Edward Shideler, E. L. Laralde and Henry Bentley. The company will succeed to the business of the Barriett Electric Company. The new company announces that its latest style of motor, the Barriett type F, is now ready for the market.

The Elmwood Electric Light Company of Elmwood, Ill., has just secured a 50-year franchise in Maquon, Ill., and will soon be in the market for two cars of 25-foot five-inch-top poles, 7,000 pounds of No. 6 bare copper wire, two 30-kilowatt (6,600 to 1,100-volt transformers, 500 two-pin arms with pins and bolts, 3,000 feet No. 14 rubber-covered insulated wire, and interior wiring supplies. When the Maquon extension is completed the Elmwood company will be serving four towns, with prospects of others. Mr. E. L. Brown is manager of the company.

The Bureau of Supplies and Accounts, Navy Department, is inviting sealed proposals until August 8th for furnishing eastern navy yards with

the following: Schedule 39, electrical conductors, cable, wire, annunciators, testing set, cells, etc.; schedule 42, motors. Blank proposals can be obtained at the navy pay office in New York. On August 8th the bureau will open bids for furnishing the Pensacola navy yard with electrical supplies, cable, telephone wire, etc., embraced in schedule 44, which can be obtained on application to the bureau. On August 15th the bureau will open bids for furnishing western navy yards with the following: Schedule 46, telephone cable; schedule 47, conduit, voltmeters, ammeters, circuit-breakers, switches, lights, Grimshaw and Okonite tape, wire, cable, micanite board, etc. Blank proposals can be obtained from the bureau.

BUSINESS.

In a note printed in the Western Electrician last week describing the exhibit of Johnson & Morton of Utica, N. Y., at the Boston electrical exhibition the expression "cotton link" fuse should read "open link."

A. W. Beresford, secretary of the Cutler-Hammer Manufacturing Company of Milwaukee, was in Chicago this week in the interests of his company. Mr. Beresford says that the demand for Cutler-Hammer products was never better than at present, and he anticipates a heavy fall trade.

The plant of the Sills-Eddy Mica Company, manufacturer of mica products, on Frelinghuysen Avenue, Newark, N. J., was destroyed by fire a few days ago. The origin of the fire is unknown. The plant consisted of a main structure and several smaller buildings. The loss is estimated at about $50,000.

F. B. Badt, the well-known electrical engineer of Chicago, has just returned from a six weeks' vacation. Mr. Badt seems much improved in health and states that he is prepared to handle any number of orders—no matter how large—for any of the well-known specialties for which he is the western agent.

Orders have been received by the Westinghouse Electric and Manufacturing Company from Nelson Morris & Co. for 19 type CCL induction motors varying in size from five to 50 horsepower and totaling 410 horsepower, and for eight motors of the same type from the Decatur Car Wheel and Manufacturing Company of Birmingham, Ala. These are the latest design of induction motors which have been built by this company and have just recently been placed on the market. On the same day an order was entered from the Illinois Steel Company for 80 direct-current motors having an aggregate capacity of 3,920 horsepower. These motors are all of the railway type and range from 30 to 75 horsepower.

Pass & Seymour of Solvay, N. Y., announce that it is their intention materially to increase their facilities for handling orders in the territory covered by their Chicago office, and to this end have secured the services of Mr. W. F. Hessel, formerly sales manager of the Western Electric Company, at Chicago. Mr. Hessel's long experience and intimate acquaintance with the materials and needs of the electrical business is of such a character that Pass & Seymour are more than pleased to announce his association with them, and wish to advise their customers that they want them all to feel at liberty to call upon him at any time for information, not only regarding their line of electrical specialties, but also regarding any problem of a general nature on which his past experience will be of service. Mr. Hessel's headquarters will be at 130 West Jackson Boulevard.

Space No. 2 at the Contractors' Electrical Exhibition in Boston recently contained exhibits of the Safety-Armorite Company, the Condit Electrical Manufacturing Company and S. B. Condit, Jr., & Co., of Boston. These were represented by S. B. Condit, Jr., P. R. Fisher and F. W. Nason. The first-named company exhibited a neat rack of conduit, showing all sizes from three-eighths-inch to four inches, both in Loricated duct and Galvaduct. The Condit Electrical Manufacturing Company showed a switchboard having two panels of laminated type circuit-breakers and switches. S. B. Condit, Jr., & Co. exhibited a large sample board, showing a complete line of Toler switches, outlet and junction boxes and T. & B. bushings, lock nuts, fixture studs and box connections as manufactured by Thomas & Betts of New York city, for whom the company is agent. There were also in attendance Robert Garland and F. C. Hodkinson, treasurer and secretary, respectively, of the Safety-Armorite Company, Pittsburg, and H. D. Betts of New York.

The Duncan Electric Manufacturing Company of Lafayette, Ind., is making preparations to take care of a very large output of its direct-current wattmeters. The company asserts that its shipments the last month have averaged 157 direct-current wattmeters a day. Taking this as a forerunner of a heavy business later on, new facilities for manufacturing are being added. The testing room is to be extended 58 feet, doubling the output of the department. Much new machinery is also to be added. A special department for the manufacture of switchboard meters has been instituted, and machines necessary for doing this work have been specially chosen. The shipments of the company have become so numerous that it has just finished the erection of a special building in which to make boxes as well as store excelsior. Ever since the Duncan company went into business it has always been its aim to improve upon its meters whenever requirements demanded, and this course seems to have won for it the admiration and patronage of a large circle of friends.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) July 25, 1905.

795,285. Switch. William S. Jackson, Hoboken, N. J. Application filed August 27, 1904.

The trolley switch comprises a support, a contact member carried thereby and an actuating member mounted upon the support and operable by the trolley. The actuating member is extended in the direction of travel of the trolley and oppositely movable thereby, a second contact member being movable by the actuation of the first-named member.

795,312. Receiving Apparatus. Harry Shoemaker, Jersey City, N. J., assignor to the International Telegraph Construction Company. Application filed February 13, 1905.

Receiving apparatus for a space-telegraph system comprises a receiving conductor, a source of electrical energy comprising an electrochemical cell associated therewith as a wave-responsive device and a local circuit connected in shunt to the wave-responsive device and including a signal-translating instrument.

795,314. Signaling System. Howell W. Souder, Tamaqua, Pa., assignor of one-half to W. D. Zehner, Lansford, Pa. Application filed September 27, 1904.

Electric signaling apparatus is composed of a signal circuit having two terminal branches, a feed circuit, two switches arranged to connect the feed circuit with these branches and electromagnetically operated means for opening either switch after the other is closed.

795,318. Annunciating Mechanism. Charles E. Trump, Philadelphia, Pa., assignor to the Novelty Electric Company, Philadelphia, Pa. Application filed July 28, 1904.

Annunciating mechanism comprises a visual signal and an electric circuit having electromagnetic mechanism and normally open spring contacts therein. The signal is thrown and held by the electromagnetic mechanism upon closing the contacts, and automatically restored to its initial position upon the opening of the contacts. A second electric circuit has an electromagnetic mechanism and a switch therein, and a signal held in its initial position by the last-named mechanism is automatically thrown to close the contacts upon the closing of the switch.

795,322. Railway Block-signal System. Ludwig S. Walle, Brooklyn, N. Y., assignor to Fridtjof Jebsen, Bergen, Norway. Application filed December 29, 1903.

The semaphore signal has an electric solenoid acting intermittently with a counterweight to operate the signal successively and intermittently through intermediate positions. Means for closing the solenoid circuit when a train passes a predetermined point are provided.

795,323. Apparatus for Electrothermal Treatment. Daniel M. Watson, Portland, Ore. Application filed December 7, 1904.

An apparatus for electrothermal treatment by means of electric incandescent lamps is the basis of the patent.

795,325. Galvanic Battery. David L. Winters, Chicago, Ill. Application filed November 2, 1904.

The battery comprises a containing cell, positive and negative electrodes, supporting means for the electrodes and a circuit-closing member attached at its upper end to the supporting means of the positive electrode to depend into the electrolyte. This device is adapted upon the disintegration of the positive electrode to move into contact with the negative electrode and effect a short circuit in the cell.

795,340. Circuit-closer. Eugene R. Carichoff, East Orange, N. J., assignor to the Sprague Electric Company. Application filed August 25, 1900.

A reciprocating member of the circuit closer has two bridging bars which engage with two sets of yieldingly mounted contacts electrically connected in parallel and arranged to open and close successively. These contacts have a rocking and transverse movement on the bars. A magnetic blow-out is also included.

795,361. Speed Indicator. Michael J. McDonnell, St. Louis, Mo. Application filed April 8, 1905.

A device for registering the pulsations of motors includes an indicator circuit and an indicator in the path thereof. A time mechanism whose circuit is in multiple with the indicator circuit is provided, also means controlled by the time mechanism for automatically making and breaking the time mechanism circuit. Means in the indicator circuit momentarily close the indicator circuit during each pulsation of the motor.

795,369. Automatic Controller. Ernest Schattner, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 8, 1904.

An automatic controller comprises a switch, means responsive to a predetermined load for opening the switch, means for short-circuiting the switch, a casing for the controller having an opening, and a seal for the opening so arranged that the short-circuiting means can be operated only by the rupture of the seal.

795,392. Automatic Regulator for Alternating-current Motors. George H. Hill, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed January 15, 1904.

Combined with a repulsion motor are a brush-shifting device therefor responsive to variations in current flow through the motor, a latch for retaining the device in its starting position, a tripping-magnet for the latch responsive to current flow through the motor and means for returning the device into engagement with the latch. (See cut on next page.)

795,402. Telegraph and Like Cable. Oliver J. Lodge, Birmingham, England. Application filed December 9, 1904.

A substantially distortionless cable has a core of low resistance. Iron divided longitudinally surrounds the core and a waterproof sheathing with means whereby leakage is allowed between the core and the outside of the cable is provided.

795,403. Telephone Call Register. August Meyer, Baltimore, Md. Application filed August 24, 1904.

Combined with a suitable frame are dial, indicator, sound producer and an operating lever. Connections between the lever and indicator register a call with each operation of the lever.

795,432. Polarized Armature Apparatus. Martin Fischer, Zurich, Switzerland. Application filed September 1, 1904.

Pole pieces of an electromagnet have their pole faces inclined in opposite directions. An armature rocks on centers on the pole pieces, a line through the centers intersecting a line passing through the centers of the pole pieces.

795,436. Snap Switch. Henry Geisenhöner, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 19, 1902.

The essential parts of the switch are a switch blade, a crank pin, a link-connecting means between the blade and crank pin whereby rotary motion of the pin produces oscillating motion of the blade and means for intermittently rotating the pin.

795,452. Trolley Wheel. William K. Richardson, Leavenworth, Kan., assignor of one-half to Martha L. Richardson, Leavenworth, Kan. Application filed October 17, 1904.

The trolley wheel comprises a pair of metal disks which form the body of the wheel provided with central transverse openings having countersunk ends and a tubular bushing inserted through the openings and having its extremities expanded into the countersunk ends.

795,459. Spark Plug for Explosive Engines. Fredus A. Thurston, Chicago, Ill. Application filed February 17, 1904.

The spark plug consists of a shell or casing, an electromagnetic device confined therein, means actuated by the device for producing a spark and insulating material inclosing the device but not inclosing the spark-producing mechanism.

795,462. Electric-control Apparatus. William A. Turbayne, Lancaster, N. Y., assignor to the Gould Coupler Company, New York, N. Y. Application filed September 15, 1904.

Combined with a main generator are a circuit, an exciter apparatus for the field magnet of the main generator, a regulating device for the circuit actuated by the exciter apparatus and means for varying the excitation of the exciter apparatus in accordance with variations in load.

795,467. Electric Terminal Bond. Henry J. Wessinger, Duluth, Minn. Application filed April 15, 1904.

The bonds are connected to the rails by means of externally threaded thimbles which screw into holes in the rail. The thimbles are taper-bored on the inside and receive tapered plugs of the terminals.

795,473. Annunciator. Severin B. Bankson, San Francisco, Cal. Application filed July 26, 1904.

An annunciator system has a series of audible signaling devices at the respective distant stations, corresponding series of annunciator drops and contact-making devices at the central station. Independent lines run from the annunciator drops to the distant stations where switches are located. Independent lines run from the respective contact-making devices to the audible signaling devices at the distant stations.

795,481. Dynamo Electric Machine. Henry Chitty, London, England. Application filed April 11, 1905.

In a dynamo-electric machine having radial pole pieces are a pole piece having a portion removed from both its sides in a direction transverse to that of rotation of the revolving member of the machine and a bridge piece of magnetic material extending between adjacent pole pieces and forming a shunt path for the magnetic flux.

795,492. Incandescent Electric Lamp. Timothy G. Dineen, St. Louis, Mo. Application filed August 6, 1904.

A series of insulated leading-in wires extend from the base through the stem. Lighting filaments have each one end in electric circuit with a corresponding leading-in wire, their opposite ends coupled to a common wire in electric connection with the base. A swinging arm or switch is mounted about the post and adapted to successively engage the terminals of the leading-in wires. (See cut on next page.)

795,497. Spark-timing Device. George A. Elsasser, Jr., and Paul M. Elsasser, Philadelphia, Pa. Application filed February 17, 1904.

Combined with a spark plug are a bar, a second bar formed of spring material and insulated from the first bar, an induction coil, electric connections between the induction coil and the bars, electric connections between the induction coil and the spark plug, a cam for forcing one bar toward the other and adjusting the distance between them and means for bringing the two bars into contact.

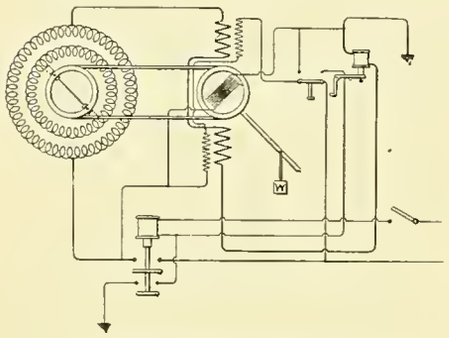
795,512. Electric Railway Signal. Charles F. Hoover, Lockport, N. Y. Application filed January 12, 1904.

An electric railway signal comprises a main indicator, a main magnetic shifting device for operating the indicator, a return indicator located remote from the main indicator and a magnetic shifting device for operating the return indicator arranged in a return electric circuit. A recording device is also provided.

795,520. Strain Insulator. John S. Lapp, Rochester, and Arthur S. Watts and Walter T. Goddard, Victor, N. Y., assignors to the Locke Insulator Manufacturing Company, Victor, N. Y. Application filed March 6, 1905.

The strain insulator comprises upper and lower flaring portions of insulating material connected by a body portion of insulating material to which the conductor is attached between the flaring portions. The insulator has an open lower end to receive the holding pin and a closed upper end and also a securing portion above the upper flaring portion. (See cut.)

795,521. Insulator. John S. Lapp, Rochester, N. Y., assignor to the Locke Insulator Manufacturing Company, Victor, N. Y. Application filed February 20, 1905.



NO. 795,392 —AUTOMATIC REGULATOR POR ALTERNATING-CURRENT MOTORS.

A pinhole extends entirely through the insulator and comprises a piece having a tubular body, to which the conductor is attached, and an integral petticoat portion at one end. A separate annular petticoat piece bears against the opposite end of the tubular body portion and is secured thereto.

795,532. Selective Signaling Apparatus. Frank R. McBerty, Evanston, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed April 4, 1901.

A series of magnets is arranged in groups, the members of each group being responsive to distinct electric currents. Means successively apply current to actuate the members of each group, a switch operated by each magnet controlling the circuit of the succeeding magnet in the series, to render the magnet operative when excited by another current. A locking circuit for each magnet, closed in the operation of its switch, maintains the shifted condition whereby the magnets may be successively excited to switch any desired one of the series.

795,538. Protective Device for Electric Circuits. Joseph J. O'Connell, Chicago, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed July 20, 1904.

A protective device for electric circuits comprises a base, electrical terminals mounted thereon, extensions for the terminals, arrester plates having holes therein in which the extensions are adapted to enter to complete electrical connection with the plates and means adapted to hold the plates in close proximity to one another whereby the arrester plates may be lifted as a unit from the terminal extensions. (See cut.)

795,541. Apparatus for Electric Welding. John C. Perry, Clinton, Mass.; William S. Perry, executor of said John C. Perry, deceased; said executor assignor to the Clinton Wire Cloth Company, Clinton, Mass. Application filed March 23, 1901. Renewed January 7, 1905.

Coöperative elements of an electric welding apparatus embody electric-welding jaws, plungers carrying movable welding jaws, connections between the plungers and circuit-breaking means carried by the connections whereby the movement of the connections to break the welding circuit is controlled by the average amount of movement of the plungers. (See cut.)

795,551. Service Meter for Telephone Lines. Charles E. Scribner, Jericho, Vt., assignor to the Western Electric Company, Chicago, Ill. Application filed September 26, 1904.

An electromagnetic service meter for telephone lines is associated with a device at the substation of the line controlling the circuit of the meter magnet. Link conductors are provided at the central office, also a connection switch for uniting the link conductors with the line, the service meter magnet being rendered inert by the closure of the connection switch to record the call.

795,558. Cut-out. Charles W. Snyder, Hudson, N. Y. Application filed November 15, 1904.

The device consists of an electrical switch and a shunt circuit and an automatic circuit-breaker arranged in the shunt circuit having a time limit, the current through the shunt circuit producing light.

795,570. Current Controller. Swen G. Anderson, Chicago, Ill. Application filed January 27, 1904.

Two sets of resistance sections, one set having connections for insertion in series or in parallel in an armature circuit, and the other set having connections for insertion in series or in parallel in a field circuit, means for similarly varying the insertion of the sections of each set and means for reversing the current flow through the sections are the salient points of the device.

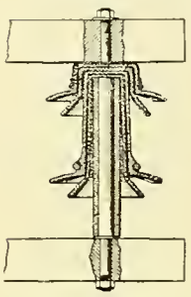
795,571. Connection Register for Telephone Exchanges. Henri E. A. André, Paris, France, assignor to the Western Electric Company, Chicago, Ill. Application filed July 9, 1903.

Associated with a number of telephone lines are an electromagnetic recording device permanently associated with and common to the lines, the device being adapted to be selectively actuated to make a distinctive record for each of the lines and means associated with each line for bringing about the actuation of the recording device to effect the record peculiar to that line.

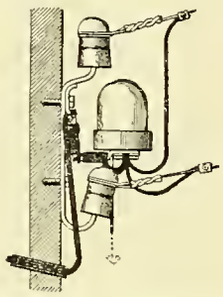
795,577. Printing Telegraphy. George A. Cardwell, New York, N. Y., assignor to Frederic J. Swift, New York N. Y. Application filed December 9, 1903.

A number of working circuits or branches, each including a working magnet and having at least three breaks or gaps are provided with selectable magnets controlled by characteristic kinds of impulses. Sets of switches are operated by the selectable magnets, each set closing breaks in different working circuits, but not all the breaks in any one circuit. The operation of particular sets of switches in a certain order of three at least closes all the breaks of a particular working circuit. Selecting magnets and circuits control the selectable magnets and non-interference magnets prevent interference with the operation of printing.

795,600. Signal System. William S. Franklin and William R. Whitehorne, Bethlehem, Pa. Application filed April 18, 1905.



NO. 795,520.—STRAIN INSULATOR.



NO. 795,538.—PROTECTIVE DEVICE FOR ELECTRIC CIRCUITS.

A signal system includes an indicating device on a car, a generator normally supplying an inoperative current to the device, a main signal and electrical means responsive only to an alternating current and controlled by the main signal for varying the current flow through the indicating device under predetermined conditions of the signal.

795,617. Sparking Igniter for Explosive Engines. Charles Jacobson, Warren, Pa. Application filed July 11, 1900. Renewed December 31, 1904.

Details are described.

795,668. Floor Box. David R. Waters and William McGuineas, Chicago, Ill. Application filed July 20, 1904.

The body portion of the floor box contains a longitudinal passage leading from the head passage and terminating at its inner end in branch passages. A stem carrying contacts is provided, a plug being insertible, without turning, through a sleeve to enter the stem into the socket and engage the contacts on the stem with the socket contacts.

795,670. Electric Controller. William R. Whitehorne, Bethlehem, Pa. Application filed March 28, 1905.

In a controller is a series of contacts arranged in the arc of a circle. A contact arm is provided for the contacts and means for automatically moving the arm over that portion of its arc of movement which is unoccupied by contacts.

795,681. Electric Arc Light. Heinrich Beck, Meiningen, Germany, assignor of one-half to the Firm of Physickalisch Technisches Laboratorium G. M. B. H. Meiningen, Germany, and one-half to the firm of Allgemeine Leichtgesellschaft mit Beschänkter Haftung, Berlin, Germany. Application filed January 21, 1904.

A pair of carbon electrodes, arranged points downward, have a lateral support on which one of the electrodes rests with its extreme lower point. Means are supplied for retarding the consumption of the part of the electrode turned away from the arc of light.

795,689. Device for Influencing Electric Arcs. Tito L. Carbone, Berlin, Germany. Application filed January 31, 1905.

A device for influencing the arc of electric arc lamps having downwardly directed converging carbon electrodes consists of an iron ring with a winding which is wound in such a manner that magnetic poles of opposite polarity are produced at the two carbon electrodes and that the magnetic action is of the same direction as the current flows through the carbon electrodes.

795,726. Electric and Pneumatic Governor. William H. Nightingale, Philadelphia, Pa., assignor to John E. Reyburn, Philadelphia, Pa. Application filed July 16, 1904.

In an electric and pneumatic governor are a magnet adapted to be energized on maximum pressure, a switch adapted to be opened by the magnet when energized and a latch adapted to hold the switch in open position and to be released on minimum pressure, whereby the switch is closed by gravity.

795,739. Water-level Indicator. Ross H. Stollar, Longbeach, Cal., assignor of three-fourths to George A. Raney, Samuel J. Turk and Emma Stollar, Longbeach, Cal. Application filed November 22, 1904.

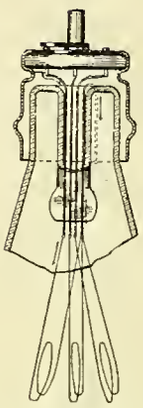
Electromagnets operate the pawl and ratchet mechanism of the indicator.

795,762. Wireless Telegraphy. Manuel R. Garcia, Paris, France. Application filed January 10, 1901.

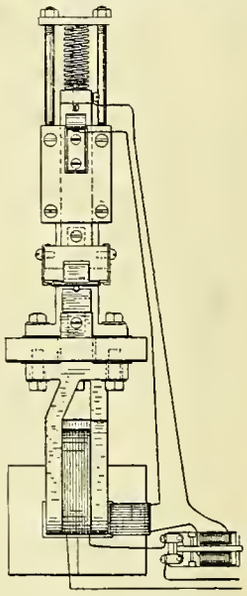
Combined with a metal case and receivers therein is a non-automatic device for decohering the receivers without breaking the continuity of the metal case.

795,780. Alternating-current Motor. Maurice Milch, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed January 2, 1904.

Main field coils, a rotor-winding supplied with a commutator, brushes bearing on the commutator and displaced from the line of magnetization produced by the main field coils and auxiliary compensating coils displaced from the main field coils are the essential features.



NO. 795,492.—INCANDESCENT LAMP.



NO. 795,541.—ELECTRIC WELDING APPARATUS.

795,789. Electromechanical Selecting Device. Richard P. Elliott and Anson G. Cox, Boston, Mass., assignors to Spencer W. Richardson and Richard P. Elliott, trustees. Application filed June 10, 1902.

In a selecting and actuating mechanism are selecting bars, means to select and move the bars, means to return the bars to their normal position, actuating bars mounted to coöperate with the selecting bars and means for moving the actuating bars laterally and longitudinally whereby the movable portion of a given mechanism is selected and operated.

795,803. Electrical Resistance. Elise Vedovelli, Paris, France. Application filed May 23, 1904.

An electrical resistance element comprises parallel conductors and insulating beads provided with a number of bores engaging the conductors and forming therewith a continuous fabric.

EXPIRING PATENTS.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on July 31, 1905:

386,796. Automatic Regulator for Electric Lamps. R. Belfield, Great Barrington, Mass.
386,797. Method of Automatic Regulation for Electric Currents. R. Belfield, Great Barrington, Mass.
386,814. Art of Telegraphy. E. Gray, Highland Park, Ill.
386,815. Telautograph. E. Gray, Highland Park, Ill.
386,828. Temperature Regulator. C. W. Johnson, Holyoke, Mass.
386,887. Multiple Switchboard. M. G. Kellogg, Hyde Park, Ill.
386,898. Secondary Battery. J. S. Sellon, The Hall, Sydenham, County of Kent, England.
386,925. Electrical Non-conductor. C. T. Lee, Boston, and C. N. Waite, Medford, Mass.
386,936. System of Electrical Distribution. M. M. M. Slattery, Fort Wayne, Ind.
386,956. Regulator for Electric Circuits. R. Belfield, Pittsburg, Pa.
386,965. Telephone Transmitter. William R. Cole, Detroit, Mich.
386,974. Phonograph. T. A. Edison, Llewellyn Park, N. J.
386,986. Electric Insulator Peg. W. E. Joslin, South Scituate, R. I.
386,992. Galvanometer. P. Lange, Pittsburg, Pa.
386,993. Galvanometer. P. Lange, Pittsburg, Pa.
387,010. Brush Holder for Electric Machines. A. Schmid, Alleghany, Pa.
387,013. Electric Converter. O. B. Schallenberger, Rochester, N. Y., and H. M. Byllesby, Pittsburg, Pa.
387,044. Storm Protector for Electric Lamps. T. A. Brady, New Britain, Conn.
387,051. Lightning Arrester for Electric Circuits. F. A. Cheney, Elmira, N. Y.
387,117. Apparatus for Electrical Conversion and Distribution. W. Stanley, Jr., Great Barrington, Mass.
387,131. Electric Indicator. W. A. Anthony, Manchester, Conn.
387,145. Galvanic Boiler-cleaning Compound. F. J. Clamer, Philadelphia, Pa.
387,146. Galvanic Boiler-cleaning Compound. F. J. Clamer, Philadelphia, Pa.
387,160. Electric Rock Drill. G. Guntz, Wilkes Barre, Pa.
387,194. Regulator for Electric Motors. A. G. Waterhouse, Hartford, Conn.
387,195. Regulation for Electric Motors. A. G. Waterhouse, Hartford, Conn.

WESTERN ELECTRICIAN

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LIBRARY OF ELECTRICAL ENG'G

Electrical Equipment of a Large Glue Manufacturing Plant.

Among Chicago's large industrial plants the glue works of the Armour Company, at Thirty-first and Benson streets, are worthy of attention. The establishment employs about 1,000 men and makes use of 30 buildings. A large amount of power is required in various places in the plant to drive the machinery which is necessary in the quite complicated process by which by-products of the large meat-packing establishments are reduced to a marketable commodity in the shape of glue. Another and less important line of manufacture at this plant is soap.

About a year ago it was decided to build a new power plant for the works, and accordingly plans were prepared by Mr. Charles W. Brown, the Armour Company's chief engineer at this plant. The principal part of the work has now been completed, and in general arrangement and detail the installation stands as a proof of the engineering ability and good judgment of the designer.

Before deciding upon the equipment Mr. Brown, together with his chief electrician, Mr. J. M. Davis, took a trip about the country, visiting various large manufacturing establishments and a number of industrial plants. After giving the steam turbine due consideration, they came back imbued with the idea that for the particular requirements of their plant the reciprocating engine was the one for them to employ.

Fig. 1 is a view in the engine and generating room, showing in the foreground the two direct-connected generator units, and in the rear the compressors for the refrigerating plant. Two horizontal cross-compound condensing Corliss engines, built by the Fulton Iron Works of St. Louis, are connected to two General Electric direct-current generators. The larger engine, which is the second one in the picture, has cylinders 26 and 52 inches in diameter, with a stroke of 48 inches. This drives an 800-kilowatt generator at 90 revolutions a minute. The smaller engine has cylinders 22 and 44 inches in diameter, with a stroke 48 inches, and drives a 600-kilowatt generator at 90 revolutions a minute.

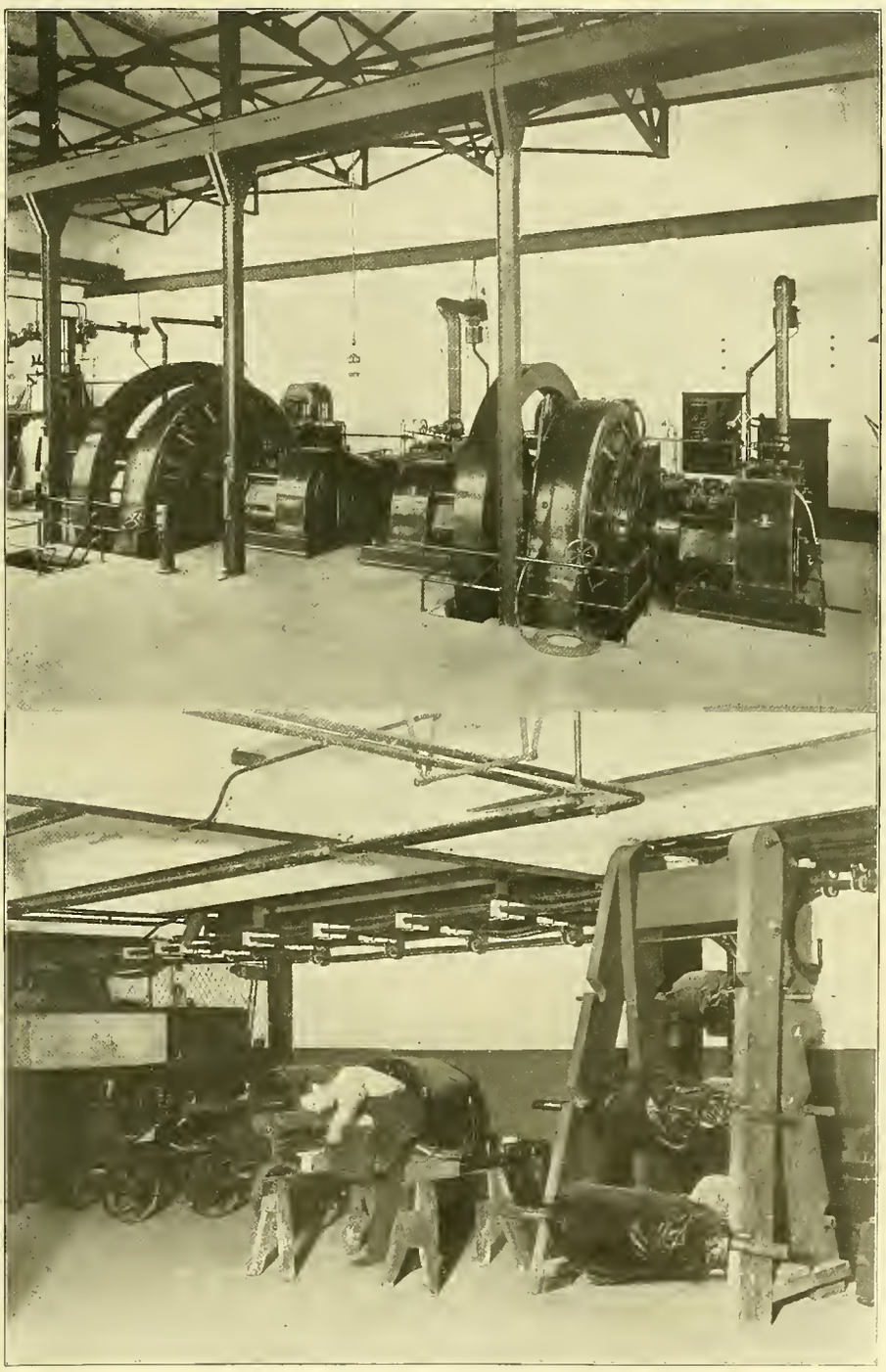


Fig. 1. View in Engine Room, Showing Two Direct-current Generating Sets.
Fig. 2. Repair Department and Spare-armature Room.
ELECTRICAL EQUIPMENT OF A LARGE GLUE MANUFACTURING PLANT.

The engines are exceptionally massive in design and are fitted with water-jacketed main bearings, foot under-slides, cast-iron sole plates under the cylinders, and are of the long-range cut-off type. They were installed in January, 1904, and have been in practically constant operation since that time.

The engines are fitted with O'Neil's auxiliary safety governor, which operates directly on the steam hooks of the high-pressure valve gear. This device prevents the valves from opening, thereby making it impossible for the engine to run away in case the main governor belt breaks, or anything happens which has a tendency to bring the engine above its normal speed. At the same time it does not allow the engine to be shut down. For example, should an accident happen to the main governor of the engine the engine could run with a slight variation of speed until shutting-down time, when the engineer would have an opportunity to make the necessary repairs. This governor is especially adapted for synchronizing three-phase 60-cycle alternating-current generators.

The two generators mentioned develop current at 500 volts and are compound-wound. The 600-kilowatt machine has 10 poles and the 800-kilowatt 14. They are wired to the switchboard for parallel operation, although either will carry the full load of the plant at the present time.

The equalizer switch is mounted on a pedestal on the floor at a point between the two machines. The main switchboard stands in the southeast corner of the generator room and was remodeled from the one used in the old plant. This board was built by the Walker Company. The board consists of four panels of Tennessee marble, 45 by 84 inches each. The two generator switches are mounted on the first panel, and three feeder switches, with their current breaks and ammeters, are mounted on the other three panels.

The feeder wires enter a wire shaft or tower above the roof of the power house and are led down the shaft to a point on a level with the top of the switchboard, where they pass through the wall and enter the kicking coils, which are mounted on slate panels. These panels are mounted on a horizontal plane on top of the straps holding the switchboard to the wall; they also carry the feeder fuses.

The wiring about the works is at present all overhead, but a 16-duct conduit system is being laid, and all new circuits will be placed therein, with the probability that all old circuits will eventually be put underground.

In the installation of the underground system a unique idea in the way of terminal vaults was utilized. These vaults, which are constructed of brick, cement and concrete, are located outside of their respective buildings, and are easily accessible to firemen and other operators, and will be used to house the transformers and service switches and also as centers of distribution.

Lighting at the present time is done by means of belted motor-generator sets located in the basement beneath the main generator room. There are two 500-volt motors—one of 50 and one of 100 horsepower—driving 1,000-volt alternators. Current is transmitted from the alternators to transformers in various parts of the premises, where it is stepped down to 100 volts for incandescent lighting. In all there are now connected about 2,300 lights.

The lighting plant above described is, however, only a temporary affair, and will soon give way to a permanent installation in the main generator room. The new plant will consist of two 150-kilowatt engine-type revolving-field alternators driven by Fulton tandem compound engines, with cylinders 11 by 22 by 22 inches. The Crocker-Wheeler Company will furnish the generators, which will be two-phase 60-cycle, and will be connected to a six-panel switchboard for multiple

operation. These units will be operated at a speed of 200 revolutions a minute, and the exciters will be driven by means of a friction pulley direct from the flywheel of the engine.

Steam power for the plant is generated by 5,000 horsepower in Stirling boilers, divided into 15 units, with pressures varying from 150 to 225 pounds. The boilers will be equipped eventually with Green chain-grate stokers, although at present they are hand fired. Coal is run directly into the boiler room in the car and is shoveled out in front of the boilers. About one-third the boiler capacity is required for power

There are about 48 direct-current 500-volt motors used in the plant, ranging from three to 200 horsepower. Two of these, of 125 horsepower each, were originally direct-current generators used in the old plant. They were made over into motors and are doing satisfactory work. In the new soap factory now being erected motors of about 300 horsepower will be installed, ranging from 2½ to 100 horsepower each. There are now operated in the plant seven electric elevators, and the new soap factory will require two more.

Many interesting things are to be found around this plant besides the regular equipment. One of these is the repair department and spare-armature room, shown in Fig. 2. Here are stored spare armatures for all the larger types of motors, ready to be run out and put in place at a moment's notice. The temporary shut-down of a motor 50, 100 or 200 horsepower in size means the shutting down of a large section of machinery and the enforced idleness of many men. To prevent any very great delay spare armatures are stored in readiness, as shown in the picture. Some of these are mounted on trucks ready to be run out on a "hurry" call, and others are mounted on a rack as shown. This feature of the plant is a very commendable one.

There are some interesting "wrinkles" in the engine room in the way of lighting. The main lighting at night is done by incandescent lamps with the aid of a few arcs. Back of the main girder which runs lengthwise of the room and high up above the machinery are six groups of incandescent lamps with 18 lamps in a group. This gives an even and soft light on all the machinery. To light up any particular section about the engines or generators an ingenious wall fixture is used. This consists of a sort of searchlight comprised of a cluster of six incandescent lamps in front of a reflector. The reflector and lamps are so mounted that they may be turned and the light thrown in any direction. There are in all four of these miniature searchlights. In addition to these means of lighting portable lamps may be used connected to receptacles.

A mercury column in the engine room gives the vacuum on the condenser. In the engine room is also located one of the stations of an electric fire-alarm system which protects all parts of the plant. Each building, according to its size, is provided with a number of fire-alarm stations which communicate signals to the company's private fire department, to the power station, where the fire pump is located, to the general office and to engine house No. 28 of the city fire department.

In Baltimore there is a company that furnishes from a central plant refrigeration in summer and steam heating in winter. The local papers allude to it, rather aptly, as "the temperature company."

Two-phase 400-volt Service from a Four-wire Three-phase System.

In a case where service was desired by the owners of an isolated plant which had broken down, the following method of rendering 400-volt two-phase service from a four-wire, three-phase system, described by H. B. Gear of Chicago in the "Wrinkles" department of the National Electric Light Association, was employed:

It being an emergency case and the load being approximately 400 kilovolt-amperes, it was necessary to accomplish the result by the use of eight 50-kilowatt standard lighting transformers, four of which had a ratio of 10 to one, with 208-volt secondaries, and the other four a ratio of nine to one, with 230-volt secondaries. Following the usual Scott system of transformation from three-phase to two-phase, the scheme of connections shown in Fig. 1 was worked out on the basis of using two transformers in series on both primary and secondary. The normal primary voltage being 2,080 from neutral to either phase wire and 3,600 between the phase wires, it was necessary to use two 2,080-volt windings in series on the primary side. The voltage of the motors being 400, it was likewise necessary to connect the secondaries in series. In order to secure approximately 400 volts on each of the secondary phases it was necessary that the primary pressure be about 4,160. The pressure was obtained by inserting boosters in the three-phase line.

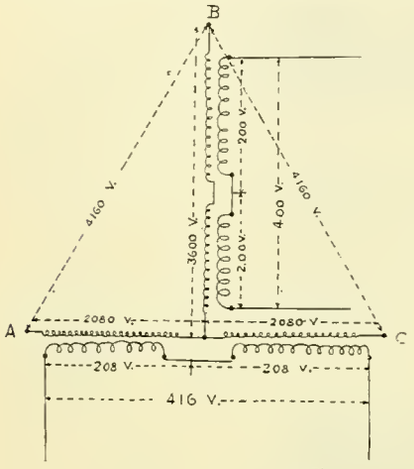
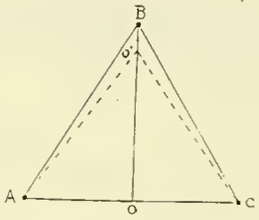


Fig. 1.



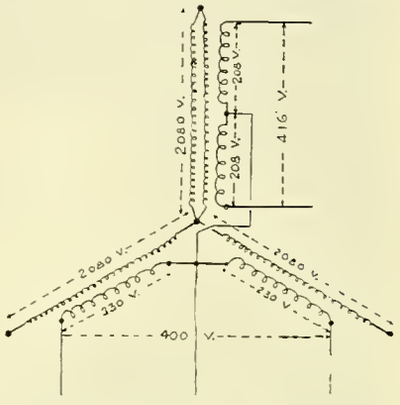


Fig. 2.

TWO-PHASE 400-VOLT SERVICE FROM A FOUR-WIRE THREE-PHASE SYSTEM.

After connecting the transformers, as shown in Fig. 1, voltmeter readings were taken without load. These readings indicated approximately 400 volts on the transformers between the (A) and (C) phases, but a somewhat lower pressure on the transformers connected from the (B) phase to the midpoint between the other two transformers. Upon attempting to start a five-horsepower motor the voltage on the vertical phase fell back almost to zero, while that on the horizontal phase was but little changed.

On connecting a separate transformer from the mesh point (O) to the three-phase wires (A), (B) and (C), respectively, it was found that the point (O) assumed a position about equivalent to that represented at (O') on the small diagram. It was therefore impossible to render any service with this scheme of connections.

A theoretical analysis of the phenomenon involved seemed to indicate that the trouble was due to the fact that the current which passed from the (B) phase to the (A) and (C) phases was choked by the impedance of the two transformers connected between (A) and (C). These transformers offered an impedance to this current because of the fact that their windings were not on the same magnetic circuit, as is the case in the usual method of phase transformation.

It was therefore necessary to adopt the scheme of connections shown in Fig. 2, in which the two ten-to-one transformers were connected in parallel from (B) phase to the neutral wire of the four-wire line, and the two nine to one transformers were connected from the (A) and (C) phases, respectively, to the neutral. The secondaries of the (B) phase transformers were put in series to get 400 volts and the 230-volt secondaries of the other two were combined in a similar manner. The primary voltages were such in this case that it was unnecessary to install boosters, which would have been required in the other scheme of connections. This scheme, however, unbalanced the three-phase line in the following ratios:

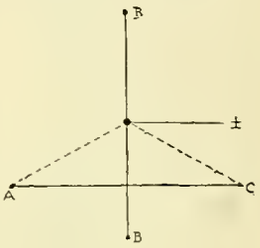
A	57.7	amperes
B	100	amperes
C	57.7	amperes

The company supplying current not being provided with meters designed for 440-volt service, the midpoints of the two-phase windings were tied together, as shown in the small diagram in Fig. 2, and the secondary neutral thus formed was carried into the building to act as a pressure wire for the meters. Two sets, consisting of four 50-kilowatt transformers each, were connected, as shown in Fig. 2, to carry the load.

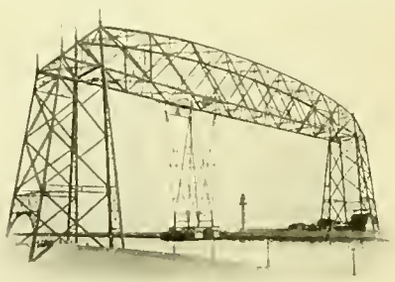
The installation was mounted on a platform 15 feet above ground, which was supported on three poles placed about 12 feet apart, the entire work of setting poles, mounting transformers and extending primary line 500 feet being finished in about 24 working hours.

Electrically Operated Transporter Bridge at Duluth, Minn.

The Duluth (Minn.) ship canal, which annually passes a commercial tonnage equal to that of the Suez Canal, is spanned by the only stiff-truss transporter or ferry bridge in the world. The canal, which was cut across Minnesota Point by the city of Duluth, was adopted by the United States government, and was broadened in 1901 to 300 feet. No practicable method of spanning the canal presented itself until the scheme of a suspended transfer bridge similar to that at Rouen, France, was hit upon, and the winter of 1904-5 saw the completion of such a bridge. The accompanying illustration is a good representation of the structure.



In the foundation of the bridge are 730 tons of concrete. The bridge has a clear height above the water of 135 feet. The truss at the center is 51 feet deep, making the total height 186 feet. The car will carry at one time 125,000 pounds, or a weight equivalent to a fully loaded double-



ELECTRICALLY OPERATED TRANSPORTER BRIDGE AT DULUTH, MINN.

truck street car, two loaded wagons with teams and 350 passengers.

The motive power of the ferry car is electricity, current being supplied from two separate sources, having different cable systems. A switch under the control of the motorman enables him in case of the failure of one source to immediately turn on power from the other. A further safeguard against delays is provided by an adequate hand-power, which can be used in the event of both sources of power failing.

Two 40-horsepower motors, placed under the floor of the car, actuate two drums, each nine feet in diameter, on which are wound one-inch cables extending to the truss, and thence over nine-foot idle-wheels, through the inside of the lower chords to the towers, where they are fastened, producing the motion which causes the car to run. The track, to carry the car and hangers, is ingeniously arranged, being enclosed on three sides within the box section of the lower chord, thus avoiding the danger of its becoming coated with snow or sleet in the winter time. There are four rails within the two bottom chords, two in each, and 32 wheels, arranged in pairs (eight pairs in each

lower chord), roll on them, which carry the truck. As the bearings of these wheels as well as those of the drums and idlers have roller ball-end thrust bearing, the friction of all the working machinery is reduced to a minimum. The handpower method of propulsion is applied by use of lever handles, which, by a series of gears and sprockets, communicate power to the drums on the car. The normal speed of the car is four miles an hour, but the motors are capable of propelling it at twice that rate.

A neat little booklet illustrating and describing the bridge in detail has been issued by the engineering department of the city of Duluth, and may be had upon application.

Insulating High-tension Wires from Trees.

[From Question Box of National Electric Light Association.]

QUESTION.

What is best to do with overhead high-tension alternating-current lines where line passes through a good many trees and trimming is objected to? Is there any satisfactory tree insulator in use?

ANSWERS.

J. F. C.: We get very good results from a home-made tree insulator, consisting of a wooden batten made in two halves of one-inch by two-inch seasoned oak with corners chamfered on one side, and a half-inch plow one-fourth-inch deep on the other side, given two good coats of paint. We get these made in 12-foot lengths and cut them in pairs of various lengths to fit the requirements. If it is possible to get up the tree they can be put on line wires without interfering with service by binding the two halves together with scrap magnet wire and anchoring it on wire with insulating tape.

W. L. Sees, Commonwealth Electric Company, Chicago: We have not been able to find a satisfactory tree insulator. Where it is impossible to trim trees we have raised or shifted wires to get clearance. In a few cases it has been found necessary to leave the trimming to the live wire.

C. W. Koiner, Madison County Gas and Electric Company, Oneida, N. Y.: It is better to go above or under the limbs of the trees. In no case should high-tension lines be fastened to tree limbs with tree insulators, as it is only a makeshift and will eventually give trouble. If the wires cannot be run above the trees they should go under the lower limbs, and the limbs should be cut off for a distance of four or five feet from the wires; but it is better to build lines away from trees if possible.

Warren Partridge, United Electric Company of New Jersey, Orange, N. J.: Use wire with three-thirty-seconds-inch rubber wall and triple-braid cover, and where same comes in contact with tree limbs large enough to wear the insulation, cover with wooden molding.

Charles H. Peters, Durango Light and Power Company, Durango, Colo.: If you cannot raise wires without great expense, we know of but one other thing to do: Put up a nice talk to the owners of trees; tell them that swaying will cause them to make contact with wires and result in their being killed; that you are too much of an admirer of trees to wish to see them destroyed, and would like their permission to carefully trim the tops sufficiently to remove all danger. If you can get one or two persons to grant this request, have a competent man do the trimming, and then your difficulty is half over with the owners.

J. T. Cowling, Westchester Lighting Company, Mount Vernon, N. Y.: Tree insulators are worthless; use tree wire for distributing circuits. For extra high-potential lines, buy the trees and cut them down or go above them.

A. M. Cover, Fork Electric Light, Heat and Power Company, South Fork, Texas: Use high poles and run wires above the trees; or better still, move line and go around trees. There is no satisfactory tree insulator now made, and owing to movement of trees and the amount of water on same in wet, stormy weather, none can be safely used.

Tariff Classification of Small Battery Carbons.

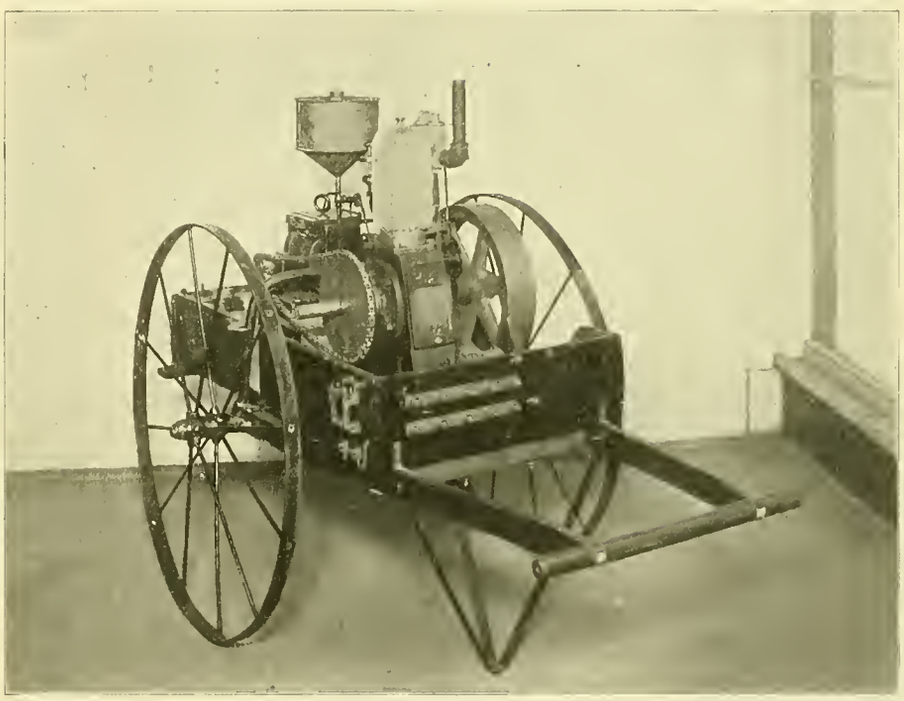
The Board of General Appraisers has rendered a decision in the matter of certain protests entered by H. Reisinger against an assessment of duty by the collector of customs for the port of New York on certain cylinders of carbon, five-sixteenths of an inch in diameter and 2½ inches long, and which were invoiced as battery carbons. The United States appraiser returned the merchandise as "carbons for electric lighting," and this made the rate of duty at which they were assessed 90 cents per hundred under the provisions of paragraph 98 of the tariff law. The protest was to the effect that the merchandise should have been more correctly classified under the provisions of paragraph 97 of the same tariff, which would have made them dutiable at the rate of 35 per cent. ad valorem.

The carbons in question were intended for use in the construction of small dry batteries, used in conjunction with portable hand or pocket lamps, of the type where pressure upon a button in the side of a cylindrical casing closes the circuit and causes the illumination of the bulb to the extent of about one-eighth of one candlepower. The small dry batteries in which such carbons are employed are simply adaptations for a specific purpose of the standard dry batteries used for the generation of current for the ringing of bells, etc.

From these facts it was the opinion of the board that these carbon cylinders under protest were not suitable for use in commercial electric lighting, and that their intended purpose for use is in the generation of electric current equally well adapted to other purposes than that of effecting a glow in a small incandescent bulb, and it was therefore held that they were correctly dutiable, as claimed in the protest, at 35 per cent. ad valorem, and the protest was accordingly sustained.

Electrical Apparatus for Firing High Explosives.

In the excavation of canals, and in railroad and quarry work, where the areas operated upon are considerable, it is often necessary to set off a large number of blasts at once—perhaps several hundred. That the combined effect of these blasts may be obtained it is essential that they all be fired at the same instant rather than in a series. To accomplish this a considerable amount of current is required, and dry batteries are not satisfactory. The accompanying illustration shows an ingenious portable firing outfit invented by Forée Bain of Chicago.



PORTABLE ELECTRICAL FIRING SET FOR HIGH EXPLOSIVES.

The apparatus consists of a 2½-horsepower four-cycle air-cooled gas engine and a bipolar compound-wound dynamo mounted upon a two-wheeled cart, which may be drawn around from place to place as the conditions require. The dynamo is capable of developing 50 amperes at six volts, which current is sufficient to set off almost any number of blasts desired. The engine drives the dynamo by a sprocket wheel and chain. The dynamo circuit passes through a main switch to a series of terminals for the blast circuits mounted on the body of the vehicle. The novel feature about the device is a second switch in the dynamo circuit which is adapted to throw the current therefrom either through the blasting terminals or through a dead resistance, according to the position of the switch. The resistance is a coil of coarse wire of about one-eighth of an ohm, and the switch is so held by a spring that the circuit is normally closed through the resistance, but by throwing the switch suddenly the full pressure of the dynamo may be thrown onto the terminals.

In the feature just described lies the particular merit of the device, for it is thus possible to start up the dynamo and test it through the resistance before firing the blast. In this way the operator can be sure that the dynamo is generating the necessary current by simply laying his hand on the coil and ascertaining by its warmth when the dynamo has picked up sufficiently to go ahead. As the switch is held by a spring, it is impossible for the operator to inadvertently close it on the blasting circuits, with a possible loss of life to the men who have not yet left the vicinity of the blasts. To make assurance doubly sure the main switch may also be opened.

The resistance is designed to furnish just about the full load of the dynamo, which is as much as any number of blasts could possibly require. The whole apparatus is comparatively light and is well balanced and adapted to be run over the rough ground in a canal bed or railroad cut. It is built by Cavanaugh & Darley, gas-engine builders of Chicago.

A Large Issue of Meter Patents.

Forty patents were issued by the United States Patent Office to Thomas Duncan of Lafayette, Ind., on August 1st. They are numbered 796,031 to 796,070, inclusive. The patents nearly all relate to electrical measurement, the titles being as follows: "Electric Meter," 21; "Electrical Measuring Instrument," 10; "Meter," five; "Automatic Switch for Storage Batteries," two; "Indicating Instrument," one; "Three-wire Meter," one; total, 40. The dates of application range from June 26, 1901, to October 10, 1904, with renewals as late as January 7, 1905. Five of the patents are assigned to the Duncan Electric Manufacturing Company of Lafayette, Ind.

These patents relate to broad systems of electrical measurement as well as to details of meter construction. Several cover storage-battery arrangements, with means to modify the rate of operation of the meter per unit of load or energy to compensate for battery loss, and the like. The two patents covering automatic switches for storage batteries describe means in the charging circuit for opening the circuit when the storage-battery pressure has reached a predetermined limit.

There are patents for alternating-current instruments, power-factor indicators, meters reading in dollars and cents, maximum-current instruments, watt-hour meters and combined ammeters and watt-hour meters, discount meters, maximum-demand meters, storage-battery input and output meters (some of the latter designed to be operated at varying rates of speed per unit of load or energy, according to varying rates of discharge), prepayment meters, voltage indicators for storage batteries, motor watt-meters, wattmeters for three-wire systems, and several others. Taken altogether, this group of patents is very comprehensive and foreshadows in an interesting way some probable future developments in the art of electrical measurement.

British Pacific Cable.

The government report relating to the working of the all-British Pacific cable shows that the expenditure during the 12 months ended March 31, 1905, was, roughly, $300,000, some $20,000 less than last year. The total receipts were nearly $450,000, some $50,000 more than last year. When, however, interest and sinking-fund and renewal-fund charges have been met, there is a deficiency of $385,000, a fair decrease over last year.

Russian Synchronizing Device.

By C. Domar.

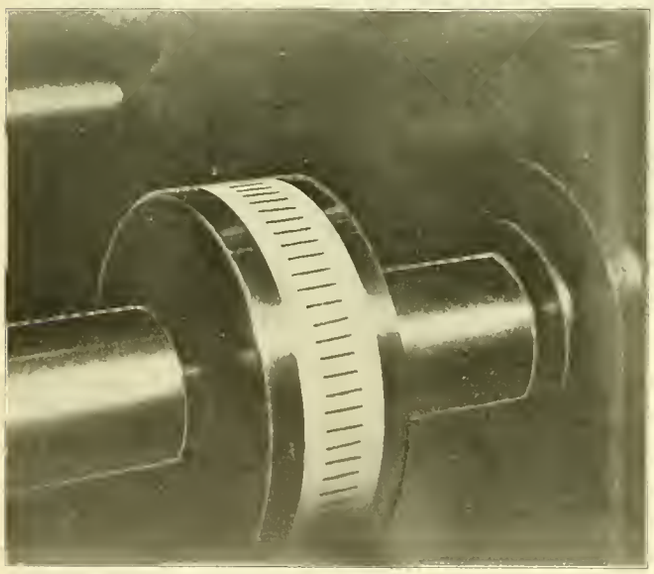
While coupling alternators in parallel, incandescent lamps are still used to show when the machines are in step. The lamp is fed by both of the machines to be coupled, and in case of polyphase alternators it shows directly which of the alternators is in advance, while with single-phase alternators the lamp indicates only the coincidence of speed, and the engineer must find some other means of knowing at which moment the idle machine may be connected to the bus-bars. In most cases the apparatus placed on the switchboard for this purpose is not in sight of the engineer when the regulation of the driving power is being obtained by varying the speed of the engine away from the switchboard.

It is therefore of great importance to have a device placed near the regulator showing the precise moment when the alternators are in step.

At the central station of the Electric Equipment and Power Distribution Company of St. Petersburg all the seven alternators are provided with a drum two inches wide and having black transverse lines drawn on a white ground. The number of these lines, 72, corresponds to the number of the magnets on the rotor. The drum is placed on the shaft governing the steam distribution, which revolves at the same speed as the main shaft. Thus as the drum revolves the lines drawn on it will pass before the eye of the witness, or before any other fixed point, in rapid succession in coincidence with the frequency of the current.

If, then, that current feeds an arc lamp which illuminates the drum, it is clear that the black lines drawn on the drum will seem to be motionless, as the impulses of light which reach the drum in rapid succession will meet every line relatively in the same place. But if one of the machines be not in step with that which feeds the lamp the black lines of the drum placed on that machine will seem to be either in advance or behind the position occupied by the line at the previous moment of the light's pulsation.

The resulting effect will show itself in a very



RUSSIAN SYNCHRONIZING DEVICE.

distinct but slow advancement or retardation of the lines on the drum.

The accompanying photograph was taken while the machine was at work. This apparatus, invented by Mr. P. A. Kovalef, has been in use for more than a year, and it has proved itself to be very useful, as the coupling of the alternators is thereby much simplified. Although a patent for a similar apparatus was granted to the inventor in Germany in 1892, it has not been until the present time much utilized in practice.

Public Lighting in Indiana.

Examination of figures just compiled by the chief of the Indiana bureau of statistics relative to lighting plants in the 84 cities in the state show that 32 cities of the 84 in Indiana own their electric-light plants and 52 cities are lighted by contract with private concerns. The entire annual cost of street lighting for all the cities was $890,666.44. The cost of the 32 municipal-plant cities as given was $320,327.61, and for the 52 cities with private plants $570,338.83. The average cost per city of those owning their plants was $10,010.23 and of those renting the light was $10,966.15. The total receipts of all public and private plants in the cities of the state for lighting and power for the year ended June 30, 1905, were $10,022,550.48.

Useful Method of Reading Meters.

The old method of reading meters from meter books takes a great deal of time, and in combined gas and electric companies a reader for the gas and one for the electric meters must be sent over the same ground. In the "Wrinkles" department of the National Electric Light Association Mr. E. C. Allen of Albuquerque, N. M., describes a method which he has used to advantage. His company operates the gas, electric-light and power business of Albuquerque and has discarded the meter books entirely. It employs a form of meter slip printed on thin, stout bond paper, using different colors for gas, power and electric. A blank is printed, giving ledger, folio, route, number, application date, date set, date out, make and size, maker's number, company's number, constant, name and location and blanks for the year's business by months. At the bottom of the sheet is the December reading of the previous year.

The route of the meter reader is made up in bundles of one day's readings and numbered from one up in consecutive order. Each bundle is known by letters, as A, B, C, D, etc. Should a customer move from one part of town to another, the letter is changed on the meter slip so as to be in rotation for reading, the idea being that after the slips are distributed in numeral order on each route the next number in the reader's file should take him to the next meter location, so that he will not double back and forth to hunt for a certain name and location.

Whenever there are new installations interspersed on the route the number of the meter slip for that location would appear as a cipher prefixed to the previous number; e. g., John Smith has an electric service installed, or, for that matter, gas or power (it makes no difference), next door to John Jones, whose number is, say, 32. This new consumer's number would therefore take the cipher thus, 0-33, which shows the meter reader that he should read this meter before going to the original number 33. If the meter reader finds any numbers missing in his route file he naturally assumes that the service has been discontinued. At the end of the day's work the meter reader turns his finished file in to the bookkeeper, who distributes it in alphabetical order for his ledger, making all deductions. Should there be any great discrepancies, either over or under, these slips are placed with the "not at homes" and other slips for which it has been impossible to get readings, for various reasons. They are put in a separate bunch, and after the regular work is finished are again placed in route form, and another trial is made. Three attempts are made to get in all meter readings, and if it happens that a reading cannot be obtained after the third trial, "not at home" is simply entered on the meter slip in place of the reading, and the minimum charge carried to the ledger.

This manner of reading meters has been found very satisfactory; in fact, it makes it possible for one man to read as many meters in one day as four men did under the old way, and it is much more satisfactory, as all agree that the average family takes it as almost an open insult for a man to ring the doorbell and in ever so polite a manner ask to "read the meter." It is best to send as few men out on this work as possible. Besides, when these meters slips are properly routed in the office, ready for the meter reader, so that he does not have to study names and locations and where he is going to end his day's work, it is found that the greater portion of his work is done; it is not so much the number of meters as how to get to them.

Each route is made up of a portion of business installations, so that the reader can begin his work early in the morning, and by the time he gets to the residence portion of his route breakfast is over in the private families, and they are in a measure ready to admit the "octopus" representative, as they term him.

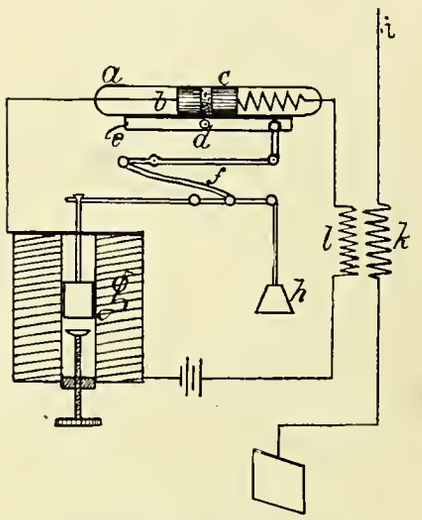
The electric-light contractors should also arrange the meter loops so that it will not be necessary to carry a step-ladder. The instruments should be placed where they may be conveniently read from the floor.

Hülsmeyer Automatic Coherer.

By Dr. Alfred Gradenwitz.

In connection with such coherers as have so far been used, the metal powder sensitive to electric waves is decohered each time a signal has been given, by shaking the glass tube with a hammer actuated by the local current, so as to make it sensitive to the next wave sent. The sensitiveness, being dependent on the actual resistance of the metal powder, is rather unequal, varying according to the arrangement of the metal particles, and the working of the receiving apparatus is therefore oftentimes rather unreliable.

Mr. Christian Hülsmeyer of Düsseldorf, Germany, has endeavored to obviate this by the following arrangement.



HÜLSMEYER AUTOMATIC COHERER.

The regulation, dependent on the variation in the distance of the metal electrodes, is done by hand in all the previous forms of coherers. In the Hülsmeyer coherer, on the contrary, the sensitiveness is adjusted for to a given degree, after which it always returns to the desired standard.

As seen from the diagram, two metal pistons (b) and (c) are arranged in an exhausted glass tube, the piston (b) being fixed, while (c) is movable and suspended by a wire spring. The coherer powder is placed between the two. The glass cylinder (a) is arranged on a support (e), free to rotate around an axis (d), and is adjusted in a more or less oblique position by the lever system (f), engaging at the end of (e). The levers are influenced by a solenoid (g), which is traversed by a local current, and by a counterweight (h). According as the end of the coherer with the piston (c) is drawn upward or downward by this lever system, the movable piston, that is suspended by a spring, will press on the coherer powder more or less by virtue of its weight, thus establishing a more or less intimate contact. In the inactive condition the local current traversing the coherer and the solenoid would have to be so strong as to counterbalance the counterweight (h).

If the weight (h) be augmented, the resistance of the coherer will be decreased, the latter being placed obliquely and the piston (c) being lowered; if, on the other hand, the weight be diminished, the resistance will augment. If, the coherer being adjusted for a given resistance, the antenna (i) is struck by waves, the latter will be transmitted from the primary coil (k) to the secondary coil (l) of the local circuit, actuating the coherer, while the resistance is dropping. The Morse apparatus or telephone and hammer, inserted in the same circuit or in another circuit dependent on the coherer, will then be operated, and the coherer will return to its previous resistance. The same process will be repeated over again with each signal.

The solenoid (g) may be arranged also in a shunt, including an additional resistance. Instead of using the counterweight (h), the solenoid effect can be made to act also on an iron core arranged in the shunt field, when the solenoid will have to be arranged in the main circuit.

The sensitiveness of the coherer and its resistance are thus adequately regulated by the differential pull of two forces, one of which is constant and the other variable.

[Editor's Note.—This brief description of the Hülsmeyer automatic coherer may well be read in conjunction with Mr. McNicol's article on "Electric Wave Detectors" in the Western Electrician of August 5, 1905, where other automatically decohering wave detectors are described.]

Wireless Telegraph Act in Great Britain.

A government return relating to the working of the wireless-telegraph act in Great Britain for the first three months of its operations has just been issued. The act came into force on January 1st, and it gives a government control over the use of wireless apparatus. The number of licenses applied for under the various sections of the act was 73, of which 48 were granted. Of the remainder, 10 are still under consideration, one was refused, one "partly" refused, and four alternative sets offered in lieu of refusal.

In the case of the licenses refused, the reasons stated were risk of interference with other stations, or that the exchanges suggested would have contravened the postmaster-general's telegraphic monopoly.

The American De Forest company applied for a commercial ship-and-shore license from numerous points on the coast of Great Britain and Ireland at a radius varying from 50 to 400 miles, but it was refused in regard to the majority of the stations proposed, on the ground of risk of interference with other stations. A license was offered, however, for certain specified localities. The company also asked for a license for transmitting inland messages for press purposes, but the further information asked for by the postmaster-general has not yet been furnished. A license for a site in Scotland was offered to the De Forest company for an experimental plant to communicate with America, but the return does not state whether it was accepted or not.

Another interesting portion of the return is that relating to the business carried on with the Marconi company for transmitting messages from shore to ship, which has now been discontinued. The number of messages accepted by the Postoffice inland stations was 111; 21 messages were not delivered by the Marconi company (apparently lost); in 16 cases the senders asked for refund of charges, and in six the Marconi people refused. The number of messages from ships at sea received by the Postoffice and delivered was 1,655.

Consummation of Central-station Purchase in Ottawa, Ont.

The city of Ottawa, Ont., and the Consumers' Electric Company have reached an agreement by which the city pays the latter the sum of $200,000 for its plant, the company, however, to hand over to the city only $3,000 worth of the $10,000 of the stock on hand, thus making the price equivalent to $207,000. The company originally asked $225,000, and the city offered $200,000, but to avoid delay and expense incidental to arbitration, the deal was compromised at $207,000.

New Swiss Electrolyzers.

By C. Smith.

Since 1800, when Carlisle and Nicholson first decomposed water by means of the electric current, various forms of apparatus have been designed with which to obtain hydrogen and oxygen at so low a cost that it could be prepared in this manner commercially; but up to the present time practically all of the apparatus designed have had various drawbacks, among which is the amount of space occupied, the care and attention required, and the complexity of the arrangement.

In Italy the electrolytic apparatus of Garuti and Pompili has long been in use, a very dilute solution of an alkali hydroxide being used for the electrolyte and a vertical metallic plate, insulated from the electrodes and perforated for a short space above the bottom being utilized to separate the gases.

The German firm of Schuckert & Co. has also manufactured apparatus for the commercial production of oxygen and hydrogen, a solution of 15 per cent. of sodium hydroxide in 85 per cent. of water being used as the electrolyte. Forty elements are used, and about three volts per element is required. The apparatus is made of cast-iron, except the conductors, which are of copper. The purity of the oxygen and hydrogen varies from 97 to 98 per cent. With energy costing a trifle over a cent per kilowatt-hour, the cost per cubic meter of the gases, including working expenses, depreciation, etc., is about 4.8 cents.

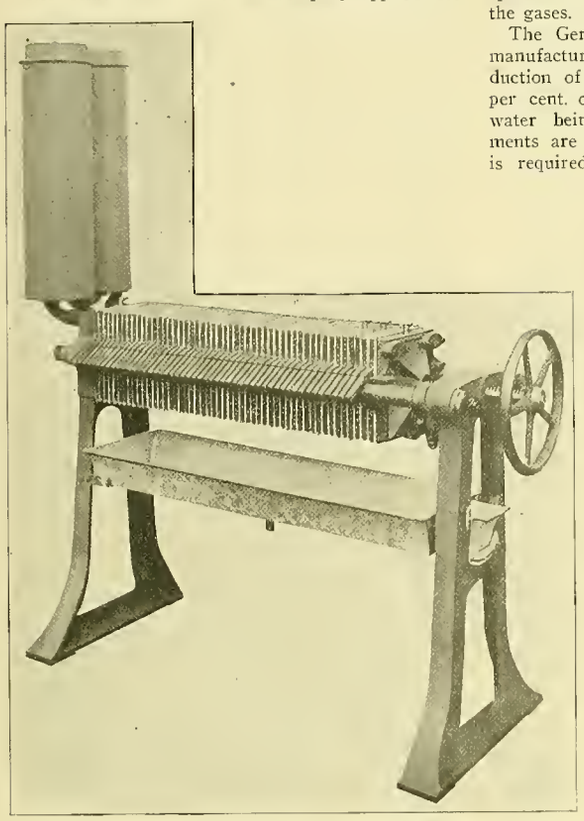


Fig. 1. Laboratory Type for 110 Volts.

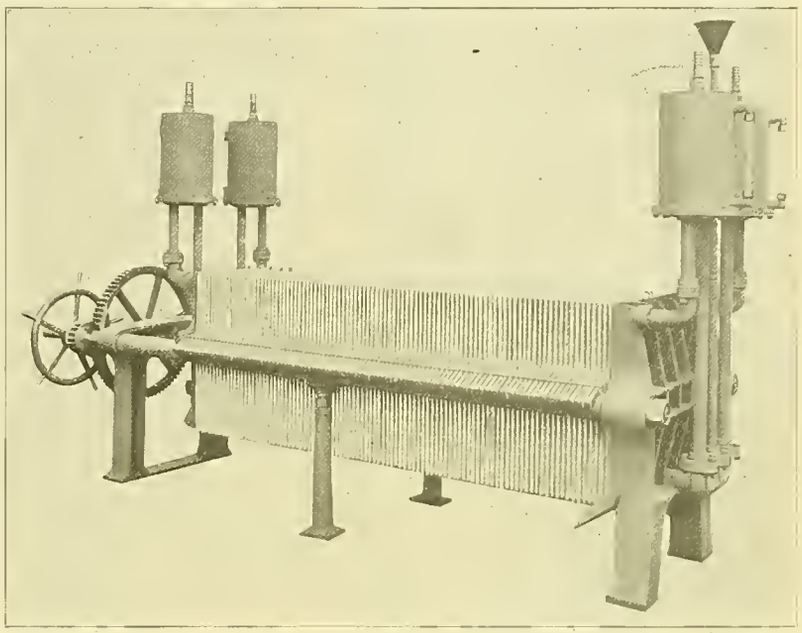


Fig. 2. Larger Machine for 220 Volts.

NEW SWISS ELECTROLYZERS.

The apparatus shown in the accompanying illustrations is a new form for the electrolysis of water, manufactured by the Oerlikon company of Zürich, Switzerland, and it is said to be free from many objections urged against former electrolyzers, being simple in construction and requiring but little attention.

The electrodes are of cast-iron, between which are placed resistant diaphragms, which serve as insulators. The cells are connected in series, and a 10 per cent. solution of potassium carbonate is used as the electrolyte. The evolved gases pass through openings in the plates into two separate pipes, and, together with part of the solution, are carried into the separators, where the gas is freed from the water, which flows back into the apparatus through a common pipe. It is stated that the gas can be supplied under a pressure of 2.5 meters of water, the oxygen being 97 per cent. pure and the hydrogen 99 per cent. The pressure used is about 2.7 volts per chamber, although, after the apparatus has been in use for some time, the temperature rises to its maximum, about 60 degrees C., when 2.3 volts are sufficient. During operation no attention is necessary outside of the renewal of the water.

Twelve kilowatt-hours is necessary to produce three cubic meters of gas, and the price of the gases naturally depends on the cost of the electrical energy used. With power at one cent per kilowatt-hour, one cubic meter of the gases, that is, one-third cubic meter of oxygen, and two-thirds of a cubic meter of hydrogen, will cost four cents.

The Oerlikon electrolyzers are made in various sizes, the accompanying illustration, Fig. 1, showing a laboratory type of apparatus for a direct current of 110 volts and 7.5 amperes, and Fig. 2 showing a larger machine for a direct current of 220 volts and 100 amperes.

Electric Railways for the Adirondacks.

An electric-railway system for the southeastern portion of the Great North Woods in the Adirondacks, running between Paul Smith's and Lake Clear and connecting Lake Champlain and Lake George with Schroon Lake, Lake Placid and intermediate points, seems assured. The Paul Smith's Electric Light and Power Company has been organized and proposes the construction of about seven miles of electric road, work having already begun, it is said.

A network of electric lines is also to be built at once by the recently incorporated Ticonderoga Union Terminal Railroad Company, New York, Philadelphia and Chicago capitalists are backing the venture. The proposed lines follow: Connecting with the Rutland division of the New York Central at Addison Junction and running through the village of Ticonderoga to the mines of the International Mineral Company; connecting with the Delaware and Hudson railroad and maintaining a system of street railways in the village of Ticonderoga; continuing from Ticonderoga to Lake George, with a spur to Old Fort Ticonderoga, with the view of developing 600 acres owned by the company into a national park; from Ticonderoga to Schroon Lake and Lake Placid; from Schroon Lake to Lake George at Hague and to Lake George postoffice at the southern end of the lake. A line from Elizabethtown to Lake Placid also is proposed. On Lake George and Lake Champlain independent boat lines will be maintained.

With the expectation of hauling large quantities of pulpwood, the trolley lines will be constructed on a freight basis, but they also will be provided with passenger facilities. In Ticonderoga the ordinary trolley system will be used, but on account of the forest-preserve laws, which forbid steam or third-rail systems in the woods, electric locomotives will be used, each having four 200-horsepower motors.

Northrup R. Holmes and F. B. Gridley of Troy, N. Y., are president and chief engineer, respectively, of the latter company.

Options have been obtained by the company on all the electric power plants along its proposed routes. Dams for the development of power will be erected in the vicinity of Ticonderoga. It is expected that construction will be begun within six weeks.

Alaska Cable Extension Completed.

An extension of 255 miles to the Alaska cable, connecting Seward on the coast with Valdez, until now the northern terminal of the cable reaching from Seattle, was completed on August 6th. This extension was begun last March by Major W. A. Glassford, U. S. A., signal officer in charge of laying the cable. The news of the completion of the extension was received in Chicago by A. C. Frost, president of the Alaska Central Railway Company, from Major Glassford in the first message over the new line from Seward. The total length of the Alaska cable is now 1,234 miles.

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DATES AHEAD.

Ohio Electric Light Association (annual convention), Hotel Victory, Put-in-Bay, August 16th to 18th.

International Association of Municipal Electricians (annual convention), Reed House, Erie Pa., August 23d, 24th and 25th.

Old Time Telegraphers' and Historical Association (annual meeting), New York city, August 29th to September 1st.

Colorado Electric Light, Power and Railway Association (annual convention), Glenwood Springs, Colo., September 18th, 19th and 20th.

American Electrochemical Society (general meeting), Bethlehem, Pa., September 18th, 19th and 20th.

American Electrotherapeutic Association (annual meeting), Academy of Medicine, New York city, September 19th, 20th and 21st.

American Street Railway Association (annual convention), Bellevue-Stratford Hotel, Philadelphia, September 25th to 29th.

ELECTRIC FURNACES play a constantly increasing part in metallurgical processes. One has been designed in England recently to deal especially with the iron sands which are found in very large quantities at Calliope Dock, Auckland, New Zealand, and elsewhere in that colony. It is said that all previous attempts to treat this sand have failed in spite of the fact that it consists almost entirely of magnetite. The difficulty has been to reduce and smelt the sand, which chokes up all the types of blast furnaces which have been experimented with. The new electric furnace enables this sand to be treated continuously, and the inventor's figures give hope that the cost of treatment where cheap waterpower is available will be sufficiently low to make the process a commercial success. The furnace is used to reduce the iron sand into metallic iron or steel by the intense heat, impurities being removed afterward. The attempt is interesting, because the furnace is designed for a special object—the treatment of material which, although exceedingly rich in iron, has hitherto defied all the efforts of the metallurgist.

BENJAMIN FRANKLIN was born January 17, 1706, and it is proposed to celebrate the two-hundredth anniversary of his birth next January by a suitable commemoration, in which the learned societies of the country may participate. This is an excellent suggestion—one which ought to be carried into effect. Dr. Franklin was one of the greatest of Americans—great as a philosopher, great as a statesman and diplomat, great as a scientific investigator and inventor, great as a man of letters, journalist and printer, and great as a practical man of affairs. Few men have displayed such many-sided excellence. It is fitting that the bicentenary of such a man should be honored in a becoming manner. Philadelphia, where Franklin made his home (although he was born in Boston and resided for considerable periods in London and Paris), may claim the honor of having the chief celebration, but there is no reason why there should not be appropriate exercises in other large cities at the same time. Chicago has a good statue of Franklin in Lincoln Park, given by the late Joseph Medill, and there should be no lack of admirers in this city among scientific and electrical men, among typographers and journalists—in fact, among all good Americans—to organize and carry out a celebration in honor of this great man.

TUNNEL construction is conspicuously facilitated by the use of electric power. This fact was noted by the author of a paper recently read before a technical society in Vienna. In the numerous tunnels at present in course of construction in the southwestern Austrian Alps electrical methods are being freely used, particularly for ventilating, drilling and pumping machinery. The pressure of the fresh-air supply at the mouth of the tunnel must be steadily increased as the length of tunnel increases. This is effected by gradually increasing the number of fans as the work progresses, the fans being connected in series with one another. In order to prevent a sudden large increase of pressure when a new fan is added, throttling is resorted to. The fans are driven by three-phase induction motors having squirrel-cage rotors. The electric percussion drills are of the crank-driven type, each drill being driven by a two-horsepower motor. In considering electric pumps the author lays stress on the ease with which the power supply may be increased when necessary as compared with steam-driven or other pumps. Current is usually obtained from hydro-electric plants. One feature of much interest is the method of protecting the 5,000-volt lines by a water-jet earth connection. Each line wire is connected to a small inverted metallic scoop, against which is directed a vertical water jet. The latter absorbs one liter per second per pole. The leakage current, occasioned by the water jet amounts to 0.03 to 0.05 ampere per phase.

SUPERHEATED STEAM, for engines of large capacity, has a value that cannot be questioned where factors such as high-priced coal offset the additional cost of machinery. It is not always an easy matter to determine whether superheated steam will pay in a certain installation without actual trial. The results of tests that have been made under various conditions will, however, be of considerable aid in determining such questions. A paper read by Mr. Lionel S. Marks at a meeting of the American Society of Mechanical Engineers contains the results of a number of tests on several high-speed two-cylinder compound engines, the engines differing only in size, cylinder proportions and their working conditions.

In summing up the general results of the tests the following conclusions appeared to the writer of the paper to be justified when applied to large size, high-speed, compound, four-valve engines of common proportions.

The jacketing of the high-pressure cylinder is of but little value when moderately superheated steam (100° F.) is used.

Reheating is probably a source of loss unless it superheats the receiver steam at least 30° F., and is not fully effective unless it superheats about 100° F. In the latter case it may be expected to effect a saving of from six to eight per cent. of the total heat used per indicated horsepower.

Jacketing the low-pressure cylinder is shown by the steam qualities during expansion in the low-pressure cylinder to be unnecessary and therefore undesirable when the reheating is effective. The effect of admitting moderately superheated steam to both the high-pressure and low-pressure cylinders is to keep the heat consumption per indicated horsepower practically constant throughout a considerable range of loads—from half load to about one-quarter overload.

The variation within the ordinary limits of the ratio of stroke to diameter in large-size engines of the same power when using moderately superheated steam does not have any marked effect upon the economy of the engine, and the size of the engine is an important factor in determining its efficiency.

THE PROJECT, now laid aside, for an extensive pneumatic dispatch system in London had some interesting features. Parliament was asked to sanction a proposal for the laying of 95 miles of double 12-inch tubes, in which would be transported all kinds of parcels small enough to be placed in the carriers. There were to be 172 stations, at which would be installed air compressors driven by electric motors, thus providing a relay system of pneumatic power. It was anticipated that the electric power required by the company would be 10,000 horsepower. The carriers were to be three feet six inches long and 12 inches in diameter, and their speed through the tubes was placed at 30 miles an hour, although it could be accelerated to 50 miles an hour if necessary. The most interesting part of the electrical arrangements was the device by which a carrier would stop at the right station. Unfortunately, the idea was not developed in detail, and all the information vouchsafed to the public was that on each carrier would be placed a projecting disk which would be so formed that it would make contact with only a special pair of needles in the tubes. When this contact was made one carrier would be thrown out at that station. It was expected that 80,000,000 parcels could be carried annually, in addition to possible business with the Postoffice and the evening newspapers.

The opposition was conducted mainly by the municipalities of London, the objection being to the breaking up of the streets which the project would involve. The argument was that no case of public benefit had been made out, and it certainly was a weak point in the case for the scheme that whereas it was expected to displace about 6,000 light wagons, carts, etc., from the streets of London, the promoters of the bill would themselves place 4,500 tricycles and 70 vans upon the roads. This was naturally made much of. Another point against the proposal was that only comparatively small parcels would go into a 12-inch carrier. It was admitted that, say, a silk hat would not be "tubable." The experimental nature of the project upon the scale suggested was also commented upon. All these arguments prevailed, and after a hearing extending over two weeks the bill was rejected without the committee calling upon the opposition to develop its case

Electrical Progress in New Zealand.

The annual report of the Post and Telegraph Department of New Zealand for the year ended March 31, 1905, has been submitted to the General Assembly of that colony by J. G. Ward, postmaster-general and electric telegraph commissioner. Continued expansion of the business of the department is recorded, the increase in revenue over the previous fiscal year being about $52,000.

The total value of the telegraph and telephone business for the year ended March 31st, including miscellaneous telegraph receipts and government telegrams, was £270,660 13s, 1½d., as compared with £261,941 6s. 6½d. for the previous year—an increase of £8,719 6s. 7d., or 3.33 per cent. The telegraph receipts for the financial year, including telephone exchange subscriptions, private wire rents, etc., amounted to £250,063 1s. 3½d., compared with £237,564 4s. 11d½. in 1903-04—an increase of £12,498 16s. 4d., or 5.26 per cent. The expenditure was £258,977 10s. 9d., as against £255,863 1s. 2d, for the previous year—an increase of £3,114 9s. 7d., or 1.22 per cent. There were 7,943⅞ miles of line and 23,704 miles of wire at the close of the year—an increase of 165 and 773 miles respectively. The total number of telegraph and telephone offices open at the close of the year was 1,200. Of these, 262 were telegraph offices and 938 telephone offices. The number of telegrams of all codes forwarded during the year was 5,159,745—an increase of 194,548, or 3.91 per cent., over 1903-04.

There has been an increase of 5.89 per cent. in the value of the colony's outward international cable traffic for the year, while the traffic to and from Australia has decreased by 5.03 per cent. in the number of messages and 8.09 in value, but this falling off is probably but temporary. The proportion of cable messages to and from New Zealand transmitted by the Pacific cable exceeds 75 per cent. of the total traffic. New Zealand's proportion of the deficit of £87,751 4s. 5d. on the second year's working of the Pacific cable amounted to £9,750 2s. 9d. The traffic receipts amounted to £70,824. It should be mentioned that the yearly deficit includes a terminable annuity payment of £77,545, which includes not only interest, but a sinking fund which extinguishes the capital cost of the cable in 50 years.

Four new telephone exchanges were opened during the year, and one closed, and 1,318 new subscribers were added to the exchanges throughout the colony, bringing the total connections up to 13,423, an increase of 10.89 per cent. for the year. Of the total increase, 595 were added at the four chief centers. There were on March 31st 28 central and 57 sub-exchanges, a total of 85 in all.

The department has for several years been superimposing telephone circuits on telegraph wires and telegraph circuits on telephone wires, and nearly all the wires available for this purpose have now been absorbed. Wherever the conditions permit, use will be made of telegraph wires for telephone purposes or vice versa, either superimposed or on the condenser system. It is intended to give a telephone service between Wellington and Palmerston North on the condenser system. There is also in operation what is known as duplex telephone circuits, and these will be extended where the necessary wires exist. Such a duplex circuit is at work between Napier and Hastings, where four telephone wires allow of a third metallic circuit being superimposed on the two metallic circuit pairs.

Every effort is being made to reduce the cost of country extensions, consistent with safety to the public and a reasonable prospect of an uninterrupted service. The work of installing metallic circuits to eliminate induction from electric tramways, telegraph wires and neighboring telephonic circuits is in progress at Auckland, Wellington and Dunedin. Materials for Christchurch also are now coming to hand.

The department is watching the progress of space telegraphy. When recently in Australia the postmaster-general of this colony, in the course of an interview with the commonwealth postmaster-general, discussed the desirableness and feasibility of establishing wireless stations between Australia and New Zealand, and Mr. Sydney Smith expressed himself favorable to the proposition. Since then the matter has been under the consideration of government, and the postmaster-general has been requested to make a specific recommendation.

The work of the Department under the electric telegraph commissioner, who has the delegated powers of the board of control for electrical undertakings, including tramways, and also the authority under the Electric Lines Act to issue licenses, has been steadily increasing. The tramway undertakings now in existence in the Auckland, Wellington, Christchurch and Dunedin districts include eight orders in council, all of which have been reviewed for the board of control, and supervision over the electrical conditions of these undertakings is continually being exercised. One of them (the Dunedin tramways) involves a 32-mile transmission line, in course of erection, at a voltage of 35,000.

Up to the present nine licenses have been granted by the electric telegraph commissioner under the Electric Lines Act, and several are now being dealt with. These licenses embody regulations framed to meet the varying circumstances of each installation, mainly to secure the safety of the public. The work in connection with this is very great, and involves much consideration and technical knowledge. A list of licenses issued includes Bluff, Christchurch, Dunedin, Gore, Hawera, Inglewood, Maori Hill, New Plymouth, Outram and Reefton.

Owing to the many technical branches of electrical work requiring attention, and the rapid growth of all brances of the business, especially in exchange work, an increase in the superior and technical staff will have to be considered. The Department has officers capable of filling any such positions.

Some Experiments in Radio-activity.

By E. H. Bowen.

During the last year certain work in radio-activity was suggested to the writer in connection with a graduate course at the University of Maine. Very little of the work is original in its character, but it is thought that since the subject is of such recent development, any results obtained ought to be added to those already collected.

Radio-activity may be detected in three ways: by photography, by a galvanometer, and by an electroscope. Readers of the Western Electrician are doubtless familiar with these methods, but a short description of the third—the one employed—is given.

The radio-electroscope as commonly employed consists of a copper wire, to the upper part of which is attached a strip of gold leaf. Other devices are added to increase its sensitiveness, and it may be charged in the usual manner. If now a substance which is radio-active is brought near the electroscope, the air becomes a conductor by ionization, and the leaf approaches the copper wire.

If in connection with this apparatus one employs a micrometer microscope the rate of collapse may be measured for various substances, and for the same substances under different conditions. In the experiments outlined the microscope was kept at about 53 centimeters from the electroscope, and at this distance the constant of the microscope was such that one turn indicated 1.164 millimeters in terms of the motion of the gold leaf.

One of the chief difficulties to be avoided was the natural leakage of the electroscope. In testing substances whose radio-activity was small, this was likely to be of the same order of magnitude as the effect sought. For substances of greater activity it could be neglected. Tests for leakage were made as follows:

Table. I.

Date.	Humidity. Per Cent.	Temperature. Degrees C.	Rate of Collapse. Space Per Hour.
December 28	45	12	0.22
December 30	50	14	0.09
December 31	58	15	0.09
January 3	60	10	0.11
January 5-6	..	..	0.18
January 9	..	..	0.18
January 13-14	..	..	0.15

These data indicate a fair degree of uniformity, and the term "space" means one turn of the micrometer of the microscope.

The next table gives some results which are largely qualitative, since the amount of the radio-active substance was not known in every case.

Table II.

Substance.	Amount.	Space Per Hour
Radium bromide	300,000 activity	2,330.00
Kunzite	1 mg.	0.14
Carootite	9.2 g.	34.00
Carootite	7.1 g.	30.00
Carnotite	30 g.	54.00
Zircon	30 g.	1.96
Uranium concentrated	20 g.	27.00
Pitch blende	115	46.10
Thoriooite	1	13.10
Molybdenum	3	No result
Pitch bleode box	....	1.30
Carnotite box	....	1.16
New snow	....	19.80
Snow evaporated	....	0.84

The next table indicates the results due to varying the distance between the source and the electroscope. The radio-active substance used was radium bromide of about 300,000 activity.

Table III.

Distance	3.5 cm.	6.0	8.5	11.0	13.5	26.0
Rate of collapse	2,293	132	23	12.6	9.1	2.2

From this table it will be observed that the rate of collapse falls rapidly as the distance increases.

In Table IV. are shown the results due to the presence of radium enclosed in a tube and the same substance at the same distance in free space.

Table IV.

	First Trial.	Secood Trial.	Third Trial.	Fourth Trial.	Average.
With tube	12.5	12.6	12.0	12.4	...
Without tube	8.9	9.0	9.1	8.0	...
Difference	3.6	3.6	2.9	4.4	3.8

It is quite likely that these results were modified by the radio-activity excited upon the walls of the tube.

A rather extended series of tests was made to determine the penetrating power of radium through substances which are used as commercial insulators in various appliances. The table shows the thickness of the substances and the rate per hour of the collapse of the leaves:

Table V.

Substance.	Thickness. Mm.	Rate.
Nothing	...	47.00
Horn fiber shellaced on both sides	1.08	15.00
Red leather board	0.61	14.00
Red paper fiber	3.64	4.00
Ground dried rubber	1.00	12.00
Canvas with vulcanizing cement	1.06	19.00
Oiled heavy duck	1.38	9.00
Manganese fiber wood	4.00	10.00
Combination of canvas, shellac, oiled cloth, shellac, mica, rubber	2.20	9.00
Canvas, mica, oiled cloth, rubber cloth, shellac	1.55	8.00
Canvas, shellac, oiled cloth	0.85	18.00
Cardboard shellaced and baked	0.65	17.00
Thick asbestos	5.75	1.80
Thin asbestos	1.35	7.00
Varnished and baked paper board	0.50	17.00
White fiber	0.25	7.50
Ground red paper board	4.00	10.00
Mica compound	0.20	25.00
Photographic black cardboard	0.75	14.00
Black paper board	0.80	1.35
Thin red fiber	1.55	8.30
Manganese fiber	0.85	5.00
Thin black fiber	0.85	18.00
One-fourth inch red fiber	6.40	1.60
Thin red cardboard	0.25	18.00
Oiled linen, cardboard, shellaced and baked	0.65	26.00
Duck, shellac, oiled linen, shellac, duck	1.30	17.00
Cotton cloth, black shellac, mica, black shellac, cotton cloth	1.00	25.00
Cardboard	1.15	9.90
Egg shell horn fiber	0.30	16.70
Thin horn fiber	0.35	40.00
Red paper	0.15	38.00
White paper	0.05	36.00
Brown wrapping paper	0.05	41.00
Oiled cotton cloth	0.15	36.00
Oiled linen	0.15	34.00
Asbestos	0.65	5.10
Thin pasteboard	0.50	41.00
Turpentine, oil, linen	0.35	38.00
Horn fiber	0.80	28.00

Since these substances are all in common commercial use, their insulation resistance has doubtless been determined. These specimens were too small to be tested in this way. A comparison between insulation resistance and resistance to radio-activity would be interesting.

New German Steam Turbine.

In a recent paper before the Association of German engineers, Mr. Wenger gave some particulars of a novel steam turbine brought out by the Union company of Essen, Germany. This is, in small units, a single or multiple-pressure stage-action turbine, with multiple-speed stages in the various pressure stages, while in large units a multiple-stage action turbine at the high-pressure end is combined with a multiple-stage reaction turbine at the low-pressure end. Conical nozzles are used in front of each pressure stage, and the same applies to the first stage of large units, the nozzles being combined in groups that are placed in opposition to avoid any axial thrust on the shaft. The disks of the running wheel are turned from full nickel-steel plates, and are given equal strength against the centrifugal strain, the vanes of the action wheels being milled into their rims by means of a special process, while the reaction vanes are fitted into them separately. The vanes are similar in design to those of Pelton action wheels, being provided with U-shaped pockets, which reverse the steam jet by 180 degrees, and thus insure the most satisfactory relative hydraulic efficiency. The disks have been polished, and any friction resistances on the walls of the vanes have been reduced, so as to diminish friction in the steam.

Lightning Struck Wireless Station.

For some time there has been a question among the naval wireless experts in regard to the greater danger which might be in the wireless stations on account of lightning. This danger was anticipated and provision made as a means of protection. It does not, however, seem to have been entirely satisfactory. A report came this week from the wireless station at Guantanamo, Cuba, to the effect that the station had been struck by lightning. For a time it looked interesting for the observers at that place, who thought that the establishment was doomed to total destruction. When the shock was over it was found that only minor damage had been wrought by the bolt. Nevertheless, the people on duty there have promptly filed a requisition for a supply of lightning rods. It is doubtful if any are sent to Guantanamo, however, for the reason that it is believed the ordinary precautions adopted for the benefit of wireless telegraph stations will offer sufficient protection against lightning. Details are lacking in the report from Guantanamo, and it is not known whether the usual means of protection were taken. If they were, then something more comprehensive must be done to keep the wireless-telegraph stations from being struck by lightning.—New York Tribune of August 5th.

Steam Turbines in Japan.

Characteristic of the present progressiveness of Japan is the fact that, outside of Europe and the United States, this small nation is the largest user of steam turbines in the world.

With the industrial awakening of the Island Empire has come a need for electric power not only for manufacturing purposes, but for transportation and for lighting. Japanese engineers are wide awake, and their enterprise is nowhere more clearly indicated than in their adoption of steam-turbine electric generating units, which in other parts of the world are making such rapid progress.

On July 29, 1904, the first shipment of steam turbines arrived in Japan from San Francisco. The machines were of 500 kilowatts capacity, of the Curtis type, and were for operating the Shigai railway in Tokio. Four weeks after their arrival they were in full operation. As significant of the success of these first units, there have been ordered by the Japanese from the General Electric Company of New York 37 Curtis steam turbines, with electric generators, with a total normal capacity of more than 35,000 horsepower. Of these 11 units are now installed and in satisfactory operation.

Japan is not slow in adopting the electrical systems which will improve its manufacturing and transportation facilities and give her people better lighting service. It is using electricity for operating the street railways of its cities and for indoor and street lighting. In the use of electric power for machine shops the Japanese are following only the best American practice, which, in many cases, requires electric motors mounted on each tool.

The coal mines of Japan will eventually be operated electrically. Some of the turbines mentioned above are intended for the Miike coal mines on the Island of Kyushu. These are owned by Mitsui & Co., and will use two 1,000-kilowatt Curtis steam turbines.

The Osaka Electric Light Company, which furnishes electricity to the city of Osaka, which has a population of over 800,000, is equipped entirely with American electrical apparatus, including six steam turbines of the same make. The capital of this company is 2,400,000 yen, and with its progressive methods it will soon rival some of the modern American illuminating companies.

One of the largest electrical interests in Japan, which has ordered some of the machinery referred to above, is the Tokio Street Railway Company, which furnishes transportation facilities for the city of Tokio, which has a population of 1,440,000. The Japanese name of this company is Tokio Shigai Tedsudo. Its franchise runs until 1952. Apparently, the municipal-ownership idea has obtained some weight in Japan, for this franchise provides that after the year 1932 the municipality may purchase the property of the company by paying a proper price for it. Its capital stock is 15,000,000 yen, divided into 300,000 shares.

Although some English and German material is used by this road, practically all of the electrical equipment is American-made. This includes five 2,000-horsepower Curtis turbo-generator units, with power-house equipment and railway motors furnished by the General Electric Company, and also Wheeler condensers and Brill trucks. Besides a small amount of German and English machinery, such as boilers and trucks, there are a few small dynamos which were made in Japan.

Coming Street-railway Convention.

The twenty-fourth annual meeting of the American Street Railway Association will be held, as before announced, in the week of September 25th to 30th in the South Building, Philadelphia Museum, Thirty-fourth Street, Philadelphia, Pa. The Mechanical and Electrical Association and the Claim Agents' Association will meet on Monday and Tuesday, September 25th and 26th; the parent association on Wednesday and Thursday, 27th and 28th, and the Street Railway Accountants' Association on Thursday, Friday and Saturday, 28th, 29th and 30th. There will be papers on single-phase railways, organization, gas and other engines, and other subjects. The report of the reorganization committee will be presented and acted upon and a new constitution and by-laws will probably be adopted. The Manufacturers' Association promises the best and largest exhibition of appliances ever shown at any convention. The railroad passenger associations have granted rates of a fare-and-a-third on the certificate plan. The headquarters will be at the Bellevue-Stratford Hotel, with rates on the European plan from $2.50 a day up. The annual banquet will be held at that hotel on Thursday evening.

The executive committee of the association has directed the secretary (Mr. T. C. Penington of 2020 State Street, Chicago) to request the officers of the different companies to notify the delegates and heads of departments representing their companies at the convention that they will be expected to be present and take part in the discussions at every session.

The Pennsylvania Railroad will run a special train from Chicago to Philadelphia, leaving Chicago Monday, September 25th at 7:30 p. m., arriving in Pittsburg next morning, where cars from Cleveland, St. Louis and Cincinnati will be attached. The run from Pittsburg will be by daylight, reaching Philadelphia in time for dinner. Further information may be had from G. G. Beltzhoover, district passenger agent, or C. L. Kimball, assistant general passenger agent, Chicago.

High-power Surges in Electric Distribution Systems of Great Magnitude.[1]

By Charles Proteus Steinmetz.

In the following I intended to give a review, investigation and discussion of a high-power surge which occurred in the high-potential distribution system of the Manhattan railway in New York during the early days of its electric operation. The very complete data on the phenomena occurring during the surge and the effects caused by it have been furnished by Mr. H. G. Stott, at that time superintendent of motive power of the Manhattan system. The surge resulted in a complete shutdown of the power station at 5:50 p. m., July 23, 1903, and again during the following night at 12:45 a. m.

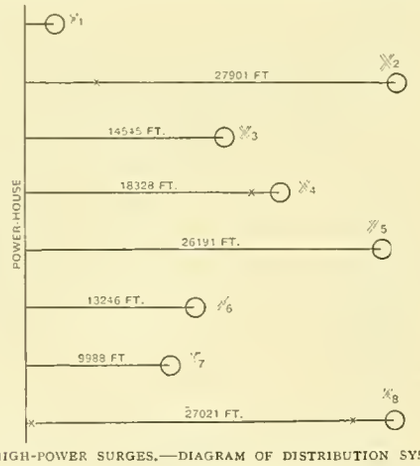
At 5:50 p. m., July 23d, the load on the generating station was 37,000 kilowatts and was being carried by six 5,000-kilowatt, 11,000-volt, three-phase, 25-cycle generators, Nos. 1, 2, 4, 5, 6 and 7. This power was being transmitted to a sub-station, No. 1, located in the generating station, and also to seven other sub-stations by three-conductor, lead-covered underground cables, as follows:

To sub-station No. 2—Six cables, each 27,901 feet long.
To sub-station No. 3—Five cables, each 14,545 feet long.
To sub-station No. 4—Five cables, each 18,328 feet long.
To sub-station No. 5—Four cables, each 26,191 feet long.
To sub-station No. 6—Five cables, each 13,246 feet long.
To sub-station No. 7—Five cables, each 9,988 feet long.
To sub-station No. 8—Four cables, each 27,021 feet long.

The sub-station high-tension bus-bars were divided into as many sections as there were synchronous converters installed, and at the time of the trouble they were being operated with these section switches open.

All feeders to sub-stations, except 4-C and 7-C, were protected with static dischargers at the power-station end of cable but not at the sub-station end. The dischargers consisted of nine air-gaps in series with three carbon resistances each of 0.003 megohms resistance. Feeders to sub-stations are designated by a number and a letter; the number denoting the number of sub-station and the letter the number of the feeder. For example, feeder 8-F is feeder F of sub-station No. 8. A diagrammatic sketch of the high-pressure, three-phase distribution system is given in the accompanying illustration.

At about 5:45 p. m. sub-station No. 7 notified the power station that there was quite a lot of static discharge on cables at that station, but that it could not be located on any particular cable. Immediately after sub-station No. 8 made a similar report, and then the power-station operator went



HIGH-POWER SURGES.—DIAGRAM OF DISTRIBUTION SYSTEM.

to the cable gallery to examine static dischargers and try to locate the trouble. He had examined the dischargers on two cables when a loud explosion was heard; whereupon he ran up to the switchboard gallery, and as soon as he arrived there No. 4 generator short-circuited. Two or three seconds before the generator short-circuited a synchronous converter in the power station arced over and its positive direct-current circuit-breaker opened. This circuit-breaker was arranged to operate on reverse current only. The explosion heard before the generator short-circuited came from a manhole just outside the power station and was caused by a cable short-circuiting. When the generator short-circuited the time-limit relays on generators Nos. 1, 2, 4 and 5 opened their respective oil switches, and the oil switches of generators 6 and 7 were opened by the switchboard attendant.

1. Abstract of a paper presented to the American Institute of Electrical Engineers at Asheville, N. C., on June 19, 1905. Mr. Steinmetz is the chief electrician of the General Electric Company of Schenectady, N. Y.

As these relays were set to operate after three seconds, it is possible that the switchboard attendant opened switches 6 and 7 before the relays had time to act.

On the feeder system the following occurred: Feeder 8-F short-circuited at a joint 243 feet from the power station, the three conductors being blown out for about 12 inches, and one leg of the feeder punctured a porcelain insulating tube and grounded in the power station between the oil switch and the cable bell. Feeder 8-B broke down in a section, and at a point 23,980 feet from power station. The breakdown showed two legs completely open and the other grounded. Feeder 2-E broke down at a point 4,800 feet from the power station, the break showing one leg open and grounded.

At the power station the time-limit overload relays on feeders 4-E, 4-F, 8-B and 8-F opened their switches; the connections from the main leads to the static dischargers on feeders 4-A, 4-B and 2-F burned off; the walls of the static discharger compartments of 4-B were cracked and sprung, and two small holes were burned in the end bell on the power-station end of 2-F.

At the sub-stations no damage was done, but most of the reverse-current relays and some overload relays operated, showing that the converters in the sub-station were feeding back into the cable system.

Careful investigation shows that the following damage was caused by the cables and generator short-circuiting: On generator No. 4, 28 armature bars and 11 connectors at the terminals of machine were broken, bent or badly burned. On generator No. 1 the insulation at the end of a bar in phase "A" and one in phase "C" was punctured, showing that the pressure had jumped across the intervening air-gap of four inches; the pressure also jumped from an end connector of phase "A" to the frame, a distance of six inches, and a number of overhanging ends of armature bars of phase "C" were slightly bent. On generators 2, 5, 6 and 7 some of the armature bars of phase "C" were also slightly bent, showing excessive current.

In addition to the damage mentioned above some harm was done to the transformers supplying power for lights in the passenger stations.

Step-down transformers—11,000 to 2,300 volts—for the lighting system are located at the sub-stations. The current is transmitted to the passenger stations at 2,300 volts and is there transformed to 110 volts.

When the cables broke down and the generator short-circuited at the power station the fuses blew on nine of the 2,300 110-volt lighting transformers, and on four of them several coils of the high-pressure winding short-circuited.

The damaged parts of the system were cut out, and the power station and sub-stations again started.

On the following night, July 24th, at 12:45 a. m. a complete shutdown of the system again resulted from a surge.

The load on station at the time was about 3,500 kilowatts, being carried by generators 1 and 5. A short time previous (about midnight) the ground detectors on the 11,000-volt bus bar indicated a 10,000-volt ground on one phase. Preparations were at once made to locate the ground by a process of elimination, by cutting out the feeders of each sub-station in turn. Some delay was caused by waiting for the adjacent sub-stations to cut in enough synchronous converters to carry the load of the station cut out. Just as everything was ready to cut out sub-station No. 8, a synchronous converter in the power station blew its direct-current positive circuit-breaker. Immediately thereafter the following occurred:

Feeder 4-F short-circuited in a section 16,000 feet from the power station, burning one conductor completely open and grounding another conductor. The current transformer in one phase of feeder 3-D and the relay on the transformer burned out.

One main lead from the bell at the power-station end of feeder 3-B burned off for about two inches at a point seven inches from the copper sleeve of the joint. The static-discharger lead was connected at this point of main lead. The copper sleeve was found to be loose when the cable was repaired. The static-discharger leads from this cable were burned off, the dischargercompartment division walls were badly cracked and sprung, and a hole one inch in diameter and another four inches by two inches was burned in the bell at the power-station end. On feeder 3-A the static-discharger leads were burned off and the discharger-compartment walls were slightly cracked. No damage was done elsewhere to the system.

The most characteristic feature was the enormous volume and relatively very low frequency of the oscillating surge occurring in the system. This explains the severity of the destruction and its widespread extent. Any oscillation of very high frequency could be local only and could not extend over any considerable part of such a system, since the high capacity of the cables necessarily would act as a short-circuit to any very high-frequency oscillation.

The trouble was undoubtedly started in the manhole next to the power house by a spark discharge

between one of the conductors of feeder 8-F and the cable armor, possibly due to the gradual breaking down of a weak spot in a cable joint.

This spark discharge between conductor and cable armor, or ground, was oscillating in character, local in extent and of moderate power and pressure, but of rather high frequency. It was the discharge of a condenser of a pressure equal to the pressure between conductor and ground—that is, the Y pressure of the system, or about 6,400 volts, and the capacity and inductance between the cable conductor and ground. The capacity and inductance, however, in this case were distributed.

The length of cable from the sub-station where the electrostatic displays were observed to the point of discharge in the manhole was 26,780 feet. The estimated capacity between conductor and ground was approximately 0.115 microfarad, and the inductance between conductor and ground 0.106 millihenry per 1,000 feet of cable, or a total of 3.07 microfarad and 2.83 millihenrys, respectively.

[The author then went on to give a mathematical explanation of the reason for the surges, in which he put forward the theory of the phenomenon of a third frequency besides the impressed frequency and the frequency of oscillation of the circuit.]

I have dwelt somewhat fully on this system of wave-trains and the frequency of propagation along the circuit, since I believe this phenomenon of a third frequency, besides the impressed frequency and the frequency of circuit oscillation, has not before been fully recognized. It seems, therefore, that in an electric circuit containing distributed capacity and inductance, as in an underground cable, a long-distance transmission line, or in the high-pressure winding of a transformer or high-pressure generator, three distinct frequencies must be recognized that are essentially independent of one another.

1. The impressed frequency supplied by the generating system, of 25, 40 or 60 cycles as fundamental, and their odd multiples as higher harmonics or wave-shape distortion, which higher harmonics are usually of small or even negligible magnitude.

2. The frequency of oscillation of the system, or natural period of the circuit, depending on the constants of the circuit, mainly the capacity and the inductance, and consisting of a fundamental frequency $N_1 = \frac{1}{4\sqrt{L_0 C_0}}$, and all the odd multiples thereof as higher harmonics. The relative magnitude of fundamental and higher harmonics depends on the distribution of pressure and current in the circuit at the moment where the oscillation starts. As a rule the higher harmonics are not negligible, but usually rather predominate.

3. The frequency of circuit disturbance, which has no direct relation to impressed frequency or to the natural period, but depends upon the character of the disturbance. It appears as a system of waves traveling along the line and results in the static displays at the end of the line—that is, at the station switchboards. In its simplest form, as a single wave or impulse traveling along the circuit (frequently visible to the eye as a luminous streak), it probably appears when a moderate lightning flash or side discharge strikes a transmission line, and from there to the ground, giving at the point of impact a sudden rise of pressure against ground, immediately relieved by discharge to ground.

This phenomenon, so far as I know, has never been investigated from the theoretical point of view. While of itself rather harmless, its danger consists in the self-destructive forces that it may set into play. In the circuit under discussion here the impressed frequency is 25 cycles, the natural period 2,670 cycles, and the frequency of the static display, 13,000 cycles, but of such steep wave front as to correspond to a far higher frequency, possibly of the magnitude of 200,000 cycles per second.

In the breakdown in the Manhattan system, starting with a spark discharge between conductor and cable armor in a faulty joint in the manhole near the power station, attention was called to the disturbance by the arrival of the wave trains and the resultant static displays on the cables and switchboards of the next sub-stations. No direct harm was done by this "static," but before the fault could be located and cut out the spark discharge had reached the next conductor of the cable and started a short-circuit between the two conductors. With six generators of 5,000-kilowatt rating and a momentary maximum of 12,000 kilowatts each, and the synchronous converters feeding back into the short circuit as evidenced by the opening of the reverse-current relays in the sub-stations, it probably is a conservative estimate to assume that for a short period a power of 100,000 kilowatts was concentrated in the short-circuiting arc in the manhole. The energy of 100,000 kilowatts applied during only 0.1 second equals the explosion of about half a pound of dynamite.

The explosion tore off the insulation and protection of the conductor, and a flaring arc started in the manhole, and being oscillating or self-rupturing in character, created a surge of low frequency and enormous power in the whole system, beyond the disruptive strength of any part of the system or any protective device. This short-circuit oscillation was a surge of the whole system throughout, and almost instantaneously caused all the breakdowns in feeders, cables, cable bells, transformers, generators, etc. The static protectors apparently discharged and somewhat lowered the pressure, but could not be expected to take care of the enormous volume of the surge. Some burned up explosively, due to the excessive pressure imposed upon them.

From the data available I estimate the capacity of the system between two conductors as C = 76 microfarads. In series with this capacity is the self-inductance of the generating system. Extensive tests which I made some years ago on a long-distance system at high pressure with the aid of the oscillograph proved that electric oscillations due to changes of circuit conditions, when occurring in a high-pressure line, are not limited to the line but extend back into the generating system, even if the generators are separated by transformers from the oscillating line, as was the case in my experiments. That is, the whole system, including generators, oscillates electrically. This has since been corroborated by observing that a breakdown in one feeder causes breakdowns in other feeders issuing from the same generator bus bars, and therefore that the oscillation passes into and over the main generator bus-bars.

Assuming that the short-circuit current or synchronous-impedance current of these generators at full pressure and no-load excitation is about three times full-load current, or approximately 800 amperes, gives a synchronous impedance of eight ohms "Y." We may probably assume that somewhat less than one-half of this is self-inductive reactance participating in the oscillation and that the rest is armature reaction.

With the understanding that there is some reactance in the station wiring, current transformers, etc., we may assume the self-inductive reactance per generator as about x = 4 ohms, corresponding to an inductance of 25.5 millihenrys. The self-inductauce of the six generators in circuit during the accident then is 4.25 millihenrys. Allowing 0.25 millihenry for effective resultant inductance of the cable system gives a total inductance: L = 4.5 millihenrys.

The fundamental frequency of the surge of the whole system would be: $N_0 = \frac{1}{2\pi\sqrt{LC}} = 270$ cycles, or quite low.

With C = 76 microfarads, L = 4.5 millihenrys, and $e = \frac{11{,}000}{3} = 6{,}340$ volts per phase, the instantaneous short-circuit current or the volume of the surge would be:

$$i_0 = e / 2\pi N L = 9{,}000 \text{ amperes.}$$

Where N = impressed frequency, and the pressure of oscillation:

$$e_0 = 2\pi N_0 L i_0 = 68{,}800 \text{ volts per phase,}$$

or 119,000 volts between lines, where N_0 = frequency of oscillation.

With such a volume of surge all breakdowns that occurred would also be oscillating and therefore would not relieve the system by discharging the oscillation, but set up secondary oscillations. I observed this same feature in the experimental tests referred to above, where in one instance I had three oscillating circuits simultaneously in existence, and still enormous electrostatic displays.

Thirty-two static protectors of 0.003 megohm each, hence of a total delta resistance of 282 ohms, and a "Y" resistance of 94 ohms, would at 100,000 volts delta or 58,000 volts "Y," carry off about 630 amperes, or seven per cent., and therefore lower the pressure of oscillation by seven per cent.—that is, to about 110,000 volts between lines, but they would be loaded far beyond their capacity, as evidenced.

As seen, the most prominent features of the surge seem to have been its enormous volume and relatively low frequency, which account for its very wide extent and destructiveness.

From another phenomenon we can also estimate the approximate frequency of the surge. The burning out of the fuses of some 2,300-volt transformers without destruction of these transformers is explained by assuming that the high-pressure oscillation penetrated to these transformers and that their primary pressure rose so as to bring the iron of the transformers beyond magnetic saturation and blow the fuses by the excessive exciting current, due to magnetic saturation. This did not occur in the 11,000-volt transformers, which were operating at lower magnetic density; while the 2,300-volt transformers, built originally for higher frequency, were operating normally at fairly high density on the 25-cycle circuit.

From this we may estimate the frequency of the surge. Twenty-five-cycle transformers are necessarily operated at fairly high magnetic density, so that increasing the normal magnetic density two or threefold results in such high saturation as to blow the fuses by the exciting current. The magnetic cycle of the surge is superimposed upon the normal magnetic cycle of the transformer. It then depends at what point of the normal cycle the abnormal cycle started. If at the maximum point, an abnormal cycle of one-half the amplitude of the normal cycle would double the density and so saturate. If at the negative maximum point, an abnormal cycle would have two times the amplitude of the normal to treble the density. The most probable is that the abnormal cycle or the surge started near the zero point of the normal cycle or near the maximum point of the circuit pressure and then at 1.25 times the amplitude of the normal cycle, the abnormal cycle would increase the density 2.5 times.

Assuming from the striking distance a pressure of 80,000 for the oscillation, or 7:2 times normal pressure, to give an abnormal cycle of 1.25 times the amplitude of the normal cycle would require a frequency of 9.0 times the normal frequency, or 225 cycles, respectively. The frequency of oscillation therefore would probably be in the neighborhood of 225 cycles.

The shutdown of the generating station ultimately stopped the surge. I should believe it quite possible, however, that besides the breakdowns which have been observed by their destructive effect, some more breakdowns have occurred, lasting so short a time before the taking off of the generating system as not to cause any noticeable destruction, and merely weakening and partly breaking down the insulation. The breakdown occurring again towards midnight I attribute to such a partial breakdown, which was completed by some small oscillation as the opening of a converter circuit-breaker.

Two years have passed now, and I believe no further surge of this magnitude has occurred, and a protection of the system has been devised.

The Edison Storage Battery.

Mr. Edison denounces as untrue recent statements attributed to him to the effect that his battery would drive a vehicle from New York to Philadelphia and back on a single charge. The best he will guarantee, according to the New York Times of August 4th, is 100 miles on a single charge. Mr. Edison is further reported as follows:

"The troubles in the battery that I have been trying for two years to remedy have been purely mechanical. They have been greatly due to the swelling of the nickel element. I have succeeded in reducing the weight of the battery to from 40 to 45 pounds per horsepower. It has taken time to find out what was needed for this battery, because we can't look ahead and see just what such a thing is going to do after we have it sketched on paper.

"I do not pretend to have solved the problem of touring vehicles. That can only be possible when more charging stations are spread about the country. Young Cooper Hewitt of New York has helped to solve that problem with his mercury rectifier, which takes the place of the old transformer and makes it possible to convert the alternating currents used in small towns so as to make them available for charging the batteries.

"With proper motor and wagon equipment we can, with our cells, operate an ordinary delivery wagon for 58 per cent. of the cost of maintaining a horse."

Mr. Edison said that, under the best conditions, it took five hours to charge the battery, though if economy was no object the charging could be done in less time.

The inventor has worked with his battery with the particular object of applying it to auto-trucks for commercial purposes, and he says he can drive a two-ton truck now at the rate of 33 miles an hour, if necessary.

Kansas City Railway and Light Company.

The annual report of the Kansas City Railway and Light Company, which controls the street-railway and electric-light properties of Kansas City, Mo., for the year ended May 31st shows a prosperous condition of the company and steady growth. President Bernard Corrigan says the gratifying showing is due to the growth of the city and its suburbs and the improved service given by both the street-railway and light companies. The company is now installing a 5,000-kilowatt steam turbine, and during the year 148.854 feet of track was laid, increasing the total mileage to 217.79 miles of single track. The income account for the year gives the following figures:

	Railway Companies.	Light Companies.	Total
Gross earnings	$3,906,757	$542,376	$4,449,134
Expenses	2,020,378	214,882	2,235,260
Net	$1,886,378	$327,494	$2,213,872
Other income	16,588	.....	16,588
Total income	$1,902,967	$327,494	$2,230,462
Deductions	1,464,211	92,651	1,556,862
Surplus	$ 438,756	$234,843	$ 673,600
Preferred dividend, 5 per cent	.....	.....	476,[illegible]
Leaving for surplus or common	.....	.....	$ [illegible]

Practical Points in District Heating.

[From Question Box of National Electric Light Association.]

QUESTION.

To what extent is it economical to supply exhaust steam for heating?

ANSWERS.

G. W. Richardson, Cicero Light, Heat and Power Company, Oak Park, Ill.: Enough to keep the back pressure of the engine below four or five pounds. There is a plant at Peoria, Ill., using exhaust steam for district heating, where they tap the receiver of a cross-compound Corliss engine direct to the street mains. They have an adjustable screw and vernier to adjust the cut-off of the low-pressure cylinder while the engine is in operation, and I am informed that it meets the requirements of an ideal district-heating system, from the standpoint of both economy and flexibility.

The Edison Electric Illuminating Company of West Chester, Pa.: To the full extent of the exhaust, if business is within reach of short mains. Interest, depreciation and repairs on investment of service pipes and mains are the chief expense connected with the business.

G. Wilbur Hubley, Louisville Lighting Company, Louisville, Ky.: To the extent only of the amount of excess of available waste exhaust steam under the minimum conditions of the heating season.

George Howe, New York Edison Company: If the town is small or thickly populated in proportion to its size and there are a large number of steam-heating users in the immediate vicinity of the central station, the selling of exhaust steam for heating purposes might prove profitable. However, if the heat units in the exhaust steam are to be supplied for heating purposes, I believe that the hot-water system is by far the best, as the engines may still continue to be operated as condensing engines, giving up the latent heat in the exhaust steam to the condenser water, and this water be circulated through insulated pipes to steam-heating users at such a moderate temperature that radiation from these pipes will be very small. Such a system, I understand, has been most successfully operated at Evanston, Ill.

American District Steam Company, Lockport, N. Y.: The real meaning of this question is not altogether clear. Taking it for granted that the questioner desires to know to what extent it is advisable to carry back pressure on his engine, would say, this would be determined very largely by the style of engines used. So long as operating conditions do not make the cost of furnishing exhaust steam exceed the cost of furnishing the same amount of live steam, everything being considered, it is advisable to use exhaust steam in preference to live steam.

QUESTIONS.

(a) Is it not time to place "district heating" in its proper place as a business by itself? (b) Can it be made to pay its own way? (c) What is the ideal method of making charges for this ideal heat? (d) Provided regulation at plant is good, has any efficiency been gained by use of regulators on houses for hot-water heating, from actual reliable tests?

ANSWERS.

F. N. Jewett, Chicago: (a) No. (b) A heating plant alone, operated purely as a heating plant, cannot be made to pay, except in rare and isolated cases. (c) Meter basis. This is ideal, but more "ideal" than practical.

American District Steam Company: District heating has suffered more from lack of intelligent management than from anything else, and, until recently, from the absence of any accurate means of measuring the consumption of steam. Where careful and intelligent management has been given district steam-heating plants, uniformly successful results, from a financial standpoint, have been secured. The only proper way of charging for heat from a central station is on the basis of meter measurement. Heat is more easily wasted than any other commodity furnished by a public-service company. A radiator is a condenser and the rate of condensation of steam in a radiator is directly dependent upon the temperature of the air surrounding the radiator. If the temperature of the surrounding air be kept at a low point by open doors, windows or like conditions, the rate of condensation is immediately greatly increased over normal and proper conditions. This is done without warning. If gas is allowed to escape from a gas jet, its odor attracts attention at once. If gas is burned unnecessarily, the light and heat produced serves as a reminder to the customer, and it is turned off. If electricity is used for illuminating or power purposes, its use is accompanied by certain visible phenomena that act as a sort of alarm, but the rate of condensation of steam in a radiator may be almost instantly increased to several hundred per cent. of the normal rate through a current of cold air from an open door or window, without any warning being given. Moreover, no two consumers use steam in the same quantity, even under similar conditions, and it is manifestly unjust to charge the same rate to different consumers for widely different amounts of consumption.

C. R. Maunsell, Edison Electric Illuminating Company, Topeka, Kan.: For the last three years the committee on district heating has been endeavoring to make a place for this valuable adjunct to light and power business and will be glad to receive, from anyone, suggestions that may prove of interest to the members engaged in this branch of business. It certainly can be made to pay its own way.

The ideal method of charging for heating is the meter system, supplemented by supervision of the installation to guard the customer's utilization of all heat units delivered to the building. Thermostatic regulators, if inspected occasionally, give good results, both in the regulation of temperature and the saving of expense for heating.

R. N. Kimball, Kenosha Gas and Electric Company, Kenosha, Wis.: The ideal method of charging is a combination of meter and flat rate based on square foot of radiation required for steam plants. There is a large class of business in which the average meter use would not justify the necessary investment in station capacity. A readiness-to-serve-charge must be made in addition to meter rates.

Efficiency has been gained in hot-water plant by the use of the thermostat; 40 per cent. of the amount of water pumped has been saved.

QUESTION.

Which is the better plan where a new lighting and power company is establishing a station with an expected annual load factor of 30 per cent., 24 hours' lighting service—to operate the heating system with live steam and engines of the highest possible efficiency, for generating current, or to use engines of lower efficiency, utilizing exhaust for heating?

ANSWERS.

W. L. K.: The question of operating the combined heating and lighting station was thoroughly experimented on by the writer some six years ago. After a series of exhaustive tests it was found that the general station economy was very much improved by using engines of high efficiency, heating the feed water from the exhaust of the engines, and not attempting to put any back pressure whatever on the engines by forcing the exhaust through steam-heating mains. This test covered high and low-efficiency engines, with engines running condensing to running with as high as 7.5 pounds back pressure.

P. Junkersfeld, Chicago Edison Company: The peak of the daily heating load comes during the early morning hours. The peak of the daily lighting load comes during the late afternoon or early evening hours. This means either the use of considerable live steam for the heating peak or no demand for considerable exhaust steam at the lighting peak. The heating demand is heavy on considerably less than one-half of the total hours in a seven-month heating season. For all the remaining hours of the entire year, engines of reasonably good steam economy are advisable, even though it be necessary to use some live steam for heating for a short time in the morning on cold days.

F. N. Jewett: It is better to use engines of lower efficiency, utilizing the exhaust for heating. It will be seen that but little of the total heat in the steam can be taken out in useful work, even in a theoretically perfect engine.

Coming Ohio Electric Convention.

As previously announced, the eleventh annual convention of the Ohio Electric Light Association will be held at Hotel Victory, Put-in-Bay Island, August 16th, 17th and 18th. The convention will be opened by a reception and concert to be held on Tuesday evening, August 15th. The regular sessions will begin at 9:30 a. m., Wednesday. In addition to the president's address the following-named papers will be read:

"Central-station By-products," J. A. Bendure, Lima, Ohio; "Notes on Use of Barriers in Switchboard Construction," H. L. Wallau, Cleveland, Ohio; "Mercury Arc Rectifier," P. D. Wagoner, Schenectady, N. Y.; "Effect of Large Alternating-current Motors on Plants of 1,000 Kilowatts and Less," E. H. Best, Youngstown, Ohio, and Leo Phillips, New York city; "Electric-motor Applications," J. Henry Flinck, Pittsburg, Pa.; "Conditions Under which it has been Found Advantageous to Use Potential Regulators," W. E. Richards, Toledo, Ohio; "Pole-line Construction," B. L. Chase, Columbus, Ohio, and E. E. Noble, Cleveland, Ohio; report of committee on "Cost Determination," E. J. Bechtel, Toledo, Ohio; M. C. Hull, Columbus, Ohio; "Methods of Selling Current as Applied to Cities of 20,000 Inhabitants," H. C. Ayers, Greenville, Ohio; "Methods Employed in Getting New Business and Retaining Present Business when Gasoline and Natural Gas Competition Exists," W. E. Russell, Massilon, Ohio; R. L. Johnston, Akron, Ohio, and J. R. Maxon, Gallipolis, Ohio; "Wiring Moderate-size Residences," J. Kermode, Cleveland, Ohio; "Meter and Billing Records," F. E. Valentine, Piqua, Ohio; D. W. Low, Alliance, Ohio; C. E. Inman, Warren, Ohio; George Hayler, Joplin, Mo.; "The Tantalum Lamp," William Ambler, Cleveland, Ohio; "The Nernst Lamp," E. R. Roberts, Pittsburg, Ohio; "High-efficiency High-candlepower Incandescent Lamps," F. W. Wilcox, Harrison, N. J.

There will also be the "Question Box" and an illustrated lecture on "Illuminating Engineering," by W. D'A. Ryan, Lynn, Mass., followed by a banquet on Friday evening. The entertainment features include the reception above mentioned, a trolley ride around the island and visit to the caves, a dance in honor of the ladies on Wednesday evening, boat rides, bathing, bowling, tennis and croquet as well as a trip to Cedar Point on Friday. An elaborate array of prizes has been provided by the friends of the association for the ladies' contests. D. L. Gaskill of Greenville, Ohio, is the secretary of the association.

Reclamation of the Yuma Desert.

One of the most difficult irrigation undertakings of the present day is the proposition to transform 85,000 acres of the arid Yuma Desert into fertile farming land. The United States Reclamation Service has awarded the contract for this work to J. G. White & Co.

The project presents many difficulties. The nearest town is the city of Yuma, located 12 miles down the Colorado River. Suitable drinking water is extremely scarce, and the summer temperature in the Yuma Desert ranges from 100 to 120°. A modern camp will be built, and will be controlled by special officers employed by the contractors, or by the government police of the Indian Reservation. It will be equipped with a complete refrigerating system to provide ice and cold storage.

The transportation difficulties will be overcome to a great extent by the use of a 30-foot gasoline launch, to run as an express boat between the dam and the city of Yuma. Barges and other floating equipment will be used to transport heavy supplies. At the dam will be located complete telephone and telegraph systems, so that constant communication may be had with the city of Yuma.

At a point where the Colorado River forms a dividing line between the state of California and the territory of Arizona, a dam one mile long will be built across the river. It will extend completely across the valley, and will have a sluiceway at either end, which will be connected with the main arteries of the system of irrigating canals. Under ordinary conditions, the Colorado River at this point is about one-quarter of a mile wide, but the flats on either side are frequently flooded by high water. This is especially the case during the early summer months, when heavy floods are caused by melting snow in the mountains.

The contractors estimate that the work will require the removal of over 300,000 cubic yards of solid rock and 300,000 cubic yards of lighter material. The rock will afterward be used for filling in the dam. The three vertical concrete core walls in the interior of the dam will require 30,000 cubic yards of concrete and 50,000 linear feet of sheet piling. Eighty thousand cubic yards of rock paving three feet thick will be needed to complete the face of the dam. The construction is to be pushed rapidly this fall and winter, so that the dam may be finished before the wet season of 1906. As indicative of their determination to finish this great work within the year, it is interesting to know that work was actually commenced by the engineers within six hours after the contract had been signed.

Government Invites Electrical Proposals.

Sealed proposals are being invited until September 30th by Elliott Woods, superintendent of the United States Capitol, for furnishing all material and erecting and putting in operation, in a building and on foundations to be provided by the United States, in Washington, D. C., a complete heating, lighting and power plant, including machinery, boilers, piping, electrical transmission, cables and conduits, and all other equipment. Plans showing the general plan and complete information and specifications will be furnished responsible intending bidders by the deposit of a certified check with Superintendent Woods.

The Navy Department, through the Bureau of Supplies and Accounts, is inviting sealed proposals until August 22d for furnishing eastern navy yards with the following: Schedule 62, incandescent lamps, carbons, insulating tape, wire, lamp cord, testing sets, wattmeters and miscellaneous electrical supplies; schedule 63, generating set, wire, cable, cells, electrical supplies; schedule 64, conductor cable, testing magnetos, supply boxes. Blank proposals can be obtained at the navy pay office in New York or on application to the bureau. The bureau is also inviting sealed proposals until September 5th for furnishing the Mare Island and Puget Sound navy yards with the following: Schedule 58, dry cells, insulators, generating sets.

Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until August 23d for the installation of a conduit and electric wiring system for the United States postoffice and custom-house building at Burlington, Vt., in accordance with drawings and specification, copies of which may be had at the above address or at the office of the superintendent of construction at Burlington.

Management of the Instrument Department in Telephone Exchanges.

By Charles H. Coar.

In speaking of the instrument department in most telephone exchanges one has reference to that portion of the exchange where the telephones are assembled and given to the "installers" or instrument "setters" for installation in accordance with the various orders or contracts turned into this department from time to time. While the scope of the work placed under the supervision of the instrument department in some exchanges is more broad than in others, many of the methods of conducting this department can be similar without effecting any evil results.

In many large exchanges any installation, whether it be a private branch exchange, the wiring of a building, or simply the placing of an instrument, would be confined to this department. In other exchanges the work is placed under different heads so that the work of the instrument department consists mostly of assembling and installing the telephones and other extra apparatus, such as call bells, etc.

A well-regulated instrument room should be located in a position where it will secure plenty of daylight and fresh air and still be free from any dampness which would have a decided detrimental effect on the apparatus. It should also have ample space for storing the apparatus, for the work bench and other shop accessories, and should also be provided with easy access to the street. Desk room should be provided for the person in charge of the department, from which the orders to the installers are issued and the records filed. A space should be fenced off in the instrument room for the installers to wait in for their orders. This space should be provided with lockers for the men, a bulletin board for any special instructions or other information, as well as with benches for the men to sit on. The installers should not be allowed inside the instrument room proper, but should receive their telephones and equipment through a half door or wicket upon showing orders for them. This will do away with considerable confusion and facilitate the work.

In such telephone companies as receive their telephone apparatus in parts, as so many receivers, transmitters, etc., the recording of these parts becomes quite a task and the records required are somewhat complicated, but at any event all the apparatus should be thoroughly checked and recorded upon its receipt and throughout its useful existence.

Nowadays manufacturers in most instances stamo the different telephone parts with a number which can be used to identify each particular piece of apparatus, or, when the complete telephone is purchased, this is given a number for the same purpose.

When the apparatus, such as the coils, bells, receivers, transmitters, etc., are identical it is best to assign a number to a complete telephone; a letter or special mark can be used to designate the mounting. It is possible to utilize a card index for recording the telephones in this manner, a card being assigned to each telephone and a record kept thereon throughout that telephone's existence. The amount of apparatus outstanding could then be computed from the cards, as one would know of what each telephone consisted, and this could be added with the stock on hand to obtain a balance with the receipts.

The amount of material and tools, with their cost and disposition, should be thoroughly recorded. The installer's order should have space provided to note the material used on each job and the time consumed, so as to aid in figuring up the cost of any or all the installations for any length of time. To describe the various record forms which have been adopted to suit the different requirements is not the purpose of this article, but every exchange should maintain a complete record of everything so that the work can be systematized to some degree of accuracy. Too often many of the smaller details are looked upon as unimportant, with the result that a loophole for additional expense is opened.

The workshop portion of the instrument should command much attention for the reason that the class of service furnished by the company depends much on the class of work done here. Special pains should be exercised to have any tool or apparatus which will facilitate the setting up or repairing of the instruments. The work bench should be in a position to secure a large amount of light, should be roomy and provide a sufficient number of permanent pockets for screws and other accessories used in setting up the instruments. The pockets should be within easy reach of the various workmen. It is well to construct the bench wide enough to allow workmen on each side of it; then it is possible to arrange the screw pockets, cord racks, etc., lengthwise through the middle.

The bench should be provided with testing terminals for trying the apparatus as it is being assembled or finished. Each telephone should be given a thorough test before it is installed. Where a large amount of soldering is to be done the electric soldering iron is convenient, as the temperature is very uniform and the copper stays tinned well. The conducting cord to the iron can be arranged on a device similar to a spring curtain roller, so that the iron may be raised out of the way when not in use, or plug receptacles can be arranged at convenient points about the bench with which the irons may be placed in circuit. It is almost needless to mention that flux solder only should be used about the instruments, coils or fine wire, but in tinning iron surfaces or in heavy soldering it is best to use a soldering paste or acid. The workshop should also contain a vice and a small iron lathe, which will be found useful in rewinding coils, polishing, etc.

The lathe should be provided with the regular attachments, as it then can be used for drilling, and emery grinders can be placed on mandrels and chucked for grinding or sharpening purposes.

The instrument installers should have a kit comprising the following tools: A gasoline torch and soldering iron, a small swing ratchet brace, two Syracuse bits of the proper size for tuhing, etc., a large and small screwdriver, side-cutting and nose pliers, a hammer similar to a tinsmith's, tape, solder, screws, etc. Tools of this kind are sufficient for the ordinary installation, but the workshop should be provided with brick drills, expansion bits, saws, chisels, etc., which are often necessary.

There should be no doubt in the installer's minds as to how the instruments should be installed or connected, so it is well to issue information in some form or other which will outline the various methods of doing the work. Do not be backward about letting your workmen know why you do work one way or another.

The workmen should be provided with slips which will show the disposition of their time and material. In case any old material is taken out of a building this should be returned to the office, as screws, old wire, etc., can often be utilized or sold for junk. In buildings which are wired before occupancy, it is well to terminate the wire in a closet or some place likely to be noticed by an occupant without attracting the attention of an outsider. The wire can then be tagged with an advertising placard which will call the attention of the occupant to the fact that the house or room is wired and that a telephone can be easily placed.

The instruments returned to the workshop should be thoroughly overhauled and tested. The different parts should be cleaned and polished before it is returned to service, as nothing quite so places a company in a bad light as a new installation with a dirty or grimy instrument. Some judgment can be used as to placing instruments; the blacksmith shop does not require quite as nice an instrument as the fine residence or office. Aim to place your best wares where they will command most attention and harmonize with the surroundings.

Some companies make the mistake of not letting their employes give advice in locating a telephone during the installation, when as a matter of fact the employe can often save considerable expense by placing the telephone in some position where it will require less wire and work to better advantage. Let the employe give advice if he is asked for it, for it is reasonable to think that he should understand the requirements necessary for good service somewhat better than the average subscriber.

Aim to keep the instrument room clean and free from rubbish; cleanliness aids materially in obtaining the best results from your workmen.

Shop "Kinks."

The shop "kinks" or methods outlined herein are old and tried, and they are offered not as experiments but as a means of aid in attaining an ideal condition in the instrument room which is so necessary in this, the nursery of the telephone exchange.

An ideal disinfectant for transmitter mouthpieces and receiver caps can be made from the following formula, which will make somewhat over a gallon of the mixture:

40 per cent. formaldehyde	4 ounces
Wintergreen oil	1 dram
Eucalyptol	1 scruple
Alcohol	1 ounce
Water	1 gallon

In compounding this mixture one should be careful not to get any in the eyes, as it will smart quite painfully. The receiver caps and mouthpieces can be immersed in the solution, or they may be moistened with it by means of a sponge or cloth. It not only disinfects these parts but also dissipates any bad odors.

Often receiver and mouthpieces become stained yellow from age and use, so that ordinarily it is most impossible to make them appear presentable. If a lathe is available this may be easily done by placing the articles in the chuck and allowing the lathe to run at low speed, applying No. 000 sandpaper until the scum and scratches have disappeared. Then apply a mixture of pumice stone and water with a stiff brush, following this with whiting and wash with water. After this cleaning the polish is put on with a mixture of lampblack and oil. This can be rubbed to a finish by the bare palm or a chamois skin.

To polish walnut wood, first smooth the surface with sandpaper and apply a coat of shellac varnish, and rub this with a piece of smooth pumice stone until dry. Then apply a coat composed of beeswax, turpentine and linseed oil with a dauber and rub dry with a piece of waste or other soft material. The more rubbing the better the polish. Nickel parts can best be polished with a purchased preparation.

A little bichromate of potash added to plain glue will make it waterproof on exposure to air.

To temper a tool, first heat the tool to a dull redness, then plunge it into a mixture made by compounding the following ingredients: ten parts of resin in five parts of fish oil, with 2½ parts of tallow stirred in. When the tool is cool, reheat and plunge into water.

An excellent polish for steel or iron can be made out of the following ingredients:

Turpentine oil	5 parts
Stearin oil	25 parts
Rotten stone	25 parts
Bone charcoal	45 parts

These ingredients are mixed with a sufficient amount of alcohol to form a paste which can be applied with a brush. The alcohol evaporates and the deposited matter is then removed with a dry polish consisting of 45 parts of animal charcoal to 25 parts of rotten stone. A cloth or chamois skin can be used to do the rubbing.

By using preparations similar to the above many pieces of apparatus which would be useless can be polished up and returned to service, thus saving considerable expense in this department.

Bell Telephone Output.

The American Telephone and Telegraph Company's instrument-output statement for June and the first half of the year shows a falling off in telephone installations, which, however, is usual with the opening of the summer season. Comparative figures for the month and for the six months to June 30th are reported as follows:

	1905.	1904.	Increase.
June:			
Gross	120,555	83,312	37,243
Returned	52,427	44,144	8,283
Net	68,128	39,168	28,960
Since January 1:			
Gross	897,620	591,684	305,936
Returned	283,542	247,190	36,352
Net	614,078	344,494	269,584
Total outstanding	5,094,642	4,124,011	970,631

TELEPHONE MEN.

The death is reported of N. P. Evans of the Norborne Telephone Company of Norborne, Mo.

Fred Speechley, local manager at Cloquet, Minn., of the Bell telephone company, has been transferred to Superior, Wis., to become manager of the Bell system there. G. B. Holcomb of Ely, Minn., succeeds him.

A. T. Whittle, general manager of the Harlan and Avoca Telephone Company of Harlan, Iowa, resigned his position on August 1st and has become associated with the Corn Belt Telephone Company at Waterloo. D. A. Mann has also entered the employment of the Corn Belt company. He has been manager of the Mutual Telephone Company at Grundy Center since it was organized.

The Wisconsin Telephone Company is planning on expending about $30,000 in improving its system at Menomonie, Wis.

Telephone News from the Northwest.

Negotiations are pending at Albert Lea, Minn., for the purchase of the local exchange, both the Tri-state Telephone Company and the Northwestern Telephone Exchange Company being eager bidders for it.

The telephone companies operating in the Twin Cities do not contemplate any order forbidding the operators to ring up subscribers for early morning calls in place of alarm clocks. Neither company would wish to give late calls when the busy period of the day is starting, but they will not follow the action of the eastern company, which has forbidden the use of the instrument for early morning alarm calls.

The New Ulm (Minn.) Telephone Company has extended rural lines to Milford, Sigel, Cottonwood, West Newton, Lafayette and Courtland.

The Villard Telephone Company of Villard, Minn., has filed articles of incorporation with a capital of $10,000.

The local exchange at Maple Lake, Minn., has arranged with the Minnesota Central Telephone Company for long-distance service.

Work is under way for the construction of a telephone exchange for Akeley, Minn.

The Northwestern Telephone Exchange Company has completed the new east-side building in Minneapolis, through which the toll business is to pass, and it will be put in service as a toll exchange on August 14th. The new building will cost complete $150,000.

J. H. Shoemaker has purchased a half interest in the Traer (Iowa) telephone exchange, and with R. L. Parker has bought the exchange at Reinbeck, Iowa.

The Hickman (Neb.) Telephone Company has filed articles of incorporation. A. Brendle heads the list of stockholders.

The mutual telephone companies of Hamilton, Hardin, Story, Grundy, Marshall and Franklin counties met at Union, Iowa, and formed the Mutual Commercial Telephone System.

The Independent Telephone Company of Council Bluffs, Iowa, is planning to suspend a telephone cable across the Missouri River to South Omaha, Neb., and will erect two steel towers 125 feet high. The cables will be about 1,800 feet in length. R.

Indiana Telephone Items.

The West Terre Haute Telephone Company has filed articles of incorporation with capital of $10,000. Burton Cassiday, D. S. Gonnell and H. H. Knite are directors.

The Daviess County Home Telephone Company has issued $100,000 preferred stock, divided into $100 shares.

Indiana Independent telephone men say that a systematic plan to produce discord in the ranks of the Independent telephone people is manifest by the Bell agents traveling over the state, pretending to negotiate for almost every Independent plant, and then spreading the report that this or that plant is about to sell. The few companies that have gone over to the Bell are said to be not wholly satisfied, since 98 per cent. of the long-distance calls are for points inside the state, where the Independent connections are so much more numerous than the Bell.

The Central Union Telephone Company is erecting a telephone system in Frankton to cost $10,000. In order to secure business and successfully compete with the Home company the Central Union proposes to drop the rate to 50 cents per month.

In order to thwart the granting of an application for a franchise for an Independent telephone system in Marion to compete with the United Telephone Company the managers of the latter have filed a $5,000 bond guaranteeing that the United company will not raise the rates in Marion during the next five years.

A public statement has been given out by George W. Beers of Fort Wayne to the effect that the Independents will soon cut off the United Telephone Company from all connections, giving as a reason therefor that the manager is discriminating against the Independent toll service. Manager Sale of the United company retorts that Independent companies will not be permitted to sever their relation with the United Telephone Company in retaliation for the United signing a sub-license contract with the Bell, and if one of them tries to cut its wires it will be met with an injunction. S.

Ohio Telephone Notes.

It is stated that the plan of liquidating the Federal Telephone Company will be postponed at least two months as the officers do not consider this a good time to dispose of the large amount of bonds owned by the company.

Material has been received by the Central Union Telephone Company for the new pole line between Findlay and Fostoria, and the work will be begun at once. Three copper circuits will be strung on these poles. As soon as the work is completed a new pole line with three circuits will be built between Findlay and Kenton, giving an outlet to the south.

The Home Telephone Company of Chagrin Falls has been incorporated with a capital stock of $10,000 by T. P. Ryan, W. R. Nutt and others.

It is reported that the Bell interests are negotiating with the Black River Telephone Company for the purchase of the plant at Lorain. The Bell company has had a franchise there for a year, but the Black River company has held the business against all odds.

Injunction proceedings brought by the city of Hamilton against the Home Telephone Company and the gas and electric light company have been dissolved, the court holding that an arrangement might be made whereby the latter may string its wires on the poles of the former and thus prevent the necessity of so many poles on the streets.

Announcement has been made that the Bell Telephone company will spend $200,000 on the improvement of its property at Toledo. A good portion will go to outside construction and the older lines will be rebuilt. Extensions will also be put to the switchboard, which has grown too small for the business. The work will probably be completed by October. C.

Michigan Telephone Matters.

It is reported that a merger will be effected by which the Michigan State Telephone Company will absorb the Marquette County Telephone Company, a strong competitor of the Bell in the Upper Peninsula. The Marquette company was organized 10 years ago by local capitalists and has been paying 10 per cent. dividends on a capital of $60,000. It is believed that this deal is the result of the recent visit of W. C. McMillan and party to the Upper Peninsula.

The line men of the Citizens' Telephone Company of Jackson have struck because the company refused to sign an agreement to employ union men only. Their places will be filled with men from other cities. W.

Cuyahoga Telephone Day.

The picnic of the employes of the Cuyahoga Telephone Company at Luna Park, Cleveland, Ohio, on August 5th, was a success in every particular. Rain came late in the evening and caused a scramble, but did not spoil the fun. During the afternoon and evening all of the 600 employes, with many of their friends, found time to visit the park, and it is estimated that 10,000 persons were there. President F. S. Dickson and Secretary J. B. Hoge both made pleasing addresses. The program was made up of athletic events, in which both the men and women took part. The construction department won a prize of $5 in a tug-of-war contest against all other departments. Miss Z. Allen and Miss M. Maloney were victorious in a race for young women and Miss L. Kitchen and Miss M. Werderman were first and second in a 50-yard dash for girls under 15. George Tod and Howard Colson were first and second in the race for boys under 16. George Getzein and H. Fands were the winners of the fat men's race, in the order named, while D. Powers and B. Wolf came out ahead in the potato race. L. Rosenberg and M. H. Chaptle won the 100-yard dash, open to all. In the wrestling match between General Foreman D. B. McIntyre and Assistant General Foreman George Getzein, the former won the Cornish in one minute and 35 seconds and the latter the Græco-Roman in one minute and 20 seconds.

On this day also the company made its semi-annual distribution to the employes on the profit-sharing plan. The amount was equal to a dividend of 7 per cent. on the wages for the last six months, the largest amount that has yet been distributed.

Illinois Telephone Men at Peoria.

The Central Illinois Independent Telephone Association closed a two-day session at Peoria, Ill., just as the Western Electrician goes to press. The meetings were held in the Coliseum Building on August 7th and 8th, and a good attendance was reported. One of the principal matters decided at the convention was the formation of a state organization, to be divided into districts, after the plan and in co-operation with the National-Interstate Telephone Association. A number of prominent men outside the state were present, including James B. Hoge of Cleveland, Ohio, president of the National association. A good programme, including a number of valuable papers, was presented, fuller details of which will be printed later. The officers elected were: President, E. R. Conklin of Aurora; vice-president, Manford Savage of Champaign; secretary, C. B. Cheadle of Joliet; treasurer, C. S. Hanklin of Decatur.

The disagreement between the city of Guelph, Ont., and the Bell telephone company over the extension of the telephone franchise, has been adjusted. The finance committee of the City Council will recommend the acceptance of the company's proposal that it be granted a five-year franchise in consideration of the company giving a rate of $25 on all house telephones.

GENERAL TELEPHONE NEWS.

A new monthly telephone journal known as The Transmitter has made its appearance. The paper is published at Waterford, Texas, and is devoted to the interests of Independent telephony in Texas and the Southwest.

The New York and New Jersey Telephone Company is planning to extend its lines from Belleville Lake Reservoir, N. J., to the waterworks intake at Macopin, a distance of 21 miles. This line is designed to follow the course of the supply pipe line to Newark, N. J.

The monthly instrument statement of the Chicago Telephone Company shows an increase of 1,346 telephones installed in July. Of these 1,012 were placed in the city and 334 in the country. The company reports in service a total of 131,754 instruments, a gain of 13,861 since January 1st.

E. T. Mitchell and C. A. Thatcher are applicants for a franchise for telephone rights and privileges in Nashville, Tenn. The petition is before the city, and the franchise apparently includes the conduit privileges. The applicants are from Chicago, and the city will have the right to purchase after 25 years.

The Pacific and Idaho Northern Telegraph and Telephone Company has filed articles of incorporation at Boise, Ida. The company has a capital stock of $100,000, the incorporators being L. C. Van Riper and Joseph M. Dever of New York and Edgar M. Heigho, Lewis Hall and Frank Gribbon of Weiser, Ida.

The Asheville (N. C.) City Council has ordered the merged concern controlled by the Bell people to improve the local telephone service within 60 days, on account of many complaints lodged against the service, it being provided that the franchise be declared null and void if the order is not obeyed by the company.

The Railroad Commission of South Carolina called a meeting recently to consider certain matters relating especially to the elimination of a $2.50-a-year charge per telephone whenever the Independent telephones are connected with the Bell long-distance lines. The meeting was called by request of the Independent companies.

The Rocky Mountain Bell Telephone Company at Salt Lake City will begin at once extensive improvements to its exchange. The building will be extended about 70 feet and two stories will be added, the entire fifth story to be used for the company's new and enlarged switchboard. About $250,000 will be expended in the improvement.

Preliminary steps toward forming a clearing-house company for taking care of the toll accounts of the various Independent telephone companies in Iowa were taken at Rockwell City recently. Twenty companies were present and joined the association. Another meeting will be held soon to complete the organization, and many applications for membership are expected.

Telephone lines surrounding New Orleans are tied up as a result of the strict quarantine established during the prevalence of the yellow-fever epidemic which is raging in that district. At Arcadia, La., men in charge of the exchange quit when the fever began to spread, and the city officials refuse to permit men to come from the New Orleans headquarters. A similar state of affairs prevails at Baton Rouge, whence also the manager has gone and where rigid quarantine prevails. The Baton Rouge exchange serves much of the surrounding country, and all that section will be without communication, it is reported.

The new Atlantic Telephone Company, recently incorporated, expects to operate throughout Greater New York. The company was organized under the laws of the state of New York and has a present capital of $5,000,000. Its authorized capital is $25,000,000, and the directors of the company have also authorized an issue of $15,000,000 bonds. It is the intention of the company to install an Independent telephone system in Greater New York and to connect this system with other Independent systems of the country. J. D. Powers of Louisville, Ky., and Edward L. Barber of Wanseon, Ohio, are mentioned as those principally interested in the new company.

In the first year of its operation, just concluded, the Eastern Illinois Independent Telephone Company of Kankakee made a fine showing. It has 1,500 telephones in operation and is growing at the rate of 50 a month. The annual meeting of the company was held recently, and the following-named officers were elected: President, William Fraser; vice-president, J. H. Spicher; secretary, William H. Radeke; treasurer, Thomas A. Legris. The officers, together with Louis E. Beckman, A. J. Vernier, L. D. Gotshall, Charles M. McLaughlin, George H. Probeck, I. W. Gotshall and Charles N. King, are the directors of the company. The plant of the company was described in the Western Electrician of July 2, 1904.

CORRESPONDENCE.

Great Britain.

London, July 26.—As the progress of the big London power bill continues through the committee stage of the House of Commons, frequent statements are made as to terms being arranged with various electric supply companies and local authorities. These agreements form an additional peg for the remaining opponents to hang the argument of "American trust" upon, as a reason for the rejection of the measure, and this is being "pushed" considerably.

A report was circulated in the daily press that the big German electrical firm which has a monopoly of the supply business in Berlin was backing the London scheme, but it was totally denied yesterday by the chief promotor, on oath before committee. Although hitherto electric "power" companies in Great Britain have not been purchasable, in this case the promoters have suggested a purchase clause, under which the period will be 50 years, and the basis of purchase the capital expenditure of the company at the date of purchase. They frankly confess, however, that at present they do not know who could be the purchasing authority, but they leave it in the hands of parliament.

The London County Council has just received two checks in its desire to extend its municipal trading powers. The first one is in connection with its scheme for tramways over the Thames bridge. In this a certain amount of sympathy may be felt for the council, for better means of communication in this respect are needed. The proposal was passed by the House of Commons, but much prejudice against the council exists in the House of Lords, and the bill was treated in a perfunctory manner and rejected in a short time.

The other matter in which the council has suffered a reverse is in connection with electric wiring, and here little sympathy can be extended. All fair-minded people must acknowledge that when a municipality enters upon such a purely trading career as that of electric wiring, the small electrical contractor needs protection, and the House of Lords committee that rejected the proposal that the County Council should embark in the business has done the public a service.

Some disappointment has been expressed with the indefiniteness of the proposals contained in the report of the Royal Commission on London Traffic, which I referred to last week. Certain drastic improvements are suggested, and huge sums mentioned as the cost of carrying them out, but at present it seems difficult to conceive from what direction they are likely to be materialized. It is suggested that help should be given by the local authorities, but the present extremely high rates in London are an effectual bar to that, at any rate for the present. Even apart from this, there is considerable opposition to many of the items, and the stubbornness of the authorities in the city of London itself is exemplified by a special report by the city representative upon the traffic commission, in which he differs from many of the conclusions arrived at. While this difference of opinion exists London is not likely to receive much benefit from the labors of a commission which has worked, at great expense, for nearly three years.

G.

New York.

New York city, August 5.—Although the ultimate plans of the Pennsylvania railroad as to the use of electricity on its continental lines are kept with great secrecy, certain engineering operations now going on on the New Jersey shore, indicate that the approach to the Long Island-New York-New Jersey tunnel will be about eight miles long on the New Jersey side, commencing from the little town of Kearny on the hither side of the salt swamps on the Passaic River. There are other signs that the Pennsylvania contemplates using electricity for all the passenger traffic between New York, Newark, Elizabeth and possibly beyond.

Chief Engineer George Rice reports that the under-river tunnel to connect the Manhattan subway system with Brooklyn is half completed and that probably the tunnel will be ready for use before the Brooklyn subways are finished. Mr. Rice does not anticipate any difficulty with regard to the ventilation of the tunnel.

The last horse car on the Grand Street line finished its last trip early on Wednesday morning amid a shower of fireworks, and shortly afterward the work of converting this line to electric traction was commenced. The work will occupy about two months and in the meantime the merchants on the route are complaining bitterly of loss of business.

No verification is forthcoming of the rumor that the Metropolitan Street Railway Company has purchased a controlling interest in the Coney Island and Brooklyn railroad.

What is promised to be the "largest drug store in the world" is in process of completion in the ground floor and basement of the New Times Building, at Forty-second Street and Broadway. The electrical equipment of this store will be very ornate and elaborate, and it will be kept open every hour of the day and night all the year-round. Many electric motors are to be put in to operate small machines and the soda fountain plant.

The Battery Supplies Company of Newark, N. J., has been incorporated with a capital of $100,000. The incorporators are James W. Gladstone, Eben G. Dodge and Elisha E. Hadson.

The Clark Electric and Manufacturing Company of New York was incorporated at Albany on Wednesday, with a capital of $100,000, and a directorate including T. J. Conry, C. P. Nevin and G. W. Ryburg, all of this city. They will engage in business as electrical and mechanical engineers.

A petition in bankruptcy has been filed in the affairs of the Joseph Menchen Company, manufacturer of electrical appliances and stage lighting apparatus at 354 West Fiftieth Street, New York city. Among the creditors are the International Brass and Electric Company, 76 Beekman Street, who enter a claim for $1,030; E. B. Latham & Co., electrical supplies, 39 Vesey Street, $291, and the Elmer P. Morris Company, 15 Cortlandt Street, $637. The company was incorporated by Joseph Menchen in March, 1903, with a capital of $10,000, and it is alleged that insolvency is due to losses of materials by thefts and a World's Fair contract.

The Old Time Telegraphers and Historical Association will hold its annual reunion in this city, commencing on Tuesday the 29th instant and lasting four days.

The Williams Terminal Railway Company was incorporated on July 29th with the secretary of state to build and operate a street surface electric road in Brooklyn. Its route is to be from a point on Bowne Street, southeast of Imlay Street, where it will connect with the track of the New York Dock Company, running thence southeasterly along Bowne Street to the property of J. H. Williams & Co. on the easterly side of Richards Street, a distance of 900 feet. The capital stock is $10,000 and the directors include William C. Redfield and James H. Williams of Brooklyn, Benjamin Whittaker of New York city and others.

Plans on a great scale to collect accurate data concerning municipal ownership in both Europe and America have been made by the executive council of the National Civic Federation. This body has selected a commission numbering about 75 members, and including some of America's best known lawyers, scholars and business men, to meet early this fall and determine upon methods for accomplishing this work.

Newark, N. J., has decided that hereafter all special franchises will be issued for a period not exceeding 25 years.

D. W. W.

Southeastern States.

Charlotte, N. C., August 5.—The Alamance Street Railway Company of Graham, N. C., is issuing bonds for a street railway, mention of which has previously been made. An electric-light plant is also being erected at Graham.

Work has been started on the big hydro-electric plant at Gilpin Falls, on Northeast Creek, near Bay View, Md. The new plant will supply power for numerous surrounding industries.

The Federal court has ordered the sale of the Hampton Roads Railway Company, an electric line from Newport News to Old Point, the affairs of which have been in the hands of a receiver for two years. The sale will take place five weeks after proper notice, and $20,000 must be paid down and $200,000 in 10 days. There is a lien of $750,000 on the property.

A report from Staunton, Va., says that a receiver has been asked for the Augusta Electric Company. The action is to test the claims of the company under its contract.

The Murphy (N. C.) Power and Light Company is erecting its new system for lighting the town and furnishing power from a plant which has about been completed.

The Greensboro (N. C.) Electric Company has been authorized to increase its capital from $250,000 to $500,000, the additional issue being preferred stock. John Karr is president.

L.

Dominion of Canada.

Winnipeg, Man., August 2.—Progress on the big $3,000,000 power dam at Lac du Bonnet, about 50 miles from the city of Winnipeg, has been satisfactory. The electric power project is owned by the Winnipeg Electric Street Railway Company, which is a part of the extensive Mackenzie & Mann syndicate, and with this power it proposes to run the street-railway system of Winnipeg and the electric railways connecting. It will also supply light and power en route. This will revolutionize commercial undertakings in the manufacturing line in Winnipeg, which is one of the rapidly growing cities of the West. The dam is being built across the Winnipeg River. The Ogilvie Milling Company, one of the richest concerns in Canada, is also heavily interested with the street-railway company in the development. Exhaustive reports made by some engineers from the United States state that the Winnipeg River with its large volume of water varying so slightly at all seasons of the year and within a practicable distance for power transmission to Winnipeg is a source that the industrial enterprises of the future can absolutely rely on for power.

The British Columbia Electric Railway Company's plans are about completed for the extension of its line from Stevetson to Westminster Junction, and when completed it proposes to run an hourly service.

The Calgary (N. W. T.) City Council has decided by a large majority in favor of municipal ownership of the street-railway system as soon as it is completed, and the operation of the line. The City of Calgary has also awarded a contract to the Allis-Chalmers-Bullock Company of Montreal for a complete electric plant. The current will be generated by a 260-kilowatt alternating-current generator. The contract includes a switchboard and all the wiring, transformers, pole line, etc.

The fire, water and light committee of Moosejaw, N. W. T., has recommended the extension of the electric-light system of the town and the council has passed a resolution indorsing the recommendation.

The Georgian Bay Power Company is asking for bids until August 15th for cutting down and removing the face of the mountain on the north side of Beaver River, at Eugenia Falls. This is the first work undertaken in connection with the proposed development of power for generating electrical energy.

The Glenora Power Company of Picton, Ont., has been incorporated with a capital of $100,000, for the purpose of generating electricity.

H.

Ohio.

Cleveland, August 7.—Great interest is manifested in the rehabilitation of the United States Carbon Company since the story has become current that John D. Rockefeller is behind the venture and that it will be capitalized at something like a million dollars. Under the management of Burton P. Foster, repairs to the old machinery are being made and new machinery is being installed in the buildings. Four new structures will be erected to the plant in Cleveland, and branches will be established in the oil and gas belts over the country. At the Cleveland plant high-grade carbon batteries and motor brushes will be produced, while at the branches lower grades of carbon will be made. It is said that one customer has been secured who will take about $100,000 worth of goods a year, and that a number of lighting companies have been interested. Martin E. Daly, who purchased the plant, is now in Europe, but when he returns, the company will be financed, and it is thought that it will be in operation by September 1st or a little later.

A franchise has been granted to the Lorain Street Railway Company by the council of Lorain to build a line in Thirteenth Avenue to connect with the Avon Beach and Southern in South Lorain, the company agreeing to the transfer proposition of the town. The suit against the companies will now be dismissed and work will proceed.

The Lake Shore Electric is arranging to cut the time of its limited cars to four hours between Cleveland and Lorain.

Reports are current to the effect that Joseph W. Mayer and his associates have purchased land at Lima on which to construct large car barns for the roads in which they are interested.

It is again reported that the Widener-Elkins syndicate is after the local lines in Columbus, but this the officers of the Columbus Railway and Light Company deny. The lines would form a link in their proposed systems north and south, and west toward Indianapolis.

The Columbus, Marion and Bucyrus Railway Company has been incorporated by J. G. Webb, George Whissal, J. B. Gormley, Oscar M. Gottschall and F. L. Hopley, with a capital stock of $500,000. As these men are interested in the Columbus, Delaware and Marion, it is presumed at least that the new company will extend that line on to Bucyrus from Marion. This will give a connection with Cleveland, and it is said the road may be built on to Sandusky.

The Belmont Electric Street Railway Company of Bellaire has been incorporated with a capital stock of $300,000 by J. F. Boltz, J. C. Tallerman, Franklin Neff and C. W. Rodefer.

Interviews have been printed during the week to the effect that the proposed deal between the Widener-Elkins syndicate and the Toledo, Bowling Green and Southern is off.

From appearances, the attorney-general will file a suit against the Miami and Erie Canal Transportation Company to oust it from its charter unless something is done soon to straighten matters out.

H. Clark Ford of Cleveland and his associates in the ownership of the Wheeling and Steubenville Traction Company have purchased the Steubenville, Mingo and Ohio Traction Company. A. M. Snyder of Cleveland has been elected president and A. A. McCaslin secretary. Rights-of-way for a line running from Martins Ferry to Jeffersonville have been secured, and the company has arranged for a bond issue for $650,000.

Motormen and conductors of the Columbus Rail-

way and Light Company have been granted a voluntary increase of one-half cent an hour in wages, making 20 cents an hour.

The Hillsboro, Belfast and Peebles Promoters Company of Belfast has been incorporated for the purpose of building an electric line from Hillsboro to Peebles. The nominal capital stock is $1,000.

President Schoepf of the Cincinnati Traction Company is said to be in the East discussing the lease of the Cincinnati Gas and Electric Company with financial men.

A meeting was held Wednesday at Youngstown to take further steps toward completing the merger of the companies operating lines in that section and between Youngstown and Sharon, Pa. The preliminary steps were taken some months ago.

The Lima Electric Railway and Light Company and Western Ohio, joint owners of McBeth Park, near Lima, have closed the resort, it is said, as the venture was found to be a losing one.

The Toledo and Columbus Railway Company of Toledo has been incorporated with a capital stock of $10,000 to build a line between the two cities named in the title. Henry J. Rohrs, Carrie E. James, William E. Brown and others are the incorporators. This is the line that Captain James of Toledo is promoting.

Work on the Southwestern Ohio Railway, Light and Power Company has been pushed up to the city lines of Zanesville, and traffic over a portion of the line will probably be inaugurated within the next two months. Grading between Crooksville and South Zanesville has been almost completed.

It is possible that the Cleveland and Southwestern may build a line to Vermillion, as some of the officials have been looking over a route in that direction within the last few weeks.

The Cincinnati, Newport and Covington Railway Company has placed in commission a testing car to be used in testing the strength of current, defective rail joints and bonds. It is said that it will disclose every defective rail or joint simply by passing over it.

A bond issue of $800,000 will be disposed of by the Cleveland and Southwestern within a short time and the proceeds will be used for taking up the floating debt and extensions of the road. Of this amount, it is said that local banks and financial men will take $500,000 and the remainder have been optioned. It is the intention to build a line into South Lorain, it is said. O. M. C.

Indiana.

Indianapolis, August 5.—The Jasonville Electric Light Company has filed articles of incorporation, with a capital stock of $0,000. David W. Wetnight, H. L. Hyatt and H. L. Hamahwho are directors.

The City Council of Greenfield has decided to repair its electric light plant. The proposition to take individuals into partnership with the city was not received with favor. Neither was it thought advisable to combine the electric light and water plants. An effort will be made to make a first-class plant out of it.

Samuel Murdock and associates has been granted a franchise by the Peru council to establish a central station, gas and heating plant. It is proposed to utilize the old natural gas mains in distributing the gas and heat to the citizens of Peru, Wabash and Logansport.

The City Council of Portland has reduced the rate for electricity to a schedule below that of any similar Indiana plant. The light committee reports that it is possible to grant a reduction equal to 30 per cent. The committee says a sufficient profit will then be left to pay all expenses of the electric-light department, including salaries, and give the city its 70 arc lights free. When the city plant was under private ownership, these 70 arc lights cost $80 each per year. The new schedule is: Ten kilowatts, 8 cents; 30 kilowatts, 7 cents, and 60 kilowatts or more, 6 cents, and the minimum charge is reduced from 75 to 60 cents.

That more than three-quarters of a million dollars has been expended in improvements on the right of way of the various traction companies of this state during the last year is shown by the report of the State Board of Tax Commissioners. The report shows that the properties of interurban companies have more than doubled in value, the total assessed value being over $26,000,000 against a little more than $13,000,000 for last year.

Articles of incorporation of the St. Joseph Valley Railroad Company have been filed with the secretary of state. This company proposes to build and operate interurben lines between La Grange and Angola, a distance of 40 miles. The capital stock of the company is $400,000, and the board of directors is headed by Herbert E. Bucklen.

The South Bend Machine Manufacturing Company has filed articles of incorporation, capitalized at $50,000. The company proposes to establish a plant to manufacture street, interurban and motor cars and also automobiles. Daniel McHenry, William F. Koeller and H. H. Hudson are directors.

As a step toward the constuction of the interurban lines of the Indianapolis, Newcastle and Toledo Electric Railway Company, the Newcastle-Indianapolis Construction Company has been incorporated. The company is capitalized at $50,000 and will do all the construction work on the lines proposed to be built by the former company. The company's headquarters will be in Indianapolis, under the care of C. S. Hernley.

In order to complete its road now under construction from Shelbyville to Greensburg, and to construct other roads now contemplated, the Indianapolis and Southeastern Traction Company has executed a $1,000,000 mortgage to the Farmers' Loan and Trust Company.

The East St. Louis, Vandalia and Eastern Company, which is said to be backed by foreign capital, to build a traction line from East St. Louis to Terre Haute, has made an offer to the county commissioners for the use of the national road and Wabash River bridge, from Terre Haute to the state line, of $1,000 a year for the first five years, $1,250 a year for the next five, $1,500 a year for the next five, with corresponding increases until the end of the 50-year franchise, making in all $102,250. Franchises for the use of the county roads heretofore have been granted free.

Six sub-stations are being installed on the traction line of the Indianapolis and Eastern Traction Company. The new stations are to be located at Newcastle, Lewisville, Charlottesville, Cumberland and Cambridge City—the last-named being portable. This will enable the company to increase its power and reduce running time materially.

A subsidy election held August 4th in French Lick Township, in which French Lick and West Baden are situated, was carried for a 1½ per cent. tax to aid in the construction of an electric line from Gasper to West Baden. This insures the construction of a trolley line to these popular resorts.

S. S.

Michigan.

Detroit, August 5.—A pole line to convey electric power to St. Joseph and Benton Harbor is being erected by Charles A. Chapin from his power house at Buchanan on the St. Joseph River. After considerable litigation the federal court has given Mr. Chapin the right to sell power outside of Buchanan. Power has been furnished to run the South Bend and Southern Michigan electric railway for some time and now it will supply St. Joseph and Benton Harbor with light and power, and also the new electric line between these cities and Niles.

The work of extending the South Bend and Southern Michigan electric railway from Niles to St. Joseph is now under way. The concrete foundation for a power house at Scottdale is being laid.

A new electric railway was put into commission in River Rouge, a suburb of Detroit, this week. It connects with the Detroit United Railway and runs to the ship yard of the Great Lakes Engineer Works on the Detroit River.

Promoters are working near Ypsilanti securing rights of way for a gasoline motor road between Detroit and Ann Arbor, through Cherry Hill.

Current of the Detroit Edison Company will be used in conjunction with that of the Huron River Light and Waterpower Company, and cities along the Huron Valley can use electricity for lighting or power purposes. Alex Dow, manager of the Detroit Edison Company, has recently acquired for eastern persons a controlling interest in the Huron River Company and the corporate existence of the companies will remain unchanged. The Edison company is now in position to develop and use water power if it finds it cheaper than its steam plant on the Detroit River, which is to be used in connection with the manufacture of salt.

After a strike of two months, during which the employes of the Bay City Traction Company maintained a strong boycott, the traction company has won at great expense and is hiring back such of the men as it needs on its own terms as individuals, refusing to recognize the union. The striking employes of the interurban division of the Saginaw Valley Traction Company have also gone back to work as individuals on the wage scale offered June 1st. The strike in Saginaw is practically over, as the company has been operating its cars at nearly the usual receipts for some time.

The council of Monroe has set August 15th as the day for registration for a special election for voting on bonding for a sewer system and also to vote on the sale of the city electric lighting plant.

The Jackson and Battle Creek Traction Company has reduced the wages of men on the limited cars, giving them the same pay as those operating the local cars. The expected strike has not occurred, as the men on the locals were not cut. C. G. W.

Rocky Mountain States.

Salt Lake City, August 4.—The city councils at Farmington and Bountiful, Utah, have each granted a franchise to the Salt Lake and Ogden Railroad Company, making it possible for the company to begin immediate construction of its electric road between Ogden and Salt Lake. The company has also petitioned the council of Salt Lake for a franchise.

On account of its unsatisfactory service the City Council at Laramie, Wyo., has revoked the franchise of the Laramie Electric Light and Fuel Company. A similar franchise has been secured by W. E. Sterne of Littleton, Colo., who represents a prominent Indianapolis syndicate.

The county commissioners of Salt Lake County have granted to Emil J. Raddatz a franchise for the operation of an electric transmission system, upon which work is to be commenced within the next four weeks. Mr. Raddatz agrees in consideration of the privileges granted to furnish to Salt Lake County, free of charge during the life of the franchise, a continuous service of electric lights not to exceed 50 32-candlepower incandescent lamps, or arc light equal to the same.

A company will shortly be organized at Boise, Idaho, which has in view the construction of an electric railway from that city to Big Creek. The company, which has already made surveys of the proposed route, will be capitalized at $10,000,000.

Manager E. H. Beggs of the Independent Telephone Company at Boise, Ida., has recently placed with a Rochester (N. Y.) firm an order for $100,000 worth of equipment for the telephone system.

The Knickerbocker Trust Company of New York is projecting some extensive electrical enterprises in Idaho, including an electric railway between Boise and Fayette and a steam railroad from Fayette to Vale, Ore. Donald Fitzgerald is the company's representative in Idaho.

The Little Giant Company, a mining company of Boise, Idaho, is preparing to put in an electric plant for the purpose of operating machine drills on its claims.

George M. Snow of Boise, Ida., is arranging for the installation of a light and power plant for the Trappers Flat Company. A Pelton waterwheel will generate electricity for both light and power.

It is reported that the Western Union Telegraph Company is now preparing to enter Southeastern Arizona, a territory which it has heretofore reached only over the lines of the Postal Telegraph-cable Company.

J. R. Cooper, construction agent for the De-Forest Wireless Telegraph Company, has arranged with Frank P. Read, president of the Trinidad Railway Company, to secure a nine-year lease for sufficient land for the erection of the wireless company's poles and other apparatus at Las Vegas, N. M. G.

Pacific Slope.

San Francisco, August 4.—The Northern Electric Company has filed articles of incorporation at Oroville, Cal. The company, which is capitalized at $3,000,000, was organized to build an electric railway between Oroville and Chico and reaching other points in the Sacramento Valley.

H. W. Hagen and Charles F. Roedel of San Mateo, Cal., are promoting the organization of a company to build an electric railway from San Mateo or Burlingame to the ocean beach. The plan as outlined includes the establishment of a summer resort on the San Mateo coast.

The Watsonville Light and Power Company of Watsonville and San Francisco, Cal., is preparing to issue bonds to the amount of $200,000, the proceeds to be used in the completion and enlarging of the company's plant.

The Mountain Home Electric Company has been organized at Tacoma, Wash., with a capital stock of $30,000 by H. L. Howitt, Jr., and Seymour H. Boll.

Henry W. Coe and associates are promoting the organization of a company with a $4,000,000 capital to build 200 miles of standard-gauge suburban electric railway in the form of a loop, with starting point and terminus at Portland, Ore. It is planned to erect a power house on Toutle River.

The City Council of Eugene, Ore., has engaged Frank C. Holsay, an electrical engineer, to make estimates for the installation of an electric-light and power plant at Eugene.

The city of Seattle is to add 500 arc lights to those now in use in that city and also put in 3,500 incandescent lights.

The Oregon Waterpower Company of Portland, Ore., has let a contract to James Barrett for the construction of a stone power house at Sellwood, a suburb of Portland.

The Salem Electric Railway Company of Salem, Ore., is to be extended to the company's rock quarry, some miles south of the town.

The engineers of the North Yakima and Valley Railway Company of North Yakima, Wash., began work on the company's proposed line last week.

The Portland General Electric Company of Portland, Ore., is planning to erect a five-story office building at the corner of Seventh and Alder streets. It is to be a modern fireproof steel-frame structure. The ground floor will be used as a central power station, while the offices of the company will occupy the remaining floors.

Camp No. 4 of the Edison Power Company's works in the Kern River Valley, Cal., was destroyed by fire on July 31st.

The Instantaneous Fire Alarm Company of Seattle, Wash., reports that a number of the mills and several of the schools in Seattle and vicinity are being equipped with auxiliary fire-alarm systems.

The Glendale Light and Power Company has been incorporated at Glendale, Cal., with a capital stock of $100,000. The directors of the company are L. C. Brand, M. L. Brand, F. M. Taft and others.

Plans have been drawn for a new sub-station for the Los Angeles Pacific Railway Company at Sautelle. The new building will cost about $8,000.

The bid of the Ferndale Electric Light Company

at Ferndale, Cal., has been accepted for an electric franchise in that town. Besides conducting an electric-light business the company will deal in electrical supplies.

The Tacoma Railway and Power Company has completed plans for the extension of its lines. W. S. Dimmick, general manager of the company, states that something will be done toward betterments in the near future. A.

PERSONAL.

Mrs. Clarence H. Mackay, wife of the president of the Commercial Cable Company, has been elected a member of the Roslyn (N. Y.) board of education after a spirited local fight. Roslyn is a town on Long Island.

E. C. Zehme was recently appointed editor of the Elektrotechnische Zeitschrift of Berlin, to succeed Gisbert Kapp, who resigned after nearly 11 years' service, to take the position of professor of electrical engineering at the University of Birmingham, England.

William B. Dick, founder of the well-known electrical engineering establishment of Dick, Kerr & Co. of London, England, died recently at Sevenoaks, near London. Mr. Dick was in his seventy-sixth year, and for several years has not taken an active interest in the management of the company.

The two-hundredth anniversary of the birth of Benjamin Franklin will occur next January, and the initiative has been taken by the Pennsylvania Society to commemorate the event in New York city. Sundry engineering, scientific, patriotic and learned societies are interesting themselves in the proposal.

While superintending the installation of a space-telegraph plant at Springfield, Mass., J. W. Johnson went to the top of the mast to adjust the aerial wires, and while thus engaged the rigging broke and he fell to the ground. Although Mr. Johnson fell 175 feet, it is said he will recover from the injuries received.

N. A. Pearson, electrical engineer for the New York City Railway Company, left New York on Tuesday of last week to become an engineer for the Canadian Niagara Power Company at Niagara Falls. The employes of the New York City Railway Company presented Mr. Pearson a handsome silver punchbowl before he left.

Alexander Melville Bell, father of Alexander Graham Bell, the telephone inventor, died at his son's home in Washington, D. C., on August 7th. He was 86 years old. The direct cause of Mr. Bell's death was an attack of pneumonia. Mr. Bell was born in Scotland and was one of three generations notable for the developments in the art of instructing the deaf and dumb in methods of communication.

Among the members of the commission just appointed by the National Civic Federation to investigate public ownership and the operation of public utilities are Walton Clark of Philadelphia, prominent in street-railway companies in New England and elsewhere, and Samuel Insull, president of the Chicago Edison Company. Many other business men, journalists, college professors, publicists and trades-union leaders are included in the list.

F. E. Fitzpatrick, who has been district manager of the California Gas and Electric Corporation, with headquarters in San Rafael, for nearly three years, has been appointed manager of the Sacramento Gas, Electric and Railway Company, which is under the control of the former corporation, with headquarters in Sacramento city. He will be succeeded by Wallace Foster, who has had charge of the Solano district, with headquarters at Vallejo. Mr. Foster will be succeeded by Joseph Stevens of Chico.

J. Brodie Smith of Manchester, N. H., general manager of the Manchester Traction, Light and Power Company, has been elected vice-president of the same company to succeed George B. Chandler. Mr. Smith has been identified with electrical interests in New England for over 20 years. In Manchester he was successively superintendent of the fire-alarm telegraph, superintendent of the Ben Franklin Electric Company, and superintendent of the Manchester Electric Light Company. In 1896 the Tucker-Anthony interests entered the field and Mr. Smith was made general manager of the company, which has since absorbed rival interests and now furnishes light and power to a large group of communities, taking its power from the rivers in the vicinity.

Daily newspapers, under London date line of August 8th, report that Mr. Samuel Insull, president of the Chicago Edison Company, has determined to make his residence in London. The dispatch goes on to say: "Mr. Insull's determination to make his residence in London is the result of information which he has privately received that there is little doubt of the final passage of the enabling act now before Parliament which gives authority for the building of an immense plant to generate and distribute electric power throughout the Metropolitan District of London. Mr. Insull is the moving spirit in this measure, although his name is not publicly given." Mr. Insull, with his family, is now in England, having taken a house near Oxford for the summer. He is expected home early in October. Inquiry fails to reveal anyone in Chicago who will affirm or deny the London report.

ELECTRIC LIGHTING.

The Claremore (Indian Territory) Electric Light and Ice Company has been incorporated with a capital stock of $25,000.

Bonds have been voted by Falls City, Neb., part of the proceeds of which are to be used for constructing an electric-light plant.

Plans have been prepared by William H. Dechant of Reading for the erection of an electric-light plant for the borough of Womelsdorf, Pa.

The Reading (Pa.) Illuminating Company is making active preparations to erect a power plant. The incorporators of the new company include Gustave Uldricht and Ralph W. Difford.

The Independent Light, Heat and Power Company of Fond du Lac, Wis., has been incorporated with a capital stock of $25,000. Robert Free, G. R. Hoffman and Frank D. Fulton are the incorporators.

About 80 of the leading citizens of Ensley, Ala., at a mass meeting voted unanimously to erect a municipal electric-light plant. The City Council will take formal action, after which, it is thought, a bond issue will be authorized by the voters for a municipal plant.

J. A. Corbell of Charleston, Ark., is in the market for machinery and equipment, including estimated cost of construction of electric plant, to furnish light to 600 residences, 100 stores and 20 arc lights; also cost of equipment for power plant to operate a motor car 20 miles.

The Texarkana Gas and Electric Light Company at Texarkana, Texas, has sold $132,000 of its authorized issue of $1,000,000 bonds for the purpose of making extensions and improvements. The company is owned by the Union Gas and Electric Company, which controls about a dozen of similar properties throughout the Middle West.

The taxpayers of the town of Meaford, Ont., will vote on a by-law to raise $12,000 by debentures for the purchase of the electric-light plant, to install machinery and to purchase power from the present company to operate the plants. The opponents to municipal ownership are fighting the proposition.

The Weatherly (Pa.) Town Council has decided to erect an entirely new electric-light plant instead of replacing such parts as were wrecked in the recent explosion. The new plant will be much larger than the old one and will be up-to-date in every respect. The old outfit will be retained as an emergency plant.

The Gordon Manufacturing and Power Company of North Wilkesboro, N. C., has been incorporated with a capital stock of $20,000 for the purpose of operating a plant for generating electricity for light and power and operating electric railways. The incorporators are J. Gordon Hackett, Richard N. Hackett and H. W. Gwyn.

Sealed proposals will be received until August 21st for an electric-lighting system at Fort Omaha, Neb. Proposals are to be marked "Proposals for Electric Lighting System, etc., at Fort Omaha, Neb.," and addressed to Major M. Gray Zalinski, constructing quartermaster, Army Building, Omaha, Neb.

Judge Ehrgood at Lebanon, Pa., handed down an opinion refusing the petition of the Edison Electric Illuminating Company for a mandamus compelling the city controller to certify an appropriation on a 10-year street-lighting contract. The court sustains the contention of Controller Forster that an appropriation on which a contract is let must be made before the award of the contract.

The members of the City Council of Racine, Wis., in committee of the whole, after a heated discussion, decided to accept the five-year proposition of the Milwaukee Electric Railway and Light Company to light the streets on the terms mentioned in the Western Electrician last week. The social democrats favored a one-year contract, and that provisions be made by the city to build its own plant. By accepting the five-year contract the city saves $1,500 a year.

City Electrician Carroll of Chicago is advertising for bids for 1,000 new arc lights, with transformers and regulators. Many streets in the city are inadequately lighted, and it is to improve this condition that the additional lights are wanted. The new lamps will be alternating-current arcs, and most of them will be used to replace the present direct-current lamps on the North Side, where they will receive current from the Fullerton Avenue municipal plant. New locations on the North Side will also be supplied by the new lamps. The lamps removed from the North Side will be placed at new locations in the direct-current systems on the South and West Sides.

The board of public improvements of St. Louis, Mo., has fixed August 15th as the date when it will receive bids for furnishing electricity at the city institutions for a year from September 1st. The city is divided into two districts, Washington Avenue being the dividing line. The estimate of Supervisor of Lighting Thomas B. Carter is that the northern division will consume 140,000-kilowatt hours during the coming year, while the southern district will need 210,000. During the present year the expense has been $22,000. The contract includes power for all of the fire-engine houses and other city buildings.

The Kearny (N. J.) Common Council has discovered that it has no power to issue bonds for a municipal lighting plant and has instructed its lighting committee to make a contract with the Public Service Corporation to light the streets for one year only at the reduced price offered by the company—$97 a year for arc lights and $15 a year for incandescent lights. The reduced offer made by the corporation was for a term of five years, and the company may not renew the contract, which expired on August 1st, for a year at the reduced prices.

ELECTRIC RAILWAYS

The Lincoln Traction Company is installing a new 10-panel switchboard in the power house at Lincoln, Neb.

The interurban trolley lines centering in Indianapolis carried in and out of that city in the last year 5,000,000 passengers.

The construction of the Northern electric railway, to connect Chico, Oroville, Marysville and Colusa, Cal., has commenced, grading being under way.

The Interurban Railway Company, which operates 35 miles of electric railway out of Des Moines, Iowa, has completed plans for a freight depot 40 by 60 feet in Des Moines.

The Fisher Construction Company of Joliet, Ill., which built the Joliet, Plainfield and Aurora electric railway, contemplates building an electric road from Joliet to Dwight, Ill., taking in Wilmington.

A report from Des Moines, Iowa, says that the Chicago Great Western steam railroad has absorbed the Waterloo and Cedar Falls Rapid Transit Company and the Mason City and Clear Lake Railway Company, and hereafter both the interurban electric roads will be a part of the Great Western system.

The Supreme Court of Pennsylvania, in a decision recently handed down, recognizes the fact that the use of electricity as a motive power for street-railway companies presupposes operation at high speeds, and accordingly all pedestrians using city streets must take notice of the increased danger.

According to the Milwaukee News, the Kenosha Electric Railway Company is planning to build a spur track to connect with the line now being built by the Chicago and Milwaukee railroad company, and it is expected that people can travel from Kenosha to Chicago by trolley before the first of next year.

A recent decision by a West Virginia Supreme Court of Appeals holds that where a street railway company stops its cars for the purpose of receiving passengers it is charged with the highest degree of care to see that all passengers lawfully entering its cars get to a place of safety before the cars are started.

Plans for the proposed electric railway between Ilion and Sidney, N. Y., call for the use of electric motors driven by current generated by a gasoline engine in each motor car. The route is now being surveyed and no pole lines nor power houses will be required. The road will be equipped for passenger and freight service.

The Niagara Falls and Lockport Electric Railway Company has been incorporated at Albany, N. Y., with a capital of $200,000 to operate a railway 20 miles long from Niagara Falls to Lockport. The directors are: Edward Michael, Clark L. Ingham, W. D. Ingham, Elgood C. Lufkin, Isadore Michael and John M. Bradford of Buffalo; S. P. Franchot, William P. Baker and James S. Simmons of Niagara Falls.

Japanese advices record the opening of an electric railroad between Kobe and Osaka. The trains make the distance, about 19 miles, in an hour and a half, including stops at 35 stations. Although trains on the government's steam railroad cover the distance in half this time, the cheaper fares on the electric—10 cents versus 16 cents for third-class passengers—puts it in the power of the latter to compete successfully with the former.

A deed involving 7,750,000 has been recorded in Allentown, Pa., transferring from George H. Frazier, William F. Harrity and Harry C. Trexler to the Lehigh Valley Passenger Railway Company the trolley line formerly operated and owned by the Lehigh Valley Traction Company, which was in the hands of receivers. Another deed was

recorded, transferring the Slatington branch to the Allentown and Slatington railway for $850,000.

Charles H. Baker of Seattle, Wash., the promoter of a system of electric railways in China, is organizing a corps of engineers to examine the proposition. They will sail from the Coast within six weeks and will go over the country thoroughly, not only to examine the engineering questions involved in laying the tracks but also to look into the possibilities of electrical transmission, Traffic men will be taken along to look over the question of freights.

The annual report of the Lancaster County (Pa.) Railway and Light Company, which operates all of the electric railways in the county, shows that after all expenses and fixed charges were provided for the profits amounted to $100,311, enabling the company to pay 12 per cent. on deferred dividends and leaving an ample surplus in the treasury. The profits of the company show a remarkable increase for the last several years, from $6,409 in 1903 to $81,258 in 1904, and $100,311 in 1905.

The Louisville Railway Company of Louisville, Ky., following the example of other operating companies, recently took up the work of building its own cars and has just turned out two modern electric cars, while six others are nearly completed. The new cars are 40 feet long and seat 56 passengers each. Two 50-horsepower motors operate the cars. The work was done in the company's shops at odd times when repair work was slack and the idea has proven so successful that facilities for car building on a larger scale will be provided.

Extensive improvements have been decided upon by the reorganized street railway company, now known as the New Orleans Railway Company. A meeting of the reorganized board of directors was held recently and the contract with Sanderson & Porter, contracting engineers, for improvements involving an expenditure of $1,600,000, entered into by the old board, was approved and ratified. About $450,000 of this amount has already been expended, and the plans call for the remodeling and reconstruction of all the electric lines in New Orleans.

Mr. Frederic Nicholls, president of the Toronto Niagara Power Company, and Col. Fellatt, a director, recently visited the city of St. Catharines and disclosed to the mayor and several of the city aldermen a plan of mammoth railway development in the Niagara Peninsula, which the company has mapped out and which, when carried out, will make St. Catharines one of the greatest electric-railway centers on the continent. The company will build electric lines between St., Catharines and Stony Creek, connecting with Hamilton and eventually Toronto, while the main line will run from Stony Creek to Buffalo.

It is understood that the officers of the Canadian Pacific railway are considering the advisability of utilizing electricity, instead of steam, in operation of their trains on the Boundary system in British Columbia. An electrical company in the Pacific province is making preparations for the development and supply of electricity along Kootenay River, for the operation of mines and smelters. The officials will first make a test of electricity for haulage power on an extensive scale for heavy grades on Rossland Hill, and if it proves satisfactory, the company's Boundary lines will be operated by electricity in the future.

Traffic on the elevated railways of Chicago for July made excellent gains over July last year. The South Side Elevated daily average of passengers carried increased 15,373, or 21.99 per cent.; the Metropolitan increased 11,436, or 11.19 per cent.; the increase on the Northwestern was 6,680, or 10.98 per cent., and the Chicago and Oak Park increased 3,195, or 8.26 per cent. The daily average of passengers carried by the different elevated roads in July, 1904, and July, 1905, respectively, is as follows: South Side, 69,899 and 85,272; Metropolitan, 102,142 and 113,578; Northwestern, 60,816 and 67,496; Chicago and Oak Park, 38,668 and 41,863.

Chicago men directly interested in the local surface street railways have been in the East for some days, where numerous conferences have been held relative to the preparation of plans for the meeting of the traction representatives with the local transportation committee of the Chicago City Council on August 14th. At this meeting, it is promised, some kind of a settlement of the complicated municipal-ownership, franchise-extension controversy is to be made, or at least an understanding arrived at. It is reported that J. Pierpont Morgan is to take a hand in the negotiations. Mayor Dunne is about to return to the city. During his absence A. B. Dupont has been steadily working out details for the mayor's proposed 250-mile municipal street railway.

SOCIETIES AND SCHOOLS.

The next reunion of the Old Time Telegraphers' and Historical Association and the Society of the United States Telegraph Corps is to be held in New York August 29th to September 1st. Melville E. Stone, general manager of the Associated Press, will act as toastmaster at the banquet. Other distinguished men to be present are Thomas A. Edison, Clarence H. Mackay and Col. Robert C. Clowry. President John C. Barclay, with the assistance of an able committee, is working hard to make the reunion a success.

The first annual convention of the American Public Works Association, which was to have been held at Lookout Mountain in Chattanooga, Tenn., on August 30th and 31st, has been postponed until further notice on account of yellow-fever quarantines. The object of the association is to encourage cities, towns and villages to construct public works, and to foster and protect the interests of those engaged in the construction of public works, such as waterworks, sewerage, lighting plants, public buildings, etc. W. H. Flint of Chattanooga is secretary.

The trustees of the Worcester Polytechnic Institute at Worcester, Mass., have begun the work of increasing the equipment in the power laboratory to four times its present efficiency, the cost of which will be between $18,000 and $25,000. During the last few years the unusually rapid growth of the Institute in student attendance and in facilities for its various instruction activities has developed a greatly increased demand upon the heat, light and power system in the power laboratory of the Institute. The equipment in this building was put in in 1894 primarily for purposes of instruction in steam and electrical engineering and to care for a small power-service load. Plans have been worked out for the development of a heat, light and power-service plant to supply the needs of the entire institute. Due consideration has been given to the probable growth of the institute in the near future.

PUBLICATIONS.

The Erie Railroad Company, through its industrial department, which has headquarters in New York city, has published a new pocket edition of the industrial map of its railroad system, with a description of the territory traversed by the Erie. The map is being widely circulated, to show the advantages for manufacturing and distribution possessed by the cities and towns on the Erie railroad.

The Crocker-Wheeler Company of Ampere, N. J., has issued a booklet on "The Source of Light." Generators are the source of the electric light, and accordingly the Crocker-Wheeler generators are briefly described and clearly illustrated. "The important consideration in the design and construction of the Crocker-Wheeler generators," says the writer, "is that they are built for continuous hard work."

Interesting types of apparatus are effectively described in the Northern Electrical Manufacturing Company's new bulletin, which is devoted to Northern standard dynamos and motors. The bulletin explains the adaptability of these machines to industrial-plant service, and considerable helpful material regarding the product is worked into the reading matter. The company's works are located at Madison, Wis., and its efficient advertising department is deserving of praise for the excellence of the literature which it from time to time places before the public.

A particularly interesting and instructive pamphlet comes from the American District Steam Company of Lockport, N. Y. It describes very thoroughly the latest developments in the Holly steam-heating system, besides giving a brief historical sketch of the first Holly steam-heating plant installed. It is interesting to note that in this first plant not a single device was used which is used in the perfected systems installed at the present time. It is impossible here to enumerate all the subjects taken up in this comprehensive little book, but anyone who is interested in steam heating from central stations will find therein much valuable engineering data which will be of use to him in deciding upon the advisability of installing such a plant, and in designing it when its advisabilty has been determined upon.

TELEGRAPH.

The cable ship Colonia has sailed from London with 2,400 miles of cable to lay the Commercial Cable Company's additional line from Waterville, Ireland, to Canso, Nova Scotia, and thence to Newfoundland.

The Federal Court of Cassation of Venezuela has given final judgment in the matter of the proceedings instituted against the Compagnie Francaise des Cables Télégraphiques, confirming the dissolution of the contract of the government with the company.

A general strike of the telegraphers on the lines of the Great Northern and Northern Pacific railroads was made effective last week, and at the time of this writing has not been settled. The trouble arose over the revised schedule and agreement relating to rules and wages on the Northern Pacific, which the men refused to sign. About 2,000 telegraphers went out, it is said, causing much inconvenience in the operation of trains. The railroad companies have been installing telephones along their lines for a year or more, and these have been pressed into service in the operation of trains, with excellent results, it is said. Efforts are being made by various interests to bring about an adjustment of the differences.

The Chicago and St. Paul Telegraph Company has been incorporated under the laws of Wisconsin, with $100,000 capital stock and no bonded debt, as successor to the Chicago and Northwestern Telegraph Company, whose property was recently bid in at foreclosure sale by the bondholders' committee. The property of the new company has been leased for 99 years at three per cent. per annum on the capital stock to the Western Union Telegraph Company, which guarantees dividends at the rate named.

MISCELLANEOUS.

Important extensions to the shops of the Illinois Central railroad at Burnside are to be made. Electric cranes and turntables and electrically driven machinery will be installed in the new buildings.

The Kansas City Electric Light Company has begun the installation of a large district steam-heating plant. There will be 7,800 feet of steam mains, ranging from six to 20 inches in diameter, in the business district. In the generating plant it is the intention to use Kansas crude oil, piped directly into the station, for fuel. The American District Steam Company is installing the district heating system.

A magnetic survey of the North Pacific Ocean is reported to have been organized by the Department of International Research of the Carnegie Institution at Washington, D. C. The wooden sailing brig Galilee is being fitted out for this purpose and the survey will be under the charge of Dr. L. A. Bauer of the United States Coast and Geodetic Survey. Mr. J. F. Pratt of the same department will supervise the scientific work involved.

The Westminster Electric Supply Corporation of London obtained the site for one of its new transformer stations under peculiar conditions. The station is located in Duke Street, Grosvenor Square, and was built on a site where there was formerly a private garden belonging to the Duke of Westminster. The ground was granted on condition that the corporation should maintain a roof garden which should always be open to the public between sunrise and sunset. The garden measures 250 feet by 60 feet, and is laid out in the Italian style.

One of the forerunners of the electric age, which many believe is now upon us, is the electric egg, and a certain Mr. Foster in California has experimented with barnyard fowls and electricity until he believes properly electrified eggs to be the elixir of life. Coils of wire are laid around the nests and the current turned on when the hens go to lay. Eggs laid under such conditions are said to act like a tonic. By selection, Mr. Foster asserts that he has been able to breed a race of fowls endowed with electrical properties, having capacity, in a word, beyond the power of coulombs to measure.

In need of more power and being short of room the John W. Wallace Company of New York, manufacturer of sheet-metal goods, recently installed electric power and finds the central-station service satisfactory in every particular, besides effecting a saving of $2 a day from the former cost. One instance quoted from a letter from President Wallace to the Edison Electric Illuminating Company of Brooklyn, which supplies the current, is especially complimentary to electric drive: "We found that in drawing steel, when our press came over the center our engine slowed down, while on the other hand the electric motor increases in speed and power and drives the press uniformly, and our press makes two operations per minute more by electric power than it would with steam."

BUSINESS.

The Aiton Machine Company, 126 Liberty Street, New York, has just issued a bulletin illustrating one of its horizontal types of cabling or closing machines for laying up large cable. Specifications and quotations will be cheerfully furnished upon application at the New York office of the company.

For the six months ended June 30, 1905, President J. W. Duntley of the Chicago Pneumatic Tool Company reported profits of $413,941.54. After various amounts were deducted for depreciation and repairs, experimental work, bond interest and sinking-fund reserve, there remained as profit available for dividend $273,736.52. From this were paid two quarterly dividends of one per cent. each—a total of $122,275.66—leaving a surplus of $151,460.86. The total surplus is now $376,898.17.

The D. T. Williams Valve Company of Cincinnati has made arrangements for the exclusive manufacture and sale of the Cookson steam trap and separator, formerly manufactured by the Cookson

Steam Specialty Company of Cincinnati. This trap is well known throughout the country, and is handled by the majority of jobbers.

The Chandler & Taylor Company of Indianapolis has recently secured contracts for its inclosed self-oiling direct-connected engines in Purdue University, Lafayette, Ind.; main power plant Indiana State Normal School at Terre Haute, Ind.; Girl's Industrial School, Indianapolis, Ind., and for two units in Michigan College of Mines, Houghton, Mich. These engines are all built in accordance with the recommendations of the American Society of Mechanical Engineers and the American Institute of Electrical Engineers for direct-connected units.

The Standard Metalwork Company of Thompsonville, Conn., has been established by the G. H. Bushnell Press Company of Thompsonville, for the purpose of conducting the manufacture of large pipe bends with improved joints for high-pressure steam service and difficult metal work generally, including steam superheaters, condensers, feed water heaters, as well as appliances for refrigerating, evaporating, distilling, etc. James A. Colvin is the proprietor; Mark Worth, business director, and James Acton Miller, mechanical engineer and director, the latter having been engaged a number of years in above class of special work.

Campbell Bros. of Lynn, Mass., say that their time switches are remarkable for their extreme simplicity, with increased reliability and reduced selling price. These devices are equipped with Ansonia clocks and Hart rotary indicating switches. The lowest-priced switch will turn current on or off. The parts are well made and highly finished in nickel plate. Another feature is the ease with which the switches are installed. These switches are in great demand by supply houses, central stations and electrical contractors, and although Campbell Bros. are constantly increasing their floor space and other manufacturing facilities, their factory is working at its full capacity in order to keep up with increasing sales.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) August 1, 1905.

795,820. System for the Selection of Electric Circuits. Anson G. Cox, Boston, Mass., assignor to Spencer W. Richardson and Richard P. Elliott, trustees. Application filed January 27, 1902.

A selective system has for its purpose the selection and closing of any one or more of a number of local circuits located at a distant point by means of the combined action of single characteristic impulses one over each of a number of main-line circuits. The selective means consists of a number of main-line circuits, a polarized relay and a switch magnet in each of the main-line circuits; means for sending characteristic impulses over the main-line circuits and means whereby single characteristic impulses one over each of two of the main-line circuits will cause the instruments therein to co-operate to select one or more local circuits.

795,821. Underground Conduit. Henry T. Craven, Vineland, N. J. Application filed May 24, 1904.

In a conduit structure a concave inclined face-wall and inclined pillars and a rail-supporting superstructure in the rear thereof form a deep narrow trolley groove tapering from its middle portion downward, and has passages for drainage between the pillars. (See cut.)

795,836. Selective Call Apparatus. John A. Hulit, Topeka, Kan. Application filed September 3, 1904.

A battery and a sounder are controlled by the front contact of the relay. The selective-call machine circuit is controlled by the back contact of the relay and includes another battery and an electromagnet. A signal circuit including a signal device and the second-named battery and the two-point switch selectively operable by the electromagnet for opening the machine circuit and closing the signal circuit are other features.

795,838. Asynchronous Electric Motor. Paul Jigouzo, Vanves, France. Application filed December 1, 1902.

With a rotatable armature are combined a fixed motor inductor and a fixed brake inductor, between which inductors the armature is arranged. The motor inductor has notches containing two windings, and a winding is carried by the fixed brake inductor.

795,843. Syntonic Space Telegraphy. Oliver J. Lodge, Birmingham, and Alexander Muirhead, Shortlands, England. Application filed March 21, 1902.

In the receiving circuit of a system of Hertzian-wave telegraphy are combined a condenser and a self-induction of suitable amount forming an attuned condenser circuit closed through the self-induction; also an elevated collecting conductor, an overflow path, a coherer in the overflow path and a subsidiary condenser in shunt to the receiving instrument and its battery (See cut on next page.)

795,851. System for Selecting Electrical Circuits. Albert D. Neal, South Boston, Mass., assignor to Spencer W. Richardson and Richard P. Elliott, trustees. Application filed October 18, 1901.

In a selective system are a source of electrical energy; a number of main-line circuits; a number of coacting polarized relays, one in each main-line circuit; a number of contacts on the armatures of the relays; means for reversing the direction of current through the polarized relays, and a number of local circuits attached to the contacts in the armatures of the polarized relays, any one of which local circuits may be closed at will by energizing the polarized relays.

795,852. Electrical Relay. Albert D. Neal, South Boston, Mass.; Emily S. Neal, administratrix of said Albert D. Neal, deceased. Application filed March 4, 1902.

The device consists of a number of relays, armatures for the relays, a number of contacts on the armatures, means for energizing either one of the relays before the other and means for connecting any one of the contacts on one armature with any one of the contacts on the other armatures.

795,857. Method and Means of Signaling. Frank W. Prentice, Braddock, Pa., assignor of one-half to H. C. Rehn, Cleveland, Ohio, and George D. Breck, Pittsburg, Pa. Application filed November 19, 1902.

Signaling between railway trains is accomplished by the combination of a sending apparatus comprising a Hertzian-wave generator and a timed controller therefor. The Hertzian-wave receiving apparatus comprises a coherer and decoherer device and actuating mechanism therefor, a timed controller for the device and the mechanism, a relay electrically connected with the coherer device and with its timed controller, a signaling device operated by the relay, a main metallic conductor stretched parallel with the railway track, a wave transmitting member carried upon one train in close relation with the conductor but out of contact therewith, and wire connections leading from each apparatus to the member and main conductor. (See cut.)

795,861. Alternating-current Induction Motor. Leo Schüler, St. Louis, Mo. Application filed July 16, 1904.

The motor is provided with a field adapted to be energized by polyphase alternating current and combines an induced member, a conductor containing a variable resistance and electrically connected in polyphase relation to the member at a number of fixed points at starting, and a second conductor adapted to be electrically connected at a number of additional fixed points to the member to short circuit it. (See cut on next page.)

795,864. Reversing Mechanism. Judson Shoecraft, Eskridge, Kan. Application filed December 27, 1904.

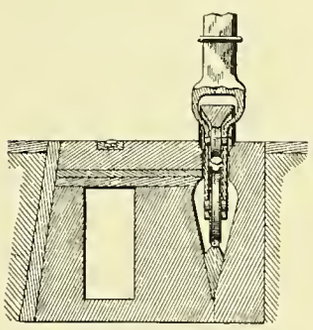
The combination is for use with a circuit including a pole-changer motor and a reversible signal controlling motor and consists of a shunt around the pole-changer motor, another circuit including a reversible signal controlling motor, and a relay for controlling the passage of current in the first circuit through the pole-changer motor or through the shunt. A pole-changer is adapted to reverse the current in both circuits.

795,867. Electric Hand Lamp. Herman F. Stakelbeck, Philadelphia, Pa. Application filed December 16, 1904.

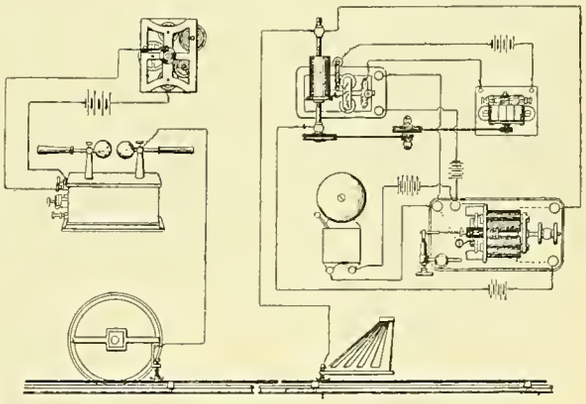
Wires lead to the terminals of the lamp through a handle and a tapered ferrule is carried by the handle. A two-part plug of insulating material is furnished upon its interior with two grooves to receive each one of the wires leading to the lamp terminals.

795,872. Telephone Exchange. Harry G. Webster, Chicago, Ill., assignor to Milo G. Kellogg, Chicago, Ill. Application filed November 16, 1904.

In a telephone exchange system a telephone line connects a substation with the central office and is provided there with a number of switching terminals. The system consists of a source of current at the central office, a testing contact for each of the switching terminals, an operator's testing terminal having normally no effective difference in electrical potential from that of the normal potential of the testing contacts, a test-receiving instrument adapted to respond to an effective difference of potential between the testing terminal and testing contacts produced through the establishment of a connection with the line, a magnet and an associated line signal normally under the control of the subscriber, an electromagnet having two energizing windings, the first winding being normally short circuited and the second winding being normally included in circuit with one limb of the line, means under the control of the operator for causing the energization of the electromagnet, and switching mechanism associated with the electromagnet adapted upon its energization to remove the second winding from the direct line circuit and to include the first winding in branch circuit of the line.



NO 795,821.—CONDUIT RAILWAY.



NO. 795,857.—WIRELESS TRAIN SIGNALING.

795,886. Making Aluminum. Anson G. Betts, Troy, N. Y. Application filed April 1, 1905.

The process of extracting aluminium from materials containing aluminum in the unoxidized condition consists in electrolyzing a fused aluminium-depositing electrolyte of greater specific gravity than pure aluminum and of less specific gravity than the aluminum containing material used with the alloy as anode and a suitable cathode.

795,887. Electrolytically Refining Silver. Anson G. Betts, Troy, N. Y. Application filed March 8, 1905.

This process of refining silver consists in subjecting the silver alloy as anode to an electric current in an electrolyte containing a free, non-oxidizing, strong acid, forming a readily soluble silver salt and electrolytically depositing the silver on a suitable cathode.

795,888. Attachment for Transmitters. Sidney A. Beyland, Elyria, Ohio, assignor to the Dean Electric Company, Elyria, Ohio. Application filed July 20, 1904.

A telephone transmitter has an attachment comprising a sight or body portion and an extension adapted to be clamped between the mouthpiece and front plate, the extension and front plate being formed to prevent turning of the attachment when the mouthpiece is loosened or partly disengaged.

795,910. Conductor Suspension Device. George F. Hagerman, Chelmsford, Mass. Application filed November 22, 1904.

The article is made of a single piece of resilient wire adapted to be attached to a span wire for carrying electric conductors.

795,956. Process of Electrically Heating Water and Other Liquids. Eugene A. Byrnes, Washington, D. C. Application filed December 10, 1904.

The process of heating liquids consists in electrically heating a porous or granular resistance conductor and introducing the liquid into the interstices of the conductor.

795,958. Controller for Electric Circuits. Fred Cedergren, Chicago, Ill., assignor of one-half to Frank S. Betz, Chicago, Ill. Application filed December 17, 1904.

One claim describes a circular strip of conducting material of high resistance; a controller arm mounted to rotate on a pivotal axis concentric with the strip, the arm being insulated at the center from the strip and having thereon a shoe having electrical connection with the strip; a sector of insulating material separating the ends of the strip; a rheostat mounted on the sector, and an electric circuit connecting in series one end of the strip, the shoe and the rheostat.

795,961. Telephone Exchange System. Elmer R. Corwin, Chicago, Ill. Application filed September 3, 1904.

Two supervisory relays in a cord circuit are each provided with an armature back contact in shunt with each other and in series with the operator's telephone circuit, constituting means by which the operator's telephone is prevented from listening connection with the cord circuit when both the receivers of the telephones of two substation telephones connected by the cord circuit are off their hooks.

795,983. Sparker. Alpha R. Joy, Wapello, Iowa. Application filed September 1, 1904.

Included in the device are: A base, an armature, a field magnet mounted upon the base, an armature shaft, a beveled friction pulley mounted at one end of the shaft and designed to engage a fly wheel, a speed governor at the other end of the shaft, a pivotally mounted forked bar, one of the tines of which is on each side of the armature shaft and rests against the collar upon which the beveled friction pulley is mounted, and a spring connected with the upper portion of the pivotally mounted forked bar and normally holding the tines in engagement with the collar upon which the friction pulley is mounted.

796,011. Apparatus for Electrostatic Separation. Greenleaf W. Pickard, Amesbury, Mass., assignor to Charles Henry Huff, Brockton, Mass. Application filed August 2, 1901.

A source of potential having a normal characteristic phase curve furnishes the means to exclude from the electrodes of the separator all of the potential created by the source except a selected portion thereof represented by an area which is only an included fraction of the normal phase-curve area.

796,012. Method of Electrostatic Separation. Greenleaf W. Pickard, Boston, Mass., assignor to Charles Henry Huff, Brockton, Mass. Application filed November 12, 1904.

This method consists in generating a potential having a normal characteristic phase curve, thereby eliminating all of the potential except a portion represented by an included fraction of the phase-curve area, and communicating this residue, as a series of static shocks, to a mass of material, meanwhile passing the material through the static fluid thus produced.

796,022. Cut-out for Telephones. John A. Tornquist, Clinton, Iowa, assignor to the Tornquist

Electrical Manufacturing Company, Davenport, Iowa. Application filed October 6, 1904.

Lightning arresting plates having extensions are mounted on a base. Carbon blocks are placed on the extensions, and bolts secure the extensions on the base and the carbon blocks on the extensions, the carbon blocks being adjustable on the bolts toward and from one another.

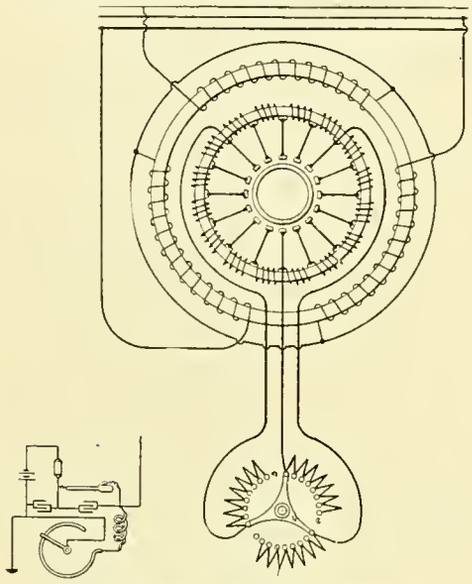
796,031 to 796,070 inclusive. The patents bearing these numbers have been issued to Thomas Duncan of Lafayette, Ind., for various electrical measuring devices. See page 121.

796,089. Telephone Exchange Appartus. Elias E. Ries, New York, N. Y. Application filed May 20, 1904.

A single lamp or signal device operates both as a supervisory and a clearing-out signal and has means for operating when the central-office operator inserts the answering plug, and means responsive to a change in the electric condition of both of two connected subscribers' lines for throwing the signal out of operation during conversation and into operation only when both subscribers resign the use of the line.

796,100. Electric Cable. Charles E. Wilson, Philadelphia, Pa. Application filed April 8, 1903.

A pair of line wires have a dielectric covering for each and a magnetically permeable core parallel with and disposed between the wires. The core has longitudinal channels, in which the wires are laid, and has poles of opposite polarity at its opposite sides at right angles to the direction of the length of the line.



NO. 795,843.—SYNTONIC SPACE TELEGRAPHY.

NO. 795,801.—INDUCTION MOTOR.

796,114. Electrotherapeutic Apparatus. Herschel E. Currey, Baker City, Ore. Application filed June 14, 1905.

A vacuum cup, a suction tube leading therefrom and a casing containing an attenuated atmosphere partly surrounding the cup and tube are described. The cup and tube form part of the wall of the casing, and a terminal is connected to the outer portion of the casing and arranged for connection to an electrostatic machine or the like, whereby the part to be treated may be drawn into the cup into intimate contact with the wall thereof and subjected to the action of the light rays of the casing while in a dilated or distended condition.

796,146. Power Brake. Louis Pfingst, Boston, Mass., assignor to the Pfingst Electric Manufacturing Company, Kittery, Me. Application filed October 24, 1904.

Included in the device are a motor-clutch and gear-driven brake spindle, an electric motor, a rotatable electric motor armature shaft and automatic means for transmitting power from the rotating armature shaft for rotating the spindle.

796,188. Trolley-wheel Bushing. Fred M. Carroll, New Haven, Conn., assignor to the H. B. Ives Company, New Haven, Conn. Application filed March 20, 1905.

A trolley-wheel bushing has an internal annular recess located midway of its length for the reception of an absorbent packing, and graphite-receiving pockets located on opposite sides of the recess and separated therefrom, the outer ends of the pockets being separated from the ends of the bushing by unbroken annular bearing surfaces to withstand the wear of the axle in the bushing.

796,241. Electrically Energized Fence. Albert D. McNair, Dallas, Texas. Application filed November 4, 1904.

A Ruhmkorff coil is provided with a primary winding and with a secondary winding, and a wire fence is connected with the secondary winding. A circuit for energizing the primary winding is provided with a contact and time-controlled mechanism for throwing the primary winding into and out of circuit. Means are provided for controlling the potential of the electric circuit in the fence.

796,254. Photophone. Bruno Saenger, Berlin, Germany, administrator of Raimund Wilhelm Hartmann, deceased, assignor to Franz Arnold, Deggendorp, Germany. Application filed September 15, 1904.

A plane mirror covers an elliptic mirror, which is provided with a small circular hole in its axis. A source of light is in the focus of the elliptic mirror, so that the rays of light emanating in all directions from the source of light are several times reflected by the elliptic mirror and the plane mirror until they pass through the small hole of the latter in an intense, thin and very acute angled pencil. A Bell mouthpiece at an angle to the axis of the elliptic mirror has a membrane which is adapted to vibrate under the action of the voice and to reflect the pencil of rays, and a telescope is adapted for changing the pencil of reflected and varied rays of light to a beam of nearly parallel rays which pass through the space. A receiving tube, having a bottom closing the one end and an object glass closing the other, is adapted to bend a beam of rays of light toward the center. A small camera obscura is longitudinally adjustable in the bottom and has a small circular hole in the focus of the object glass, and a radiophone in the small camera obscura is adapted to increase and decrease its electrical resistance under the action of the bent rays of light. Means for supporting all the parts, a telephone and a circuit connecting the radiophone with the telephone, are provided.

796,259. Electromagnetically Operated Reciprocating Tool. Harry S. Sherman, Denver, Colo. Application filed April 22, 1904.

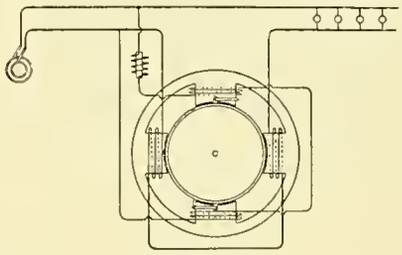
Two solenoids are located within the casing and a magnetic hammer is surrounded by the solenoids. Means are provided for passing an electric current alternately through the solenoids, whereby a reciprocating movement is imparted to the hammer, the coils of the solenoids being arranged in layers one outside of another and at varying distances from the longitudinal centers of the solenoids. The solenoid case is filled with oil to more perfectly insulate the solenoid coils, and there are suitable means for separating the convolutions of the coils to permit the circulation of the oil.

796,269. Pipe Cap for Outdoor Wiring. Wheeler H. Vibber, New London, Conn., assignor to Gillette Vibber & Co., New London, Conn. Application filed March 20, 1905.

An oblong cap having an oblong chamber and provided with an upwardly extending fastening lug has a fixed depending transversely arranged jaw located at the lower inner corner of the cap and a removable jaw applied to the fixed jaw and arranged transversely with respect to the length of the cap under which it extends intermediate between the ends of the chamber to leave the open outer end thereof free for the entrance of the wiring.

796,271. Device for Securing Metallic Protecting Caps to Fuses. Karl Wieser, Rütenscheid, near Essen-on-the-Ruhr, Germany, assignor to Fried Krupp, Aktiengesellschaft, Essen-on-the-Ruhr, Germany. Application filed June 16, 1904.

A protecting cap constructed of a single piece of sheet metal is adapted to fit over the fuse, and a band is secured by a weakened connection to the cap around the lower edge thereof and engaging the undercut of the fuse body to form a means for securing the cap to the fuse, the band having a free end extending outside of the cap and terminating in a loop for tearing off the band.



NO. 796,368 —MOTOR METER.

796,287. Electrically Controlled Shifting System for Track Switches. Thomas Bovey, Chicago, Ill., assignor of one-half to Edward J. Lehmann, Chicago, Ill. Application filed July 11, 1904.

An electric switch-shifting system comprises a main circuit, a normally open auxiliary circuit, a shunt on a car for connecting the main circuit and auxiliary circuits, a transverse reciprocal bar connecting the movable members of a track switch, a signal-circuit independent of the main and auxiliary circuits adapted to be opened and closed by the operation of the bar, devices closed to the auxiliary circuit for actuating the bar and means for locking the bar at the extremities of its movement.

796,295. Combined Brake and Take-up Mechanism for Trolleys. Henry B. Clarke, Chicago, Ill. Application filed July 9, 1904.

The combination consists of an automatic take-up device, a trolley cord connected with the take-up device, a controlling lever operatively connected with the cord and arranged to hold the latter flexed out of a direct line of draft from the take-up device to the trolley, a band-brake wheel, a band brake mounted in operative relation thereto and operative connections between the controlling lever and band brake, whereby a sudden increased draft on the trolley cord moves the lever and brings the brake into operation.

796,296. Trolley-retrieving Device. Henry B. Clarke, Chicago, Ill. Application filed October 31, 1904.

A take-up drum is provided for the trolley cord and a brake-band lever and brake band control the movement of the drum. A magnet operatively connected with the lever and holding it in normal position has electric connections controlled by the trolley and including the magnet, and there are means for actuating the lever and the take-up drum when released by the magnet.

796,297. Automatic Restoring Thermal Protector. Frank B. Cook, Chicago, Ill. Application filed December 9, 1904.

In the apparatus specified are a cylindrical portion operable upon abnormal current conditions, a member encircling the cylindrical portion and normally gripping it to operate therewith, a circuit-controlling means engaging the encircling member to operate the device under abnormal conditions to control a circuit, and means for causing the encircling member to release its grip upon the cylindrical portion and turn upon it to the operative position to reset the apparatus.

796,312. Apparatus for the Reduction of Iron Sand, Iron Oxide and Other Suitable Substances. David R. S. Galbraith, Auckland, New Zealand, assignor of one-half to William Steuart, Auckland, New Zealand. Application filed October 27, 1903.

Resistances mounted within a furnace body, intercepters arranged in suitable relation to the resistances, carbon blocks mounted in the casement and projecting into the furnace body, a cap mounted upon the furnace and provided with a feed opening and a chambered casement supporting the furnace and first-mentioned casement are the main features. The supporting casement is provided with a gas inlet and a pair of tap openings, and a receiving vessel is mounted in the chamber of the supporting casement and provided with an inlet and a pair of discharge openings registering, respectively, with the gas inlet and tap openings of the supporting casement.

796,325. Stopper for Electrolytic Pots Containing Fused Baths. Charles M. Hall, Niagara Falls, N. Y. Application filed April 30, 1902.

A stopper for pots containing fused baths consists of a tapering metal plug and a plastic body set in the tap hole and baked around the metal plug, the plug projecting outwardly beyond the pot and being removable from the plastic body to open the tap hole.

796,339. Method of Improving, Bleaching or Conditioning Wheat Flour or Other Cereals. William T. Mercier, Belfast, Ireland, assignor to the Ozonized Oxygen Company (Ltd.), Manchester, England. Application filed November 23, 1903.

This method consists in subjecting the material to the action of a mixture of ozone with chlorin generated by electrolysis of a solution of a common salt.

796,340. Apparatus for Improving, Bleaching or Conditioning Wheat Flour or Other Cereals. William T. Mercier, Belfast, Ireland, assignor to the Ozonized Oxygen Company, (Ltd.), Manchester, England. Original application filed November 23, 1903. Divided and this application filed February 1, 1904.

The apparatus comprises a blower, an ozonizer, a passage from the blower to the ozonizer, an electrolytic tank, consisting of an iron casing as the cathode, partitions fixed to the ends of the casing but not extending to the bottom thereof, an inverted box in each of the compartments formed by the partitions, anodes in each box, a passage from the ozonizer to the electrolytic tank, a chamber and a passage from the electrolytic tank to the chamber.

796,343. Electric Gas Lighter. Joseph Mlada, Manitowoc, Wis., assignor of one-fourth to Anton Mueller, Manitowoc, Wis. Application filed January 2, 1904.

The combination is used with a gas fixture having a burner and a stop cock therefor, and consists of electric conductors adapted to enter the gas fixture near the burner and extend therein to the source of electric supply. Insulating plugs are adapted to insulate the conductors from the fixture. When the cock is turned to release the flow of gas one pole will be brought into contact with the other and a spark produced to ignite the gas.

796,349. Electrical Ignition Apparatus for Internal Combustion Engines. Arthur J. Postans, South Kensington, England. Application filed October 19, 1903.

An electrical igniter comprises a sparking plug having a fixed and a movable electrode, with means for closing the spark gap when the pressure in the combustion chamber of the engine falls below a definite amount. An electrically operated device engages with the movable electrode for withdrawing it from contact with the fixed electrode, simultaneously rotating it.

796,360. Electric Switch. Joseph H. Rusby, Nutley, N. J. Application filed June 1, 1904.

A shiftable block has a plunger and an anti-frictional bearing surface, against which the plunger acts.

796,368. Motor Meter. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Company, New York. Application filed November 21, 1896.

The herein described method of actuating an alternating-current motor meter consists in setting up or establishing a shifting field of magnetism by means of magnetomotive forces acting along three intersecting lines, one magnetomotive force being proportional to the current and the other two to the electromotive force, the several magnetomotive forces being so proportioned and related to each other that the resultant of the last two is displaced in phase from the first by the complement of the angle of lag, and subjecting an armature to the inductive action of the field. (See cut.)

796,378. Apparatus for Making Armored Cables. Marcus M. Waterman, Troy, N. Y., assignor to the Sterling Electric Company, Troy, N. Y. Application filed January 28, 1905.

A series of rolls are constructed and adapted to spirally wind a single metal armor strip and interlock the edges of the convoluted strip. Means are provided for feeding a conductor longitudinally between the rolls to receive the armor as it is wound and interlocked.

796,390. Ore-dressing Machine. Henry S. Anderson, Springfield, Mass., and John W. Bennie, Clifton, Ariz. Original application filed May 17, 1903. Divided and this application filed February 2, 1905.

A metallic ore bed screen in a containing vessel forms an electrode and an electrolytic liquid containing in solution a salt of the metal of the ore treated submerges the screen. Means for causing the liquid to pass and repass through the screen, a second electrode in the vessel submerged in the liquid, and a source of electric current having its terminals connected to the electrodes, respectively, so as to maintain the screen in an electronegative condition relatively to the second electrode, are the features.

796,403. Electric Wave Telegraph Receiver. Charles L. Fortier, Milwaukee, Wis. Application filed April 17, 1903.

The receiver consists of suitably mounted electrodes; a conducting medium between the electrodes; a local circuit, including the electrodes, conducting medium, telephone receivers and a battery, a telephone being located between the positive pole of the battery and one of the electrodes and another telephone being located between the negative pole of the battery and the other electrode; a suitable wave intercepter connected to one of the electrodes, and a capacity or ground connected to the other electrode.

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LIBRARY OF ELECTRICAL ENG'G

Latest Electrical Equipment of the Karawanken Tunnel.

By Frank C. Perkins.

The total length of the Karawanken Tunnel at the north end completed up to May 17th was 4.892 kilometers. During the last 892 meters of this excavation a considerable amount of water was encountered. Four electrically operated centrifugal pumps were installed after a distance of four kilometers had been excavated, and these pumps were increased in number to eight and finally 10, in order to keep the tunnel free from water while the construction work was in progress.

For the construction of the Karawanken Tunnel electrical power-transmission plants and equipments of much interest have been utilized. The Karawanken Tunnel begins at Rosenbachthal, South Velden, on Lake Worther, in the Styrian Alps, in Austria. The south end of the tunnel is located at Birnbaum, on the state railroad, in the valley of Wurzener Saye. The construction of the tunnel was started at both ends to meet in the center at a height of 630 meters above the sea level. The fall to the south is six per cent., while the grade on the north is three per cent. In the construction of this tunnel there were employed 1,700 workmen at the northern end, 1,100 of whom worked in the tunnel itself, while on the south side there were 2,200 workmen, 1,200 working in the tunnel, which was constructed with a minimum height of three meters and a minimum width of 2½ meters.

The necessary power is supplied by two electrical power-transmission plants—one installed at Rothweinbach, a distance of six miles from the south tunnel portal, and another at Rosenbach, a distance of 1¼ miles from the northern tunnel portal. The line voltage is 5,000. The waterpower available at Rothweinbach is equivalent to 900 horsepower, with a fall of 28.4 meters and a discharge rate of three cubic meters per second. The power house here is equipped with three turbines of 450 horsepower each, a three-phase alternator of 400 kilowatts capacity being directly coupled to each turbine, the speed being 750 revolutions per minute. Two of these three electrical generators are usually employed, the third being held in reserve. These machines supply three-phase currents, with a frequency of 50 periods per second and a pressure of 5,500 volts. The turbine wheels at this plant are equipped with automatic regulators, which control the speed very accurately. The switchboard consists of three marble panels for the measuring instruments, regulating apparatus and switches which control the high-tension, three-phase power-transmission line which connects the power house with the tunnel entrance. Highly insulated iron-armored cables are used within the tunnel.

This power house was extremely difficult to construct on account of the trouble of transporting the building material and machines to the site of the plant, and a new bridge had to be constructed for aiding in the work of transportation. The hydraulic installation was undertaken by Madile & Co. of Klagenfurt, the mechanical equipment being placed by the Maschinenfabrik Andritz of Andritz, and the electrical equipment by the Vienna establishment of Siemens & Halske. The power-transmission line consists of three bare copper wires, each eight millimeters in diameter. The total length of the high-tension power-transmission line is about six miles, which includes an underground section of armored high-tension cable of the three-phase type, having a copper section of three by 50 square millimeters. The entire loss on the transmission line from the central station to the tunnel is 10 per cent.

The Karawanken Tunnel is provided with an elaborate electrically driven ventilator plant, the current being received from the Rothweinbach power house. It consists of two groups, with three centrifugal ventilators in each group. Each group of three ventilators is directly coupled to a high-tension, three-phase, alternating-current motor of 180 horsepower. At a speed of 1,450 revolutions per minute the ventilators supply 350 cubic meters of air per minute to the tunnel, making the atmosphere therein extremely satisfactory for the workmen.

DOUBLE ELECTRIC LOCOMOTIVE WITH SINGLE CONTROL AT ROSENBACHTHAL ENTRANCE OF KARAWANKEN TUNNEL.

These motors may be operated with short-circuited windings and also with slip rings and brushes.

Each of the two motors with its group of three ventilators is operated for three days of 24 hours each, and at times for a longer period, after which the second group is placed in circuit while the first group is inspected. The ventilating pipe is 600 millimeters in diameter, a water-cooling system being provided, so that the air forced into the tunnel in summer is of a moderate temperature.

For the tunnel Siemens & Halske supplied the railway locomotives. These electric locomotives were required to handle 10 loaded cars of materials, each weighing 4,200 kilograms, or together 42,000 kilograms, the smallest curve having a radius of 75 meters. Or they were required to handle a train of 15 empty cars, each weighing 1.2 tons, or together 18 tons, with the same minimum curve. The maximum draw-bar pull of the locomotive is 2,900 kilograms. Two of these electric locomotives are coupled together, forming a double locomotive with single control. Each axle is connected to a

direct-current motor of 25-horsepower capacity. The normal speed of these locomotives is 10 kilometers an hour. Three of the double electric locomotives are operated on the south side of the tunnel, the total lengths of the trips being 7½ kilometers.

The current for operating the electric locomotives is supplied from a sub-station, which was connected with the Rothweinbach power-station transmission line and equipped with step-down transformers and a 250-kilowatt rotary converter. The sub-station received current from the transmission line at 5,000 volts, and two stationary step-down transformers of 230 kilowatts each were provided for lowering the pressure to 350 volts, which the rotary raised to 560 volts direct current. The rotary converter has eight poles and operates at a speed of 750 revolutions per minute. It is provided with a six-pole synchronous motor of small size, for driving the rotary up to synchronizing speed.

The electric-railway overhead working line consists of a bare copper wire of 80 millimeters cross-section. The loss of pressure is about 10 per cent. at the greatest distance from the sub-station.

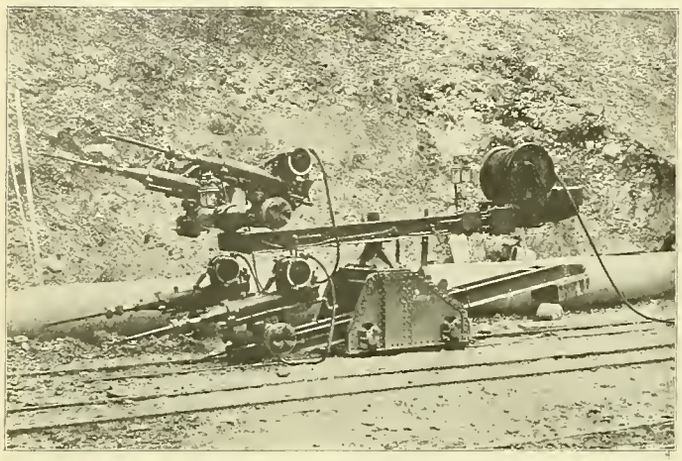
Twenty-six arc lamps of 1,500 candlepower each supply the outside lighting, while the inside lighting is provided by 618 incandescent lamps of 16 candlepower each. The lighting current is supplied from transformers of 60 kilowatts capacity, the pressure being 190 volts for the arc lamps and 110 volts for the incandescent lamps.

There is also supplied from the Rothweinbach central power station the current for operating the two electrically driven air compressors, each requiring 200 horsepower, and to a workshop in the same building, the total power used being 438 horsepower. The air compressors each supply 25 cubic meters of air per minute at a pressure of seven atmospheres for operating six pneumatic boring machines. The ventilating plant and the power station, as well as other points, are connected with a telephone system, the conductors used being 1½ millimeters in diameter and mounted on the high-pressure transmission-line poles, two meters below the power conductors. The total length of the telephone conductors is 40,000 meters.

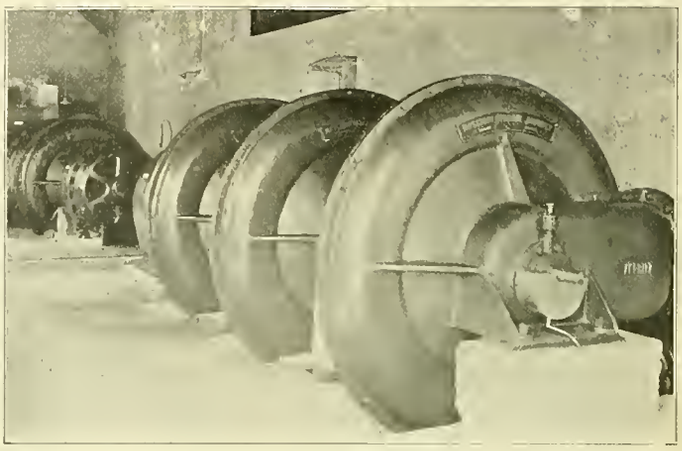
The power station on the north side of the Karawanken Tunnel, located at Rosenbach, takes water from the Drau River, a small stream which supplies a minimum of 600 liters per second, and a normal supply of 1,000 liters of water per second under a head of 72 meters. The water pipe is of wrought-iron, 800 millimeters in diameter and 1,850 millimeters long. This plant is supplied with three turbines of three horsepower each operating at a speed of 500 revolutions per minute, with a water consumption of 510 liters per second under a head of 58 meters. Each of these turbines is directly coupled to a three-phase alternator constructed by the Austrian Schuckert Works, with a capacity of 270 kilowatts as a maximum load, or an output of 216 kilowatts with a power factor of eight-tenths and a pressure of 5,200 volts.

This central station is connected by a transmission line 2,300 meters long to the electric ventilator plant at the north tunnel entrance. The transmission line consists of three bare copper wires, each five millimeters in diameter, mounted upon high-tension insulators on wooden poles. The ventilator plant includes two three-phase motors of 180-horsepower capacity, directly coupled to two groups of three ventilators each, similar to those at the south side of the tunnel, supplying 350 cubic meters of air when operating at a speed of 1,450 revolutions per minute. The double electric locomotive and electric-railway equipment, as well as the lighting installation and the telephone systems, at this side of the tunnel are very similar to those of the south side.

The use of electric drilling machines is an interesting feature connected with the construction of the Karawanken Tunnel. These boring tools are each provided with two-horsepower motors operating the drills, as indicated in the illustrations. They are mounted on a car provided with a cable drum, the drills being placed on an adjustable frame. Both direct-current and alternating-current motors have been utilized in the operation of these machines. The current from the high-tension power-transmission line, which is a 5,000-volt three-phase current, is conducted through a three-conductor iron-armored high-tension cable of three by six square millimeters' copper cross-section to a transformer of 25 kilowatts capacity, which is used for transforming the pressure to 250 volts. The low-pressure cables are also iron-armored and lead-covered, with three conductors, each of 35 square millimeters cross-section. These cables connect with the boring machines, which are provided with drums holding about 200 feet of cable.

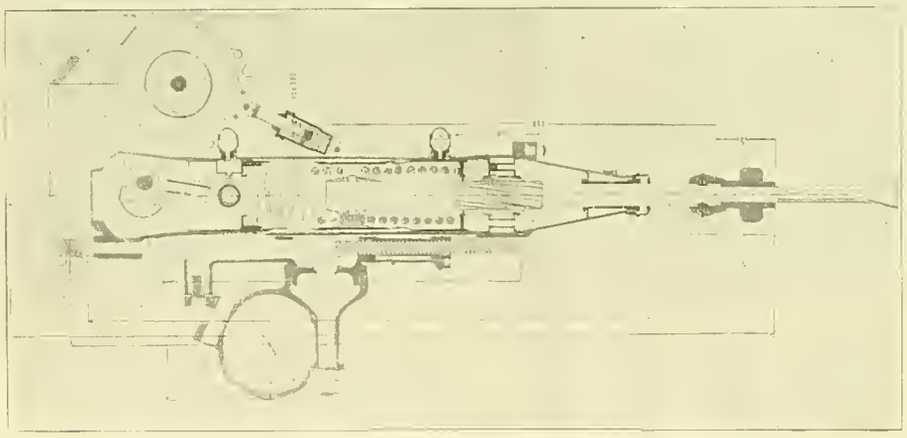


A Car with Four Electric Drilling Machines.



Electric Ventilating Plant.

ELECTRICAL EQUIPMENT OF THE KARAWANKEN TUNNEL.



LONGITUDINAL SECTION OF ELECTRIC DRILLING MACHINE USED IN KARAWANKEN TUNNEL.

Polyphase Generators for Small Central Stations.

[From Question Box of National Electric Light Association.]

QUESTIONS.

Should a small central station install polyphase generators? How can the difficulty of balancing the circuits be overcome?

ANSWERS.

Wagner Electric Manufacturing Company, St. Louis: Unless there is an isolated case of large power service in which a motor unit of 50 or 100 horsepower is required, there is really no reason why a polyphase generator should be installed in an ordinary sized city or a small town. It sometimes happens, however, that the city water pumping can be secured by the central station, and that a motor in excess of 50 horsepower will be necessary. In such event, a polyphase generator should be installed; but otherwise the writer's recommendations would invariably be for a single-phase machine. There is practically no kind of service existing in a small city, other than a rare instance of large power, which cannot be thoroughly taken care of with a single-phase motor. It would, therefore, be "borrowing trouble" to install a polyphase generator and attempt to use it as such. If a polyphase machine has been, for special reasons, installed, we very strongly recommend either operating it as a single-phase machine or putting in a switchboard which permits of using a polyphase set of bus-bars with single-phase feeders running out therefrom.

Polyphase generators are capable of being operated at 75 to 80 per cent. of their rated capacity on single phase, and it would be advisable from every point of view in the ordinary plant to run as a single-phase machine rather than as a polyphase. If a polyphase switchboard arrangement is installed, the use of the proper throw-over switches will enable all distribution, or practically all, to be single-phase. These single-phase feeders can be thrown from one phase to another of the bus-bars and the load kept fairly balanced on the different phase windings of the generator. With such an arrangement, each feeder should be controlled with an independent pressure regulator, and when such an arrangement is provided, the maintenance of a balanced voltage on the polyphase bus-bars is entirely unnecessary, as each feeder can be furnished its required voltage within a range of, say, 10 per cent., without adjustment of the bus-bar voltage.

C. F. Haywood, Denver Gas and Electric Company: If the load is within reasonable distance of the plant (say within 8,000 feet) it would hardly be necessary to use three-phase generators. If the load is greatly unbalanced, it might be a good plan to split the feeders, taking some load off the heavier feeders and throwing it on the lighter.

A. Peters, Excelsior Springs Light, Power and Water Company, Excelsior Springs, Mo.: If polyphase generators must be used, I would suggest two-phase rather than three-phase for ease of balancing. Have double-throw switches on each circuit; you can then throw on one or other set bus-bars and keep system balanced.

F. C. S., Malden (Mass.) Electric Company: No.

C. B. Leland, Stamford Gas and Electric Company, Stamford, Conn.: Use three-phase, if you have a power load, and run all the lighting circuits from one phase, regulating the voltage for this phase only.

W. F. Oviatt, Connecticut Railway and Lighting Company, Bridgeport, Conn.: Yes, if power is to be supplied. The difficulty of balancing circuits on three-wire, three-phase system can be partially overcome by installing feeder regulator on each

feeder. A little care and judgment in connecting circuits to the different phases will do the rest. I have operated such a system for several years and have had no serious difficulty in maintaining a reasonable balance with very little trouble.

W. H. C.: Generally speaking, no station under 500 kilowatts can get good regulation at the station with polyphase generators unless the number of circuits is large and their connected load small. The difficulty is less troublesome, however, using two-phase generators with independent windings than with three-phase generators of an equal capacity.

Harry Hollis, Wilmington City Electric Company, Wilmington, Del.: Yes, with a view of prospective motor business. Divide circuits so that by means of switches different phases can be loaded equally.

G. Wilbur Hubley, Louisville Lighting Company, Louisville, Ky.: Desirable to install single-phase apparatus entirely.

A. R. MacKinnon, Cheboygan Light and Power, Cheboygan, Mich.: Would consider single-phase machines preferable for any small plant.

F. D. Elwell, Sidney Electric Light Company, Sidney, Ohio: Have found the following arrangement to work satisfactorily: Install two-phase generator with single-phase distribution circuits and series alternating arc-lighting system. Operate arcs on one phase and incandescent circuits on the other. Regulate generator voltage for incandescent

POWER HOUSE AT ROTHWEINBACH, NEAR KARAWANKEN TUNNEL.

service, and let constant-current transformers take care of street system at whatever voltage they get.

C. W. Higgins, Duluth General Electric Company, Duluth, Minn.: Not advisable unless some motor business could be secured; in that case balancing could be secured by using a plug and cable board.

E. J. Bechtel, Toledo Railways and Light Company, Toledo, Ohio: In a small central station having a three-phase motor load it would probably be policy to install polyphase generators and use feeder-potential regulators on lighting feeders to maintain the proper voltage. Absolute load balance is not so necessary. In case of a lighting load only, single-phase machines are preferable.

C. H. Peters, Durango Light and Power Company, Durango, Colo.: It is not advisable for small stations to install polyphase generators, for the reason that few, if any, small stations carry a sufficient number of circuits to strike a decent balance between them. If lighting is of first importance, we recommend single-phase, 60 cycles. If a small amount of power is desired in the daytime, and station is centrally located, you would be ahead in the long run by installing a 250-volt direct-current generator to take care of this power service.

George B. Lauder, Concord Electric Company, Concord, N. H.: Polyphase generators are of no ultimate advantage unless power is to be furnished. If the station is small, and the power a small part of business and in small units, the single-phase system has many advantages, and the unbalancing feature will be eliminated. Polyphase generators admit of parallel running, which is an advantage, but not necessarily in a "small" station. If polyphase system is adopted the circuits may be balanced by cutting over the load, or by means of automatic feeder regulators.

The Seattle (Wash.) Electric Company: Unless a station is very small, polyphase generators are preferable to single-phase; also, unless very small, the distribution can be divided into two parts for a two-phase system. If a little excess capacity is allowed in the generator, exact balance between the phases is not necessary.

Augusta (Ga.) Railway and Light Company: A small station with two-phase machine has always two chances instead of one in case of lightning or short-circuit.

F. G. Proutt, Memphis Consolidated Gas and Electric Company, Memphis, Tenn.: No matter how small a central station may be, it is good policy to install polyphase generators, so that a power load may be taken care of as well as the ordinary lighting load. It is not necessary to balance the circuits on polyphase generator. The lighting circuit may be run off one phase and the voltage of the generator adjusted on one phase only. Then use the three phases for power work.

E. F. McCabe, Lewiston Electric Light Company, Lewiston, Pa.: Where there is a possibility of obtaining a motor load it is advisable to install polyphase generators. We are operating two two-phase generators and distributing single-phase from the switchboard. With some changes on our circuits we have found no difficulty whatever in balancing the phases.

C. M. Wright, Pueblo, Colo.: No.

R. N. Kimball, Kenosha Gas and Electric Company, Kenosha, Wis.: A small station should not install a polyphase machine unless large motors are a possibility. Circuits can be balanced by having proper switchboard arrangements to throw any circuit on any phase.

J. T. Cowling, Westchester Lighting Company, Mount Vernon, N. Y.: Not unless motors larger than five per cent. of capacity of generator are to be supplied. As both phases parallel each other, it is easy to transfer lights or single-phase motor load from one phase to the other to keep them balanced.

Packing Machinery for Export.

A paper on the subject of packing machinery for export was recently prepared by Mr. Paul Roux, a member of the American Chamber of Commerce at Paris, which body is doing efficient work for the advancement of American trade. The following notes are taken from the paper and will be of interest to American exporters:

Goods should, if possible, be kept within 40 cubic feet per ton. Projecting parts should be removed and packed separately. They increase space and increase risk of breakage. The parts should be so marked as to absolutely preclude the possibility of error. Herein will be found more than half the success of securing foreign trade. Not a single piece, no matter how simple, should be packed without its localizing mark. It is impossible to emphasize this point too much. Always dismount all fragile and projecting parts. Leave no delicate parts exposed. Plug up oil holes. Put on the best possible coating. It pays. Be sure to put on enough, particularly on all exposed parts.

Merchants and manufacturers should look carefully into the matter of weights and measures. They mean much in the questions of trade. Rates are often regulated on the weight basis. For example, goods weighing more than 4½ tons pay, as a rule, twice as much as do those under two tons. Large and heavy bales increase the costs of loading and unloading. Packing is a science and an art. The making of boxes has been the subject of scientific and mathematical work of the highest kind. Before a box is bought or built the merchant or manufacturer should go carefully into the minutest details as to the character of the box wanted. Care should be taken to permit of easy and efficient examination of the machine or parts packed, even to the admission of a lantern to reveal the parts. For this purpose it is a good plan to fasten one side of the case with screws, usually the side that permits of the best examination. Care should be taken in lining, or not lining, with paper, sheet tin, etc. Here questions of atmospheric effects are often very important.

Every box should be accompanied by its own list of pieces, and, when possible, by drawings of the parts and the complete machine. This helps the adjusters. It is not a bad idea to send with each machine any particular or peculiar tool that may be found useful or helpful in adjusting the parts.

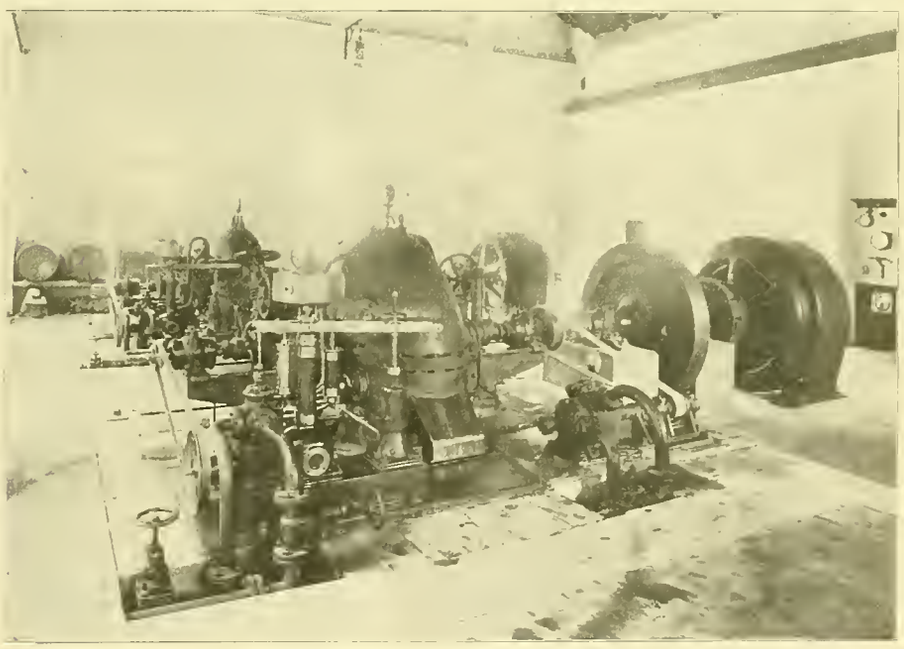
Next in importance to marking the parts of the machines is the marking of the cases. It should indicate the weight, gross, net (absolutely exact), volume and port of destination, the latter in large letters, at least two inches long. Marks of identification on each end of a case are of great value. A mark of some kind should surround the heads of nails or screws which should be removed to unpack the machine.

New Steam-turbine Patents.

Among the patents issued by the United States Patent Office on August 8th was one to Richard H. Rice of Swampscott, Mass., for a "Governing

DAM ON ROTHWEINBACH, NEAR KARAWANKEN TUNNEL.

Mechanism for Elastic-fluid Turbines." The application for this patent was filed February 6, 1904, and the patent is assigned to the General Electric Company. Fifty-four claims are allowed. One of them describes a governing mechanism for turbines comprising a plurality of individual valves, each controlling the passage of fluid to the turbine, and a governor, in combination with a reciprocating cam-bar, a reversible fluid-actuated motor for actuating the bar which is started into action by the governor, and a restoring device acting independently of the governor for stopping the motor.



INTERIOR OF ROTHWEINBACH POWER HOUSE.

It will be noted that the term "elastic-fluid" in the title applies either to gas or steam turbines.

On the same day Oscar Junggren of Schenectady, assignor to the General Electric Company, was granted a patent for a governing mechanism for turbines. The application was filed January 13, 1904. Here invention is allowed, among other claims, for "the combination of a valve, an actuator for the valve, which moves it positively, a normally stationary motor, a driving connection between the motor and the actuator, a speed-responsive device for regulating the action of the motor, and a means acted upon by the motor itself for modifying the action of the device."

The same inventor was granted another patent on the same day for a nozzle for elastic-fluid turbines. A plate is located at the trailing end of the nozzle to prevent the gas or steam from escaping without doing useful work. This patent is also assigned to the General Electric Company.

Method of Controlling Motors Using Both Direct and Alternating Current.

Electric motors may be constructed which will operate satisfactorily when supplied with either alternating or direct currents, but such motors do not ordinarily operate equally well under both conditions for the reason that when operated by alternating currents it is desirable that the ampere-turns in the field-magnet windings shall be relatively low and that when operated by direct currents the ampere-turns in the field-magnet windings shall be considerably higher in value. By making use of suitable combinations of reactance and resistance windings having different time constants it is possible to provide different conditions of operation for the two kinds of currents, by virtue of which a higher value for the ampere-turns in the field-magnet winding may be obtained when the motor is operated by direct currents than when it is operated by alternating currents. Such means were set forth in an application for a patent filed by B. G. Lamme of Pittsburg on May 3, 1904. Mr. Lamme has now taken out another patent, assigned to the Westinghouse Electric and Manufacturing Company, for an improvement to the system.

Fig. 1 is a diagram of the system embodying the invention, and Fig. 2 is a diagram corresponding to a portion of the system illustrated in Fig. 1 and setting forth a modification.

Alternating-current energy is supplied from a suitable generator (1) to distributing conductors, which are respectively connected with terminals (4) and (5) of a double-throw switch, and direct-current energy is supplied from a suitable generator (7) to distributing conductors, which are respectively connected to one terminal of a subdivided resistance element (10) and to a terminal (11) of the same switch. The various subdivisions of the resistance element are connected respectively to contact-terminal pieces with which a contact arm (13) is adapted to engage, the arm being connected to a terminal of the switch. The parts (10), (12) and (13) constitute the elements of the controlling system that pertain to direct-current operation of motors and are intended to be merely indicative of any operative means that is suitable for direct-current service.

The controlling apparatus that is intended for use in connection with alternating-current operation of motors will be now described in conjunction with the apparatus that is used in connection with both direct and alternating-current operation.

One terminal (15) of a transformer winding (16) is connected to contact terminal (17) of the switch (6), and the other terminal of the transformer winding is connected to terminal (19) of the switch. Connected to a point (20) that is suitably located intermediate the end terminals of the winding is one terminal of the secondary winding (21) of a series transformer (22), the other terminal of the winding being connected to terminal (23) of a switch (24) and also to the terminal (11) of the switch (6) and to terminals of an inductive or reactance coil (25) and a noninductive resistance (26) that are connected together. The terminals of the primary winding of the series transformer (22) are connected, respectively, to terminals (28) and (29) of the switch (24), and terminal (30) of the switch (24) is connected to a switch-arm (31) that serves to make connection with any one of several spaced leads (32), with which the transformer winding (16) is provided.

The field-magnet winding of a motor (33) is composed of two sections (34) and (35), the section (34) having more turns than the section (35). One terminal of the section (34) of the field-magnet winding is connected to one terminal of the choke coil (25), and the other terminal is connected both to one terminal of the part (35) and to one terminal of the resistance (26). The other terminal of the part (35) is connected to the armature (36), the other terminal of which is connected to the terminal (18) of the transformer winding (16) and to the terminal (19) of the switch (6).

Assuming that the switch (6) is in the position shown in the drawings, alternating current will be supplied to the motor (33), and nearly all of it will pass through the resistance (26) and the section (35) of the field-magnet winding provided the choking effect of the coil (25) is made sufficiently high. The phase relation between the current and the impressed electromotive force in the section (35) will be slightly different from that which obtains in the section (34); but as the current passing through the resistance (26) will be very much larger than that through the field-magnet winding (34), the field strength of the motor will be due almost entirely to the winding (35). It follows, therefore, that the field and armature strengths will be substantially in phase and that the ampere-turns of the field magnet will be relatively small as compared with direct-current operation. If direct current is supplied to the motor, it will flow mainly through the choke coil (25) and both field-magnet windings (34) and (35), provided the choke coil is made of comparatively low ohmic resistance, so as to furnish but little opposition to the flow of current, and also provided the resistance (26) presents a greater opposition to the flow of direct current than is presented by the choke coil (25) and the field-magnet winding (34). It follows, with these conditions, that all of the current supplied to the armature will pass through the field-magnet winding (35), and a considerable portion of it will pass through the winding (34). Hence the entire field-magnet strength will be very much greater than when the motor is operated by means of alternating current.

In order to insure the most effective operation the resistance of the element (26) should be high as compared with that of the choke coil (25) when utilizing direct current; but when utilizing alternating current the resistance of the coil (26) should be as small as possible. The lower this resistance to the passage of alternating currents the better. It may therefore be so arranged that the resistance (26) will be short-circuited when the motor is operated by alternating currents, and when operated by direct currents the short-circuiting device may be opened. This arrangement is illustrated in Fig. 2, in which the several elements remain the same as in Fig. 1, so far as they are illustrated, except that a switch (37) is provided, which is closed to short-circuit the resistance coil (26) when alternating currents are supplied to the motor (33) and is opened when direct currents are supplied to the motor. The choke coil (25) may also be short-circuited when the motor is operated by direct currents, if desired; but there can be no objection to maintaining it in circuit at all times if it is made of suitable carrying capacity.

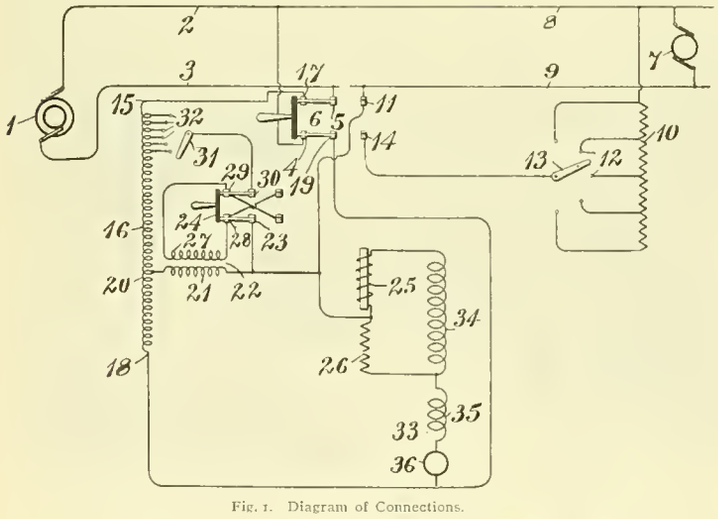


Fig. 1. Diagram of Connections.

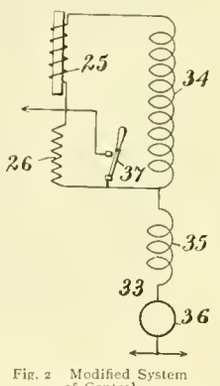


Fig. 2 Modified System of Control.

CONTROLLER FOR ELECTRIC MOTOR.

The Ultra-violet Mercury Lamp.

In a recent issue of a German publication Dr. Schott published a description of the ultra-violet mercury-lamp apparatus. The essential feature, says the London Electrical Review, is that the vessel containing the mercury vapor is constructed of a special glass pervious to ultra-violet rays, the lamp in question giving light of as short a wave-length as 253 $\mu\mu$. The ultra-violet lamp made by Heraeus of Hanau and exhibited at Breslau last year, emitted rays down to a wave-length of 220 $\mu\mu$, but being constructed of quartz, it is too expensive a piece of apparatus to be employed for anything but scientific investigation.

The new lamp for ultra-violet light (which is known colloquially at Jena by the convenient contraction "uviol") consists of a tube from eight to 30 millimeters in diameter, and from 20 to 130 centimeters long, made of the special transparent glass discovered by Dr. Zschimmer, and containing from 50 to 150 grammes of mercury. The length of the tube has to be considerable, not merely to hold the necessary quantity of mercury, but also to enable the lamp to be started, and to allow the negative pole to be constantly covered by the liquid, which is indispensable. In practice the length can be diminished either by bending the tube upon itself one or more times, or by arranging several shorter tubes electrically in series, even if disposed side by side or otherwise. The electrical connections are made by means of platinum wires fused into the glass, with carbon knobs inside as poles. The easiest way of bringing the lamp into action is by the process of inverting it momentarily.

The ultra-violet rays emitted by the lamp have not yet been thoroughly studied, but their presence may be recognized by the odor of ozone, by their power of discharging a negatively charged electroscope, and by their effect on the unprotected eye. As a result of numerous measurements with lamps of different sizes, it appears that under the best conditions a visible light of one Hefner unit is given by the consumption of 0.64 watt. The specific intensity of the visible light varies from 0.31 to 4.3 Hefner units per square centimeter (i. e., from 1.75 to 24.3 British candlepower per square inch) of the longitudinal section of the lamp presented to the photometer. According to Pflüger and Ladenburg, the intensity of the ultra-violet light afforded by the Heraeus apparatus is about equal to, or rather weaker than, that of the visible light.

Practically the lamp has been found very serviceable for photography, either for negative making or for printing. By employing two lamps, one arranged horizontally and the other vertically, excessively deep shadows are avoided. For this particular purpose it is advisable to construct the lamps of glass which does not transmit the light of shorter wave-length that tends to injure the eye. The apparatus has also been found useful for testing the degree of fugitiveness of new dyes and pigments. In the color trade of Germany it is customary to send such new materials to more sunny latitudes in the south, as local climatic conditions are such that they cannot be properly tested within a reasonable period of time to see whether they resist sunlight to the necessary extent. No other artificial light, not even that of the arc, has hitherto been found to possess the fading power of sunlight. Experiments with the "Uviol" lamp, however, show that the permanence of dyes can be estimated with its aid in a few days instead of months.

The light is very destructive to small insects. It kills a house-fly in one minute at a distance of 1.5 centimeter where the warmth can have no effect. After a lamp had been burning during a summer night in a room with open window, thousands of nocturnal insects were found dead beneath it. The light also acts like the sun in destroying bacteria, but this matter is still under examination by Professor Gärtner of the Jena University.

In the direction of therapeutics the lamp has an advantage over the ordinary arc employed by Finsen, in the larger proportion of light with short wave-lengths which it gives, and in its smaller production of heat. Surfaces of skin up to 1,400 square centimeters in area can be exposed simultaneously to a light of great intensity, and the heat emission is so small that the lamps can be approached to a distance of less than one centimeter. When a lamp is allowed to act for from five to 15 minutes at a distance of from one to three centimeters upon the healthy skin of an arm, no effect is noticeable at first. After a few hours a reddening appears, which reaches a maximum in one day's time. Soon after, a slight burn is visible, the skin becomes irritable and peels in a few days, and in two or three weeks the red color all disappears, leaving a brown mark like that caused by prolonged exposure to the sun. Experiments are now in progress at the Jena hospital under the direction of Professors Stintzing and Matthes upon the effect of the light upon skin diseases. Several mild cases of eczema, of some years' standing, have already been cured; more severe cases have been treated every day for some weeks to 15 or 30 minutes' exposure, and promise cure. A case of erysipelas has been cured almost without fever, but the

treatment was so short that the influence of the lamp could not be appraised. An elderly, strong and well-nourished man and a young man of inferior physique were exposed for 20 or 25 minutes at a time to the light of four lamps developing 1,400 Hefner units, the treatment lasting for about 10 hours in all, spread over a period of three weeks. The reddening and browning already mentioned was noticed, but, except for some irritation of the skin, no evil effects were to be observed. Both men considered the exposure beneficial, and the younger man gained weight, acquiring a better appetite.

With care, a "Uviol" lamp will last for more than 1,000 burner-hours.

Hartmann's Photophone.

A photophone is, of course, an instrument serving to transmit sound along a ray of light. The principle has been long recognized and has been utilized in many interesting experiments. Commercially, however, the photophone has so far been of little importance. R. W. Hartmann, a German, recently deceased, invented an instrument of this character which has been patented in the United States. His administrator, in the application for the patent, remarks that previously existing types of photophones present the great disadvantage that they disperse the light too much, and thus the conveyance of speech over long distances and at daylight is rendered impossible. The only means hitherto known for obtaining a pencil of rays of light as parallel as possible is the parabolic reflector. However, the more it is attempted to utilize the properties of the parabolic mirror the less will it be found possible thereby to increase the practical usefulness of wireless telephony, which is now so much aimed at. For a conversation over a distance of but a few kilometers very large parabolic mirrors would be required, so that the use of such instruments would be quite impossible for military or other purposes. The hitherto known photophones also present the defect that it is not possible to keep secret the conversation, since other receivers near the one to which speech is to be conveyed from the sender are capable of collecting the dispersed rays of light and thereby receiving the intelligence. The receivers in such photophones are, moreover, not adapted to receive only the rays of light from the right sender while excluding those from all other senders.

The present invention relates to improvements in photophones, whereby it is asserted that the conveyance of speech over greater distances than hitherto is rendered possible and the size and the weight of the photophone are kept within moderate limits, so that the latter can be easily transported, while a greater secrecy of the conversation, both at the sending station and at the receiving station, is insured.

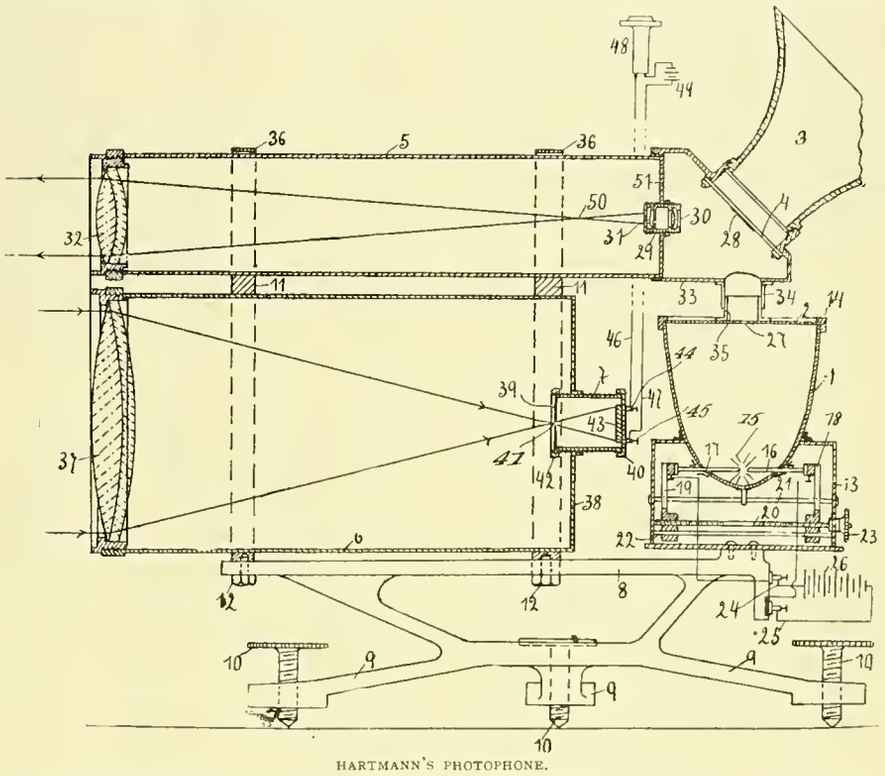
The objects of the improvement are, first, to provide an elliptic mirror with a plane mirror covering it and having a narrow circular central hole; second, to provide a source of light in the focal point of the elliptic mirror; third, to provide a mouthpiece at a convenient angle to the axis of the elliptic mirror, its membrane being adapted to serve as a mirror for reflecting the pencil of rays of light from the elliptic mirror; fourth, to provide a sending tube similar to an astronomical telescope and adapted for changing the pencil of rays reflected from the membrane to a beam of nearly parallel rays which pass through the space, all the parts hitherto named forming the sender of a photophone; fifth, to provide a receiving tube having at the rear end a bottom and at the front end an object glass adapted to bend a beam of rays to the center; sixth, to provide in the bottom of the receiving tube a longitudinally movable small camera obscura having a narrow circular central hole in the focal point of the object glass; seventh, to provide within the small camera obscura a selenium cell or radiophone, and, eighth, to provide a circuit connecting the selenium cell or radiophone with a telephone. These objects are attained by the photophone illustrated in the accompanying drawing, which gives a vertical longitudinal section through a photophone comprising a sender and a receiver.

Referring to the illustration, it will be noted that the sender is composed of an elliptic mirror (1), a plane mirror (2), a mouthpiece (3), with the membrane (4), and a sending tube (5). The receiver is composed of a receiving tube (6) and a small camera obscura (7). All the parts are shown as combined and supported by a table (8) provided with, preferably, three feet and adjusting screws. The two tubes are parallel to each other and may be superposed and rigidly connected in any known and approved manner. The plane mirror (2) is provided with a narrow circular hole (27) in the axis of the elliptic mirror (1). For producing the rays of light within the elliptic mirror any convenient source of ligth may be employed. An arc light (15) is used in the arrangement illustrated. Means are provided so that by turning the wheel (23) the two carbons can be simultaneously and longitudinally shifted in opposite directions, striking the arc. The arc light is caused to remain in the focus of the elliptic mirror (1).

At (43) a selenium cell or radiophone of any known construction is secured. This selenium cell is shown as consisting of a ceramic plate and a zigzagged selenium wire embedded in the surface of this plate. The two ends of this zigzagged selenium wire are connected with two binding posts, and the latter by two wires with a telephone (48) and a battery (49), whereby a circuit is formed. The telephone (48) is not shown in the proper size, but merely diagrammatically, as its construction is immaterial for the present invention.

The photophone described is operated in the following manner: It is directed toward the respective receiving station. After striking the arc this arc will emit rays of light in all directions; but only the rays in the axis of the elliptic mirror (1) and those very little deviating therefrom will be able to at once pass through the narrow circular hole (27) in the plane mirror (2). Thereby an intensive thin and very acute-angled pencil of rays of light is produced, which can easily be subjected to strong variations of the intensity.

The pencil of rays of light passing through the central hole (27) strikes the mirror (28) and is



HARTMANN'S PHOTOPHONE.

therefrom deflected to the lens (30). The beam of parallel rays passing from the lens (30) to the other lens (31) converges to the focus (50), and thence diverges to the large lens (32), from which nearly parallel rays of light pass through the space, so that this beam is capable of producing an image in a telescope at a distant station. Of course, the receiving tube is made sufficiently large in diameter for receiving the full image. When assuming the tube (6) to be at the receiving station and its lens (37) to receive the beam of rays from the lens (32) of the sending station, the rays will be bent toward the center and made to converge to the focus—i. e., the central hole (41) in the cover (39)—after which they will diverge and produce the image on the face of the selenium cell (43) or radiophone.

When the operator talks immediately in front of the mouthpiece (3), the membrane (4), and with it the mirror (28), will be thrown into a complicated state of vibration, which represents the three elements of the speaker's voice—namely, pitch, intensity and quality. The pencil of rays of light will, of course, be subjected to these vibrations by the mirror (28), and these vibrations will be transmitted with the rays through the space to the lens (37) of the distant receiving tube (6) and produce variations in the resistance of the selenium cell (43) or radiophone. The currents circulating in the circuit (46) (47) of the battery (49) and the telephone (48) will register all the peculiarities of the speaker's voice and produce changes in the magnetism of the magnet and of the membrane in the telephone (48). The operator at the distant receiving station placing his ear to the membrane of the telephone (48) will therefore hear the very sounds given out by the speaker at the sending station.

The sender of the Hartmann photophone presents the advantage that it does not emit any lateral rays of light—that is to say, the image of the source of light can only be perceived by an eye in or close to the optical axis of the sending tube, so that the speech can be conveyed only to a distant receiving tube (6), which is in line with the axis of the sending tube (5). In a similar manner the receiver of the new photophone presents the advantage that, owing to its small camera obscura (7), it does not receive any other rays of light but the beam of rays emanating from a sending tube (5) in line with its axis and passing through the narrow circular hole (41) of the camera obscura (7). Thereby an almost complete secrecy of the conversation is insured.

It is evident that if both photophones at the sending station and at the receiving station have two superposed tubes, the sending tube of the one photophone and the receiving tube of the other photophone require to be above, while the receiving tube of the former photophone and the sending tube of the latter photophone require to be placed below.

Where so preferred, the sending and the receiving tubes of a photophone may be placed side by side in a horizontal plane, so that the two photophones at the sending and the receiving stations may be made alike, as the sending tube of the one photophone will be opposite to the receiving tube of the other photophone, and vice versa. The elliptic mirror of each photophone may also be placed horizontally, and the two carbon pieces of the arc lamp may be placed either horizontally or vertically or at any angle.

Lottery Scheme to "Keep Tab" on Passenger Fares.

The Mexican Electric Tramways Company of the City of Mexico has adopted a novel method of keeping a check on its passenger fares. The company says that it has suffered heavy losses through the dishonesty of some of its conductors and the many efforts that were made to detect the guilty persons were unsuccessful. W. W. Wheatly, general manager of the company, determined a few months ago to inaugurate a lottery system in connection with the passenger department of the road, and his scheme was approved by the proper authorities of the Mexican government.

Each passenger when he paid his fare was given a lottery ticket by the conductor. This ticket stood a chance of drawing one of the 209 money prizes offered by the company each month. The prizes range from $1,000 down to a few dollars. The first drawing took place a few days ago and there were many thousands of tickets out. The greatest interest was manifested in the drawing by the ticket-holders, which took place in the presence of Mr. Wheatly, Sir Charles Euan-Smith of London, England, chairman of the board of directors, and a representative of the Mexican government. The first drawing was a success, according to the statements of the officials of the company, the scheme having resulted in a heavy increase in the revenues of the electric-railway system. Naturally, too, the passengers insist on getting a lottery ticket when paying fare, and in this way a check on the number of fares taken is easily arranged.

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DATES AHEAD.

International Association of Municipal Electricians (annual convention), Reed House, Erie Pa., August 23d, 24th and 25th.

Old Time Telegraphers' and Historical Association (annual meeting), New York city, August 29th to September 1st.

Railway Signal Association, Great Northern Hotel, Chicago, September 12th.

Colorado Electric Light, Power and Railway Association (annual convention), Glenwood Springs, Colo., September 18th, 19th and 20th.

American Electrochemical Society (general meeting), Bethlehem, Pa., September 18th, 19th and 20th.

American Electrotherapeutic Association (annual meeting), Academy of Medicine, New York city, September 19th, 20th and 21st.

American Street Railway Association (annual convention), Bellevue-Stratford Hotel, Philadelphia, September 25th to 29th.

Illinois State Electric Association (annual meeting), Peoria, Ill., October 5th and 6th.

WRITING of the new law governing the employment of women and children in Italy, a United States consul notes that for admission to work in mines, tunnels and the like, boys must have attained the age of 13 years where there is electric traction and 14 years where there is no electric traction; and women and girls are excluded altogether from this class of labor, regardless of age. This distinction in favor of electric traction is interesting. It throws a rather unexpected light on the manner in which electrical development is affecting sociological problems abroad as well as at home.

A RATHER striking phrase was used by Prof. E. A. Ross, a visiting lecturer at the University of Chicago, in the course of a recent address. "Steam massed people," he said, "but electricity is dispersing them." And, not quite so happily, continuing, "When the mechanic comes to think nothing of living 10 miles from his work the slum will vanish and the city will diffuse itself into the country." The objection to this is that, in American cities, the slums are not made up of mechanics. Nevertheless, the tendency of the electric railway to extend the distance between the shop and the home is undoubtedly of the greatest benefit to American workingmen. As a simple problem in arithmetic a 12-mile ride for five cents is cheaper than a mile-and-a-half ride for two cents. But the difference in standard of living made possible by the longer hauls and uniform fares of the American street railways, as compared with the shorter distances and graded fares in Great Britain, is even greater than the proportionately cheaper transportation.

TIDES, like waves and the direct heat of the sun, constitute a source of power which is constantly tantalizing the engineers by the unbounded possibilities which seem to be just outside the limit of practical availability. In the case of tides the plan generally suggested is to impound the rising tide in a pond or reservoir, and, on its ebb, utilize the power by waterwheels. But this, under ordinary conditions, would be disproportionately expensive, owing to the necessity of building massive dams to enclose the high-water and low-water basins. However, Mr. James Saunders, who considers the subject in a recent number of an English magazine, thinks that where the natural configuration of the coast is favorable, the idea of utilizing tidal power is at least worthy of study. Vertical turbines to drive electrical generators would be employed, and as it is considered that a fall as low as 10 feet may be utilized by the waterwheels, it is thought that the design of the hydro-electric units could be accomplished without great difficulty. But the great problem, of course, is the financial one.

TRAIN SIGNALING offers a field for the use of wireless communication which is attracting more attention among the railroad companies than is generally recognized. It is declared by those who have made practical tests that Hertzian-wave propagation lends itself particularly well to block signaling. It is possible to fit up each locomotive of a train so that it is constantly in the middle of a moving "block" of, say, four miles in length. Any locomotive similarly equipped coming within two miles of the first announces its presence to locomotive No. 1 by a suitable signal in the engineman's cab—the ringing of a bell, the lighting of an incandescent lamp, or both. It is evident that the ability to accomplish this by "wireless" opens important possibilities in train signaling, and accordingly may mark a distinct improvement in the vital art of safeguardng the lives and property of those who use railroads. But there are a number of practical difficulties to overcome, such as in the case of two or more tracks running parallel. Here the wireless block signals must affect only trains on the same track, or much confusion will result. Again, the signals must be operative within the block, and not outside of it, else the "block" feature will be eliminated and the signals will lose much of their significance and value. Then, too, the complications of crossings, switches and the like are to be considered. However, it is asserted that the inventive talent which has been at work on this problem for several years has at last triumphed over all obstacles and that a valuable, workable system of railroad train signaling by "wireless" is in sight. One western railroad is going into the subject very thoroughly, and many others—perhaps all other important systems in the United States—are watching the developments carefully, convinced, no doubt, that if the Hertzian-wave signaling prove practicable under actual service conditions it will come into general use.

THE LONDON correspondent of the Western Electrician has kept the readers of this journal informed of the progress of the important electric-power project for the city of London now under consideration in Parliament. In this week's letter he says that the opposition of the existing private companies has been appeased, the remaining opposition being that of local municipal authorities, and even here compromises and the general trend of discussion seem to indicate that the objections are not insuperable and that the plan will probably receive parliamentary sanction. This is interesting news from several points of view.

London has a large number of stations generating current for sale to the public—the exact number is, we believe, 54—and American central-station men have often expressed wonder that this uneconomical and inefficient duplication of plant and of effort is allowed to continue, especially in England, where competition with gas is in some respects keener than on this side. The economies of consolidation and concentration in the central-station business were perceived in this country a dozen years ago, and they have been put into practice in nearly every considerable city. The general tendency of this movement is, and should be, a reduction in the price of electricity to the consumer. Electric current for light, power and perhaps heat should not be a luxury for the rich, but should be brought within the reach of the householder in moderate circumstances and the man running a small shop. For this purpose it is the part of wisdom to effect broad economies in the generation and distribution of the current and the administration of the plants. The benefits of these economies should be shared between the public which grants the franchise and the capital employed in the work.

Properly safeguarded, then, a "private monopoly" is not a menace to a community, but a blessing. It is, of course, essential that the details of public oversight and control should be carefully worked out, for public-utility corporations are not unselfish; they are established for the purpose of making money. And the public authorities should be glad to see them receive a suitable financial reward for their enterprise and acumen, provided the service, rates and other obligations of the company are satisfactorily carried out. But it is not likely that the British Parliament will err on the side of tender partiality to a private corporation. Indeed, the fact that this great project under private ownership is so seriously considered in the stronghold of "municipal trading" is one of the most interesting and significant features of the situation.

Technically, the London power project presents many features of interest. If it is sanctioned, the new power houses, sub-stations, transmitting and distributing systems will be on a very extensive scale and represent the latest developments in the art. The plan presented to Parliament is to build three large generating stations, each having a capacity of 90,000 kilowatts. Turbo-generator units of 10,000 horsepower each are to be employed. A main supply cable or circuit will be laid around London, and current will be supplied, in some instances, at wholesale rates to existing systems of distribution. An average selling price of 1½ cents a kilowatt-hour is predicted. The promoters say that the new company will be able to sell current at a cheaper rate than it is now generated. The whole scheme is on a gigantic scale—in fact, it is looked at askance in some quarters in England as on the lines of an "American trust"—and the subsequent developments will be awaited with much interest.

Possibilities of Electric Traction.[1]

By Hylon T. Plumb.

As the electric lines increase in number and length they form centers of a network, and naturally this leads to consolidation of interests. The interurban roads are uniting and working together for through service. Who can inspect the elegant terminal passenger station at Indianapolis and not realize this. For distances of 60 to 80 miles the limited service on many interurban lines is such a competitor of the steam railroad that the steam road is practically out of the race for local business. Through traffic demands better and faster service. Some of the interurbans have luxuriant buffet cars running without stops between the large centers. Meals are furnished on these cars, so there is no necessity for long stops even in the larger towns. A few roads have electric sleeping cars, and this class of through travel promises to become highly popular as soon as faster schedule speeds can be arranged. On these high-speed lines there should be no grade crossings, and the line must be double-track road if the traffic be heavy. Interurban electric traction is like a telephone exchange—the more lines there are the more useful it becomes and the more it is patronized.

Aside from electrically driven cars for city streets, elevated structures and interurban roads, electric locomotives are coming to be extensively used on short lines of railroad, for switching service at terminals and in large industrial establishments; for hauling trains in tunnels, where smoke and gases of steam locomotives add to the dangers of congested traffic; on steep mountain grades where waterpower is cheap, and for heavy hauling from mines and especially in the mines.

When standing idle an electric locomotive consumes absolutely no energy and needs little attention. It is easily operated, not requiring a high-class engineer, and needs no fireman. The construction is simple, permitting repairs to be made easily, and the cost of maintenance is a minimum. It is more compact and will stand far more abuse than a steam locomotive. The electric locomotive has a higher power of acceleration and is less liable to be delayed on slippery tracks. With a motor driving each axle, the weight is all utilized for traction, there being no dead weight in engine truck and tender. Its steady torque and lighter necessary weight enable it to climb steeper grades, and having an external source of power gives it a greater capacity for pulling heavy loads than is possible with the steam locomotive. The electric locomotive has a wonderful overload capacity and its capacity for continuous service is marvelous; i. e., the number of hours per day, which means miles per year, that it is capable of running is far above that of any other locomotive.

The electric locomotive is capable of exceedingly high speeds. Remember the natural speed of the motors is usually reduced by gears, and when these reducing gears are omitted the attainable speed is far above the safe limit for wheels that run on rails. For example, there are the Zossen high-speed tests which were conducted by the German government two years ago, where a large electric car ran at a speed of 120 miles an hour and attained a maximum speed of more than 130 miles an hour with entire safety to the passengers. Recently the big New York Central electric locomotive hauled a long train at a speed of 72 miles an hour.

There is no question that the electric locomotive can perform the work of the steam locomotive.

Heavy electric traction is just beginning, and it is difficult to tell what its limitations may be. Many of the steam roads are fighting the electric lines with low rates, but the clean and frequent service of the electric lines more than holds its own. In almost every case, in spite of its lower speed, the trolley which parallels the steam road gets the "lion's share" of the traffic. This is due to the frequency of trains, their ability to run on schedule time, and the fact that they stop at convenient points.

In Great Britain the mileage of steam roads and the capital invested therein have greatly increased during the last 30 years, but the per cent. of net receipts to total paid-up capital has steadily decreased ("from 4.4 per cent. in 1870 to 3.4 per cent. in 1903"), and the per cent. of working expenses to gross receipts has steadily increased ("from 48 per cent. in 1870 to 62 per cent. in 1903"). The great English passenger roads have suffered by the competition of the electric tramways. So serious has their loss been that several of these roads have "electrified" their local lines and others are planning to do so. Recent extensive purchases of trolley systems by trunk roads indicate the same condition in this country. A portion of the West Shore railroad has been electrified in order to connect several interurban roads now owned by the New York Central. This great trunk line is not only buying up adjacent electric roads, but it is aiding them in every way to develop short-haul traffic to the fullest extent. Their far-sighted policy displays the belief that the trolley is in reality not a rival but a supplement to the steam road. "All methods of transit work together."

A conservative estimate of the cost of each kilowatt of energy developed at the present time makes it equal to the use of 12 tons of coal per annum; therefore as the consumption and the price of coal increase the waterpower becomes more valuable. All of which will be further incentive to electric traction. A pound of coal burned under the boilers of a modern power house will haul a given load three or four times as far as it will burned in the firebox of a locomotive; moreover, the first cost and the expense of handling is less when burned in the power house. There are even at present a few cases where the coal train is a more expensive means of transporting energy than high-tension electric wires.

The more efficient engines that have lately been installed, such as the steam-turbine and large gas engines, are all making conditions favorable for heavy electric traction.

Let us briefly consider the existing systems available for electric traction. These are applicable to motor cars or to electric locomotives.

First, the common 500-volt, direct-current motor system which is used for city street railways and is sufficient for a radius of about five miles from the power house.

Second, a modification, using a little higher trolley voltage. The current is fed into the trolley from rotary-converter sub-stations placed at intervals of 10 or 12 miles along the right-of-way. The electrical energy is transmitted to these sub-stations as alternating current at a high voltage (15,000 to 30,000) from a large central station. This is the arrangement used on nearly all of the interurban roads in this country.

Third, a system similar to the one just described, except that alternating-current motors are used on the cars and hence no rotary converters are necessary at the sub-stations. Moreover, the sub-stations need not be so frequent along the line, as the trolley voltage is higher (3,000 to 6,000 volts), with a corresponding economy of copper. On the car the current is again transformed and fed into the motors at about 250 volts. This is the single-phase system of which we have lately heard so much. It is no longer an experiment but an accomplished fact, and before the summer has passed single-phase cars to the number of several hundred will be in regular service on American roads. An example is the Indianapolis and Cincinnati single-phase railway. In some system similar to this probably lies the future of heavy electric traction.

Fourth is an arrangement much in favor abroad, but I believe there are no commercial examples of it in this country. It is one using three-phase current. It is somewhat like the single-phase system but requires two trolley wires in addition to the rail circuit. Besides, the constant-speed characteristics of the motors make it undesirable for use in this country.

Fifth is one of the most interesting applications on high-voltage to trolley-line distribution. It is that of the Oerlikon company on a railway 12 miles long in Switzerland. It was built for experimental purposes to demonstrate the feasibility of electric traction for all the steam roads of Switzerland. Each locomotive carries a single-phase synchronous motor taking power from the trolley at 15,000 volts and connected mechanically to a direct-current generator. This eliminates the rheostatic losses of the ordinary direct-current equipment as well as the rotary sub-stations along the line. Hence such a system would not require any greater total capacity in sub-station apparatus than the total train power, and is therefore an efficient system for trunk lines with few trains per mile, such as our long western railroads. There are several other methods, each having desirable features.

A very high state of development has been attained in reciprocating steam-engine locomotives. Efforts of the designer in striving for greater speed, efficiency and power are hindered by the standard narrow gauge, by the size of drivers and other parts that he may employ, and by the maximum weight that he may place on a given wheel base.

The next step with the independent locomotive may be the steam turbine, the gas engine, or possibly the gas turbine, but mechanical driving from these sources is impracticable. The connection between gas engine and axle, for example, must have the greatest flexibility. The electrical transmission system between engine and axle is the only one available at present. And combined with a storage battery it might be an exceedingly desirable one for certain classes of traction.

There are many obstacles in the way of complete electrification. For example, it is estimated that a successful interurban must have a contributary population of 1,000 inhabitants along every mile of its line and must not cost more than $25,000 per mile to construct. Estimates by conservative steam-railroad managers say that at the present stage of electric development a trunk line must have a daily traffic of 10,000 ton-miles per mile of double track before electrification would be financially advisable. Evidently, then, the present systems would prove financially disastrous in the large majority of localities, yet there are many places today where a change in motive power would pay for the entire change in equipment and increase the profits by reducing the cost of operation.

When the time comes for electrically equipping all railroads the ways for doing it will be found not lacking. An impulse is even now surging through the inventive minds of practical scientists which will set aside and overcome the existing difficulties of cheaply transmitting power to great distances.

It is my belief that there are three vital points that will appear in the final solution of the problem of heavy electric traction.

First.—Development of high-tension electric transmission at voltages much greater than are now possible.

Second.—Use of trolley voltages much higher than is now considered safe.

Third.—Utilizing small waterpowers scattered over wide areas, their power being gathered and distributed by high-tension lines.

The possible evolution as it is viewed by men who have been active in both steam and electric work seems to be as follows:

First.—Street railways.

Second.—These in turn reaching out through the suburbs till they become interurban roads.

Third.—Suburban roads pure and simple. Such examples as the proposed electrification of the Illinois Central suburban lines along Lake Michigan.

Fourth.—Suburban hauling of through trains in and out of city terminals. The New York Central is an example of this and the preceding.

Fifth.—Through trunk lines between large cities. The New York Central will probably take this step after the present experiment is thoroughly tried.

The traffic between Philadelphia and Washington is sufficiently great to warrant an immediate change of motive power. England has already several examples of this.

The complete electrification of these trunk lines will be in two stages. First, they will equip for the passenger service, then as the economies of electricity become more apparent, and for the sake of simplicity and uniformity these trunk roads will handle all freight by electricity.

Gradually, as better methods are evolved and equipment becomes standardized, the small and less important roads will naturally follow the practice of the trunk roads until finally the whole great network of railways will use electricity as the motive power.

Of course this will take time. Such changes require many years. The steam locomotive is a wonderful machine, and talk of its immediate abolition is nonsense. But electric traction with current delivered to the locomotive at a high voltage has possibilities that are revolutionary and not at all like the present interurban service with its expensive sub-stations and secondary system of distributing energy at a low voltage. But the time is coming certainly and swiftly. The only thing that can prevent this wonderful evolution is the discovery of some new and mightier source of energy, possibly like the titanic emenations of radium.

1. Abstract of a lecture recently delivered at Purdue University. The author is professor of alternating currents in that institution.

Drainage Canal Power Plant.

The Sanitary District of Chicago is advertising for proposals for furnishing electrical apparatus and materials, and for installation, for the Drainage Canal power plant at Lockport, Ill., and the transmission line extending to Chicago. Bids will be received until noon on October 11th. The work for which tenders is invited is as follows:

Division A—Main switchboard and instruments.
Division B—Transfer boards, oil circuit-breaker switches and knife switches.
Division C—Remote-control rheostats for generators.
Division D—Bus-bars and bus-bar and circuit compartments.
Division E—Conduits, service wiring, transformer and generator connections.
Division F—Transformers and lightning arresters.
Division G—Transmission-line towers or poles.
Division H—Erecting towers or poles.
Division I—Copper and aluminum conductors.
Division J—Erection of cable.
Division K—High-tension insulators.
Division L—Electric traveling crane.

Plans and specifications are on file at the office of the chief engineer, 1010 Security Building. Proposals may be tendered for any division, or for any number of them. The contract for the four 4,000-kilowatt three-phase generators to constitute the initial portion of the generating plant was let to the Crocker-Wheeler Company on March 7th. An illustrated description of the power plant at Lockport, as designed, was given in the Western Electrician of March 18th last.

Israel Hogeland of Indianapolis, Ind., is planning to exhibit his "automobile plow" at the Indiana State Fair this year. Mr. Hogeland has been working on the invention for a number of years. An illustrated description of an electric plow of his invention operated near Chicago was printed in the Western Electrician of July 4, 1896.

Recent Developments in Self-excited Compounded Alternators.[1]

By Alexander Heyland.

As is known, the main point of the system described is that single-phase or polyphase alternating current generated by the machine is directly led to the field windings for excitation and for compounding by means of a peculiar commutator. By the interposition and suitable interconnection of transformers, or by certain circuit arrangements in a single transformer, the exciting current of the machine is taken off in shunt to the main winding, and the compounding current in series, and so conducted to the commutator that the exciting current entering the field winding remains approximately constant for all loads, while the compounding current increases and decreases with the wattless component of the main current. By proper regulation we then obtain the condition that for any load the armature reaction is annulled and the drop in voltage of the machine is compensated for, or, if desired, an over-compounding of the machine with increasing load is obtained. The main feature of the machine is the commutator and the connection of the field windings to the same. This arrangement has for an object, first, to divide the main current before it enters the main winding, into two components, the watted and the wattless components, and to conduct only the wattless component to the field winding, so that the exciting current in this winding increases and decreases proportionately with the armature reaction of the machine. The second object is to prevent sparking at the commutator. For this purpose the field winding and the commutator are so subdivided and the field winding connected to the latter in such a manner that two groups of circuits are obtained. Of these the one is the field winding and receives the exciting current as well as the wattless component of the main current; the other consists of cross connections between the separate parts of the field winding, forming thus a circuit which is connected to the commutator, displaced by one-quarter of a period relative to the pole winding, and serves to receive the remaining energy component of the main current. In consequence of a peculiar connection of the transformers, these cross connections need not be dimensioned for the entire energy component of the main current, but only for a comparatively small part of the same.

In an earlier type of the machine the field winding consisted of parallel-wound wires (generally four), but as this design had some drawbacks of both a mechanical and electrical nature, another field winding was devised, which is just as simple as that of ordinary machines, and allows furthermore of an exceedingly simple mathematical calculation of the commutation, so that in no case do difficulties due to the formation of sparks occur.

By this new construction the separate parts of the field winding do not consist of parallel-wound wires, but each part consists of a group of field windings which are connected to the commutator in parallel to one another. The separate groups are constructed exactly as in the case of the field winding of ordinary machines, and consist of field coils of a single conductor. As the separate parts consist of separate coils of a single conductor, the current is not interrupted, as was the case in the

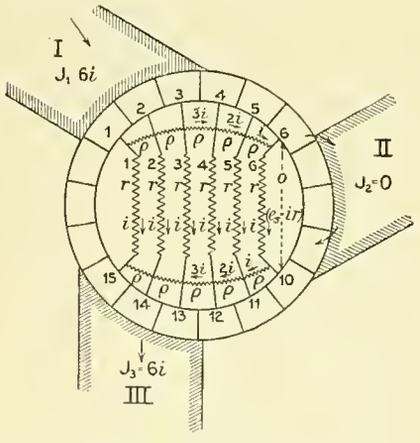


FIG. 1. RECENT DEVELOPMENTS IN ALTERNATORS.

earlier arrangement, and this is avoided in the most simple way by placing the cross connections at the ends of the conductors. But in this case the cross connections, in order to prevent a short-circuit between neighboring brushes in every brush position, must have a certain resistance which, as will be shown, must bear a very definite relation to the resistance of the field winding itself.

The arrangement is reduced in Fig. 1 to a bipolar diagram, and shown in Fig. 2 for a 12-pole machine. The field winding is here subdivided into six parts. We accordingly get in the 12-pole machine (Fig. 2), six-pole groups with two poles each, which are separately connected to the commutator. The commutator has nine segments per pole, six active and three blind segments. The segments per pair of poles are accordingly designated by the numerals (1) to (18), and the like segments of all poles are connected with one another. The cross connections between the wire ends, which are designated by (ρ, ρ, ρ), are joined to the commutator segments. (I.), (II.), (III.) are the brushes, to which the three-phase exciting and compounding current is directly supplied.

Of special interest is the theoretical process of commutation and the preliminary calculations of the resistance of the cross connections. These latter can be calculated in a very complete and exact manner, and it may be shown that, with a certain resistance of the cross connections, the commutation voltage and the short-circuit currents of commutation become nil. If then the resistance is chosen too large, a short-circuit current is produced in the one direction; if it is chosen too small, in the other direction. That is to say, with a certain resistance of these cross connections the commutation voltage becomes equal to zero. On the other hand, we should emphasize the fact that this ideal commutation is not practically obtained here, for the field pulsations and other conditions have as effect a certain commutation voltage. However, the result is theoretically very interesting, in so far as it shows that there is for the cross connections a certain most favorable resistance, with which the commutation becomes a theoretically complete one.

The calculation is made in the following manner:

Let us consider (Fig. 1) brush (II.) to be in the commutating position, that is, the position in which the brush bridges the blind segments, and thus connects the beginning and the end of the field winding at points (6) and (10). As above mentioned, the current of brush (II.) should, with an exact compounding, be in this position $I_2 = 0$. We disregard inaccuracies and any remaining part of the energy component of the main current in this brush. A short-circuit current would take, in general, the course of the arrows shown in dotted lines at brush (II.). The current in the separate parallel-connected parts of the winding is assumed to be $= i$,

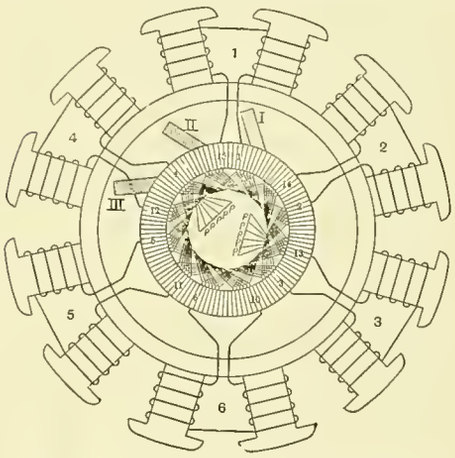


FIG. 2. RECENT DEVELOPMENTS IN ALTERNATORS.

the resistance of the separate parts of the winding $=$ r, the potential difference between the beginning and the end of the parts of the winding, lying at the time beneath the brushes—for example, (1) to (15)—is then $ir = E$, the same as the voltage between brushes (f.) and (III.) As the self-induction in the separate parts of the winding (pole groups) is very high, the separate current strengths i, i, i, can be taken as constant As a matter of fact, these currents are not exactly constant but slightly pulsating. Thus, for example, the current in the position shown will be a minimum in the parts of the winding (6) to (10), and a maximum in (1) to (15). Let us call the difference di. This is so much the smaller, relative to i, as the self-induction is greater, and we can, therefore, in order to dimension the cross connections (ρ), consider the separate current strengths as constant. It is assumed that the brushes should have the width of about three segments; the currents led to the three parts of the winding shown to the right in Fig. 1 must, therefore, flow over the cross connections, and we obtain in the cross connections the designated current divisions—that is, in the connections (5) to (6) and (10) to (11) $= i$, (4) to (5) and (11) to (12) $= 2i$, (3) to (4) and (12) to (13) $= 3i$.

That no short-circuit current may occur in the positions shown for brush (II.), the voltage between the segments (6) and (10), that is, between the ends of the part of the winding (6)—(10), must evidently be equal to zero. In this portion of the winding there appear two electromotive forces which have opposite directions; first, the ohmic drop in pressure ir, and second, an electromotive force of self-induction e_s, which is produced by taking off the current di in the part of the winding (6) — (10). The commutation voltage then becomes zero when e_s becomes $= ir$. It is clear that for this purpose the current di needs to be only very slight, so that we may assume, without making any practical error, that the current i is constant. In order that these conditions exist, that is $e_s = ir$, and that the voltage between the segments (6) and (10) becomes equal to zero, the drop in voltage in the shunt connections (3) to (6) and (10) to (13) must evidently be equal to the brush voltage. If ρ is the resistance of the separate cross connections, this drop in voltage becomes

$$2(3i\rho + 2i\rho + i\rho) = 12i\rho.$$

The brush voltage was $E = ir$. We thus have $12i\rho = ir$ or $\rho = r/12$.

For this value the commutation voltage would be theoretically exactly equal to zero. If we make ρ smaller, a short-circuit current will appear at brush (II.) in the direction of the dotted arrows; or if we

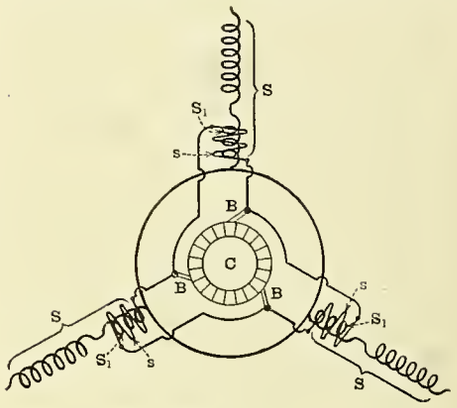


FIG. 3. RECENT DEVELOPMENTS IN ALTERNATORS.

make ρ larger, in the opposite direction. Let us call the resistance of the entire field winding, that is of the six parts in parallel, $R = r/6$; the resistance of the cross connections; that is, of the (2) by (5) cross connections in two groups in parallel is $P = 5\rho/2$. We then have $P = 5\rho/2 = 5r/24 = 5R/4$. That is, the resistance of the cross connections will be about the same as the resistance of the winding itself. While the current in the field winding is $I = 6i$, the mean current of the cross connection would be about $2i$, that is, only about one-third of the entire current of the field winding. The additional losses in the cross connections are, therefore, not more than 10 to 15 per cent. of the losses in the field winding.

The resistance of the connections ρ depends upon the number of parallel groups and on the breadth of the brushes. In practice the brushes are made four to five segments wide; so that they shall bridge across the blind segments which are not connected to the winding. In the case for the position of the commutator shown in the illustration, the connections tions between (3) to (4) and (12) to (13) are without current, and the resistance of the shunt connections must be approximately $\rho = r/6$. The shunt connections are, therefore, greater, but the losses smaller, since the mean current decreases; so that in general the losses in these shunt connections amount to less than 10 per cent. of the losses in the field winding.

The transformer connections for compounding by means of two or a single transformer remain the same as before, and have been described in former publications.

In parallel connection the compound machines work excellently, and if they are compared with ordinary machines of small armature reaction they will be found even better than the latter. For parallel connection the series windings of the transformers are connected together through three-compensating conductors, either at the terminals or at selected points of the winding. Consequently, the machines work directly upon and through one another as though the compounding was altogether removed; and since, in general, compounding machines are built with larger armature reaction than ordinary machines, they work well together in parallel connection. The compounding works only outwardly, and on account of the compensating conductors for all parallel machines together. The machines combine the advantages of machines of large armature reaction (as to operation in parallel) with those of machines of smaller armature reaction (as to constant-potential relation).

Similarly, these machines work very well if connected in parallel with ordinary machines and in existing stations. In this case one must naturally take care that the machine is at least sufficiently large that its load corresponds to the wattless currents of the plant, since otherwise it could be overloaded. When one connects a compounded machine in parallel with an existing plant it corrects entirely automatically all pressure variations. If, for example, it is desired to keep automatically the voltage constant at certain points in a network, this can be accomplished in the simplest manner by connecting at these points the compounded machines in parallel as no-load motors.

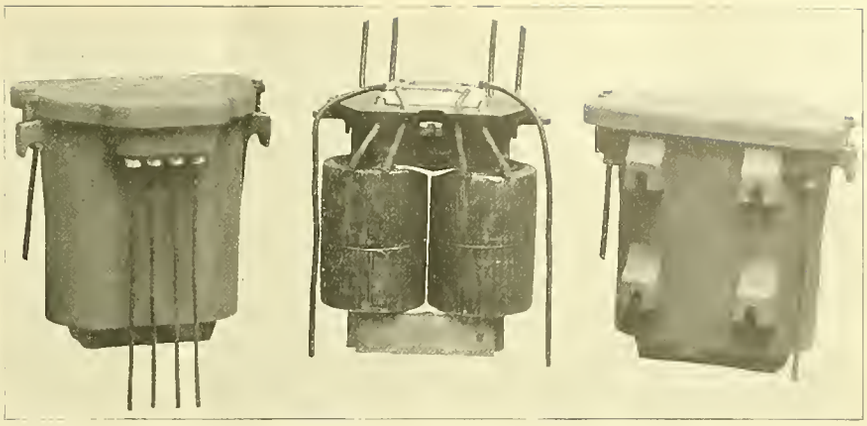
Finally, I will mention a more recent compounding connection which is of interest in so far as the connection can be applied directly to the machine without the interposition of transformers. In this

1. Abstract of a paper read before Section B of the International Electrical Congress of St. Louis.

arrangement the polyphase exciting current is generated in three auxiliary coils which are located on the stator. In order that such a machine may be at the same time compounded, a most simple arrangement has been devised whereby, in the same slots in which the auxiliary winding lies, there is placed also a part of the main winding, the respective coils being, however, connected in opposite directions to the remaining part of the main winding. The arrangement is diagrammatically shown in Fig. 3. (C) is the commutator, (BBB) are the brushes, and (sss) the three auxiliary coils wound on the stator and supplying the exciting current. (SSS) is the main winding of the stator and ($S_1S_1S_1$) the part of the main winding which lies with the auxiliary winding in the same slots. These coils are connected in opposite directions to those of the remaining part of the main winding. We can then consider the auxiliary winding together with the coils of the main winding lying in the same slots as a compounding transformer. The compounding is effected under the influence of the stray field of the machine, which is perfectly sufficient for the purpose. If the machine is loaded with a more or less inductive current, which has a tendency to produce a decrease of the field in the main winding, the same current will cause in part (S_1) of the main winding, which is wound in opposite direction to the remaining part, a corresponding increase of the field, and thus correspondingly increase the exciting voltage of the exciting current in the auxiliary winding (s). With a suitable choice of the number of turns of the compounding coils of the main winding we can in this manner obtain a complete compounding without employing a compounding transformer.

This mode of connecting is mainly advisable for smaller machines, in which it is of importance to reduce the cost of the machines to the extent of the cost of a transformer. It, moreover, has the advantage that it is very simple, consisting mainly in reversing the direction of connection of the coils of the main winding (which lies in the same slots with the auxiliary winding) with regard to the remaining main winding. There was exhibited at the St. Louis World's Fair such a machine of 60 kilowatts by the Société Alsacienne de Constructiones Mécaniques, Belfort.

Fig. 4 shows a view of a standard machine, from



NEW CORE-TYPE TRANSFORMER (SHOWN IN FRONT, WITHOUT CASE AND IN REAR).

by the trolley wheel. By using the car wheel in throwing the switch a positive mechanical action is insured, and there is no danger of failure to operate by reason of the trolley leavng the wire at a critical point. The car may operate through the block at full speed without danger of injuring the contact devices. The system may become of general use on electric railways.

New Core-type Transformers.

A new line of core-type transformers has been placed on the market by the Westinghouse Electric and Manufacturing Company. These transformers will be known as type C, and are simply an addition to the many standard forms, so that Westinghouse transformers of any desired form and construction may be obtained to meet the varying demands of present-day light and power service.

The type C transformers have operating characteristics closely approximating those of Westinghouse type O. D. transformers; their regulation is close, the efficiency high, operating temperatures

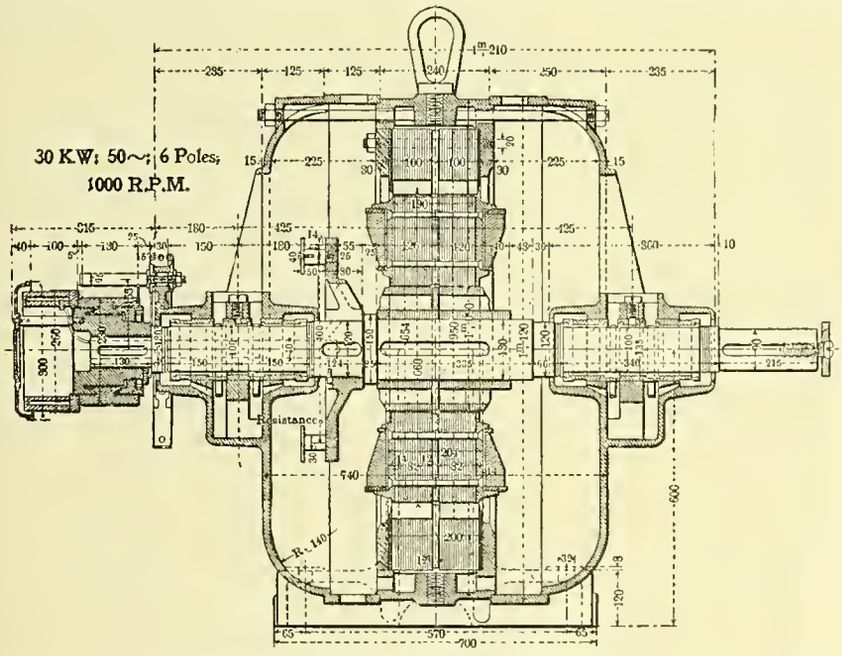


FIG. 4. RECENT DEVELOPMENTS IN ALTERNATORS.

which all relations can be clearly seen. As shown, the commutator is of very moderate dimensions in comparison with the total size of the machine and can be easily placed where otherwise the slip rings or the exciting machine would be located. The machine represents one of the first constructions in which the field winding consists of parallel-wound wires. The field winding can be clearly seen at the lower part of the field frame. All machines at present in course of construction are being built according to the diagram of Fig. 2, otherwise nothing has been changed in the exterior appearance of these machines.

New Block Signal for Electric Railways.

E. C. Folsom, formerly superintendent of transportation of the Fort Wayne and Wabash Valley Traction Company, has, in conjunction with Robert Stuart of Fort Wayne, Ind., patented what is known as the Stuart automatic block signal. The appliance was tested a few days ago on the lines of the Fort Wayne and Wabash Valley Traction Company and found satisfactory. One of the chief advantages of the signal is that the electrical contacts are actuated by the wheel of the car, and not

low, and a high grade of insulation insures long life under severe conditions. They are intended for general distribution service on 60-cycle circuits, operating nominally at 1,050 and 2,100 volts, although they will operate successfully on voltages up to 1,200 and 2,400. They are manufactured in sizes from 0.6 to 50 kilowatts, all wound from the same primary voltages, but divided into classes according to the voltages of the secondary. Class 200 may be connected for either 105 or 210 volts, and class 400 for 210 or 420 volts.

The transformer is enclosed in a cast-iron case with felt gaskets under the lid, so as to make it absolutely weatherproof. For sizes above 20 kilowatts the case is corrugated to increase the radiating surface, but in the smaller sizes a smooth case has surface sufficient to radiate the heat generated. Hanger irons are provided by which any transformer up to and including 30 kilowatts may be mounted on a pole.

The core of a type C transformer is built up of carefully annealed steel punchings of cruciform shape, and is practically non-aging. The primary and secondary coils are placed on the long sides of the core, the laminations of which are clamped together at top and bottom by suitable end frames. The low-tension winding is composed of one coil per leg, each coil having two sections so connected that the inner section of one leg is in series with the outer section of the other leg. This arrangement results in a secondary winding of two exactly similar parts both as to resistance and reactance, and insures equal loading of each primary coil, irrespective of the method of loading the secondary. A balanced voltage is thus maintained on the two sides of a three-wire distributing system, irrespective of the load. The high-tension winding is divided into two coils per leg to reduce the voltage between layers of the winding to a low value.

The core-type construction allows the use of a circular coil, which has many advantages. All insulating parts between layers of the winding and between high and low-tension coils are cylindrical in form, eliminating sharp corners, which are harmful to insulating material. The windings are so disposed and oil ducts so provided that a free circulation of oil between coils and core is obtained, insuring ready dissipation of the heat and preventing deterioration of the insulation. Careful attention has been paid to the insulation, and liberal allowances made to insure a high factor of safety. All coils are wound to exact dimensions and all insulation is cut to gauge, so that corresponding parts of all transformers of the same capacity are interchangeable.

Chicago Street-railway Situation.

Nothing developed at the first meeting of the local transportation committee with the representatives of the Chicago City Railway Company and the Union Traction Company on Monday except that a majority of the committee seems to be opposed to the mayor's plan of building a municipal system of street railways. From what could be gathered of the first meeting at which negotiations for the transfer of the surface lines from the companies to the city is being considered, it can be said on good authority that the belief of the majority of the committee is that the best way to settle the traction question is by a return to the "tentative ordinance" plan worked out by the transportation committee under ex-Mayor Harrison. It is said, however, that Mayor Dunne is determined to carry out his plan calling for a new system of street railways covering 264 miles, the maps and plans of which were not quite ready for the first meeting of the transportation committee. The negotiations will be continued, and if no agreement is reached between the companies and the committee the mayor will offer his plan as the next move, and if opposed by the committee it is said he will lay his plan for a 264-mile competing municipal system before the entire City Council.

Value of Natural Gas Production.

The approximate value of the natural gas produced and sold in the United States, as reported to the United States Geological Survey, is shown in the following table:

State—	Value.
Arkansas and Wyoming	$ 6,515
California	114,195
Colorado	14,300
Illinois	4,745
Indiana	4,342,409
Indian Territory and Oklahoma	49,665
Kansas	1,517,643
*Kentucky	322,404
Missouri	6,285
New York	522,575
Ohio	5,315,564
Pennsylvania	18,139,014
South Dakota	12,215
Alabama and Texas	14,082
Utah	.....
West Virginia	8 14,249
Other states	.....
†Total	$38,496,750

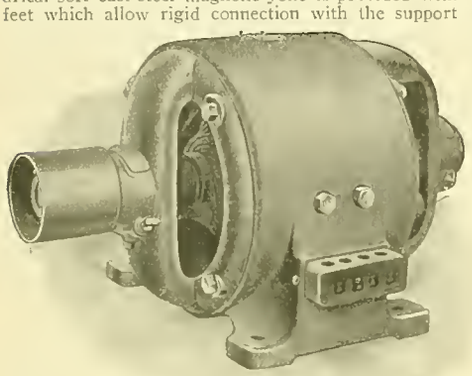
*Includes small quantity produced in Tennessee.
†Does not include value of gas produced in Canada and consumed in the United States.

A New Line of Small Power Motors.

The application of electric motors to general power purposes involves so many different conditions that motors for successful general use must now possess, to a large degree, all those qualities which hitherto have been considered necessary only in motors intended for specially severe service. This idea has been followed closely in the design of the new line of the General Electric Company's small CQ motors. These machines are built in sizes ranging from one-fourth horsepower to 20 horsepower, and are adapted to practically all conditions of service, as their design has been laid out with special reference to simplicity and durability in construction and reliability in operation. The appearance of the new motor is attractive, and its general appearance symmetrical, as can be seen by reference to the illustration. The customary form of bearing support for small motors is here utilized, but with some attention paid to appearance as well as strength and rigidity. The end shields are simple in form and of large section, giving rigidity to the frame. They may be rotated in either of four positions, differing 90 degrees from one another, to meet the requirements for various positions of installation.

The bearings encased in the end shields are lubricated by oil flooding rings revolving in the oil reservoir below the shaft. The linings are single castings of hard composition, of ample bearing surface.

The general form of the motor secures a low center of gravity of the complete motor and a short magnetic circuit, which, with high-grade workmanship, gives the CQ motor a notable efficiency for its capacity and enables the makers to produce a compact machine, free from vibration. The cylindrical soft cast-steel magnetic yoke is provided with feet which allow rigid connection with the support



NEW SMALL DIRECT-CURRENT MOTOR.

of the motor. The pole-pieces are separate from the yoke and fastened to it by through bolts, permitting ready removal when repairs are necessary. The extended tips of the pole-pieces hold the field coils rigidly in position.

One evidence of the care used in the design of these motors is to be found in the construction of the armature. The armature body is insulated in a manner similar to that employed in the standard railway motors of the same maker. The insulation is tough and impervious to moisture, and practically indestructible. Thorough tests of the insulation of the copper-wire coils are made before placing them in slots punched in the armature disk, in which they are retained by steel binding wires. The arrangement of the windings in the slots is such that a large surface of copper is provided in the position best calculated to dissipate the heat and insure cool running and high efficiency. In the larger sizes air ducts are provided for ventilating the cores and windings. The steel laminations are clamped rigidly between two cast-iron spiders or end plates, which have flanges to support the extended ends of the armature coils.

The construction of the brush-holders and brushes is extremely simple, utilizing that form of holder and pressure spring which has been found satisfactory for motors in general service. The motors operate with practically no sparking, under variations from no load to full load, and without shifting the brushes.

The manufacturer says that this standard motor will deliver its rated output with a rise of temperature in any part not over 45° C. above the surrounding air, and that it will operate with a 25 per cent. overload for one hour, and 40 per cent. temporary overload without injurious heating.

The speeds of the CQ motors have been chosen to permit direct belting to line shafts running at ordinary speeds without the use of intermediate countershafts. It will be recognized that the chief advantage of slow speed in electric motors is the reduction of losses due to belt wear on bearings and commutator, but it must be borne in mind that a decrease in speed must necessarily reduce the output of a motor for a given size and weight of material; and as the expense of a motor varies with the size and material used, it is apparent that motors with high speeds are usually cheaper to the customer; but by the use of steel magnet frames and the employment of light but rigid end shields to support the bearings, an economy of material is effected which permits, without sacrifice of strength or stability, the construction of CQ motors much lighter for a given output than other machines running at even higher speeds. The most economical speed for a given service must be determined by a careful study of the relative advantages to be derived from a slow speed, and the increase in cost required to obtain it. The speeds adopted for CQ motors have been found most advantageous and economical for nearly all purposes.

When a lower driving speed is desired than can be obtained with a standard CQ motor, a belt-tightening apparatus is furnished which allows a driving pulley smaller than the standard one to be used and at the same time secures sufficient contact to enable the full power of the motor to be transmitted. This is particularly serviceable when a very short driving belt must be used. The loose pulley may be adjusted to any lead of the belt, and in many cases avoids the adoption of a gear drive when it is undesirable.

Telegraphic Arrangements for the Peace Conference.

In anticipation of the increased telegraph and cable business incident to the peace negotiations between the Japanese and Russian peace envoys at Portsmouth, N. H., the Western Union and Postal telegraph companies made extensive additions to their facilities in that city.

The Western Union Telegraph Company added 20 operators and electricians to its regular force at Portsmouth, usually numbering only two employes, and, besides, strung 20 new wires to its large temporary office at Hotel Wentworth, which connect with all the principal cities and cable stations. It also established a direct connection between the Portsmouth stations and those situated at Canso, N. S., and New York, the two cable-connecting centers, applying a duplex instrument to the Portsmouth-Canso wire and a quadruplex instrument to the Portsmouth-New York wire. Direct connections were established between the Portsmouth stations and all the principal newspaper offices in the country, and a large hall at Hotel Wentworth was thrown open for the accommodation of press correspondents.

The Postal Telegraph-cable Company made similar arrangements. It strung a 10-conductor cable from Boston to Portsmouth, sent 18 expert operators and several electricians to the latter city and installed at the Portsmouth city office a special generator plant and eight quadruple sets. Special operators were placed at the Hotel Wentworth headquarters of each of the two peace missions as well as at the peace building in the navy yard. Connections like those of the Western Union were established between the Portsmouth offices, the cable-connecting centers and the large newspapers. Instead of the former solitary wire running from Portsmouth there are now fully 29 wires, to every one of which is attached a multiple instrument.

With the 14 Atlantic cables and the two Pacific cables, fitted, as all are, with duplex instruments, the cable companies did not find it necessary to add to their facilities. Cable dispatches reach St. Petersburg much earlier than they reach Tokio, the time from Portsmouth to St. Petersburg being eight hours and that from Portsmouth to Tokio 14. Since Russia has not permitted the Commercial Pacific Telegraph Company to lay the projected cable from Guam to Nagasaki, protesting that this would be a breach of neutrality, a cable dispatch from San Francisco to Tokio must continue by way of Honolulu, Midway, Guam, Manila, Hongkong and Nagasaki. This is not nearly as direct a way as that to St. Petersburg, the latter getting its messages direct from Emden, Germany, which receives dispatches direct from New York or from Canso, N. S., by way of Waterville, Ireland.

New Tariff of Japan.

The Japanese tariff of the present year provides that the dutiable value of imported articles shall be the actual cost of the articles at the place of purchase, production or fabrication, with the addition of packing charges, cost of transportation, insurance and all other charges incurred up to the arrival of the articles at the port of importation. In the event that an article is dutiable under more than one rate of duty, it is to be assessed according to the highest of such rates. Special war duties are imposed in certain instances, and these became operative on July 1st of the present year and are to remain in force until one year after the close of the war.

Japan also levies varying rates of duty, having a general and conventional duty, consumption and special consumption taxes, and now the additional war tax. The United States is classified with those having the "most-favored-nation" treaty, thus entitling its goods to entry at the conventional or lower rate of duty. It is also arranged that the war tax is not to be levied upon goods imported from those countries sharing the privilege of the most-favored-nation clause, provided they are accompanied by an authorized certificate of origin.

District Heating in Germany and the United States.

A long-distance heating plant, where the source of heat and the place of consumption are 2½ kilometers (1½ miles) distant, has been completed in the Eglfing Sanatorium in Upper Bavaria, according to a Berlin correspondent of the London Times. The steam conduits are arranged in a concrete channel, the walls of which are lined with an asphalt coating, which, in connection with a cork-slab vault, avoids any transmission of heat to the surroundings. The pit is sufficiently wide to allow working room for a man. A novel insulating substance has been employed to surround the conduits to protect them from loss of heat, and has so far proved satisfactory. The steam entering the conduit at 159° C. was found to have a temperature of 152 degrees after traversing the 2½-kilometer distance. The buildings themselves are heated by hot water, the steam serving only to heat the water boilers by means of coils. The plant is provided largely with electrical long-distance signaling apparatus, so as to allow of its being controlled and adjusted from the boiler house. Thirty pavilions and six administration buildings have been connected to this extensive plant, the installation of which, excluding the channel, cost about 250,000 marks ($62,500).

In the English journal the above paragraph is headed "A Long-distance Heating Plant." Mr. H. C. Eddy of Chicago, who has had wide experience in district steam heating, was asked how the distance covered compared with corresponding practice in the United States, and he answered that in several instances it has been exceeded, notably in Scranton, Pa., where the distance from the plant to the farthest customer is about 2¼ miles. In relation to the idea of heating water by the steam from a distant plant, that also has been carried into effect in this country for several years back; in fact, within the last two years it has come into general use. The drop in temperature is rather higher than would be expected in American construction, and the same may be said of the cost of installation.

Scott on the Single-phase Railway System.

In a recent article in The Electric Journal Charles F. Scott notes that a recent paper before the American Institute of Electrical Engineers contained tables giving characteristics of steam locomotives upon the principal railways of North America. Only one of these 83 locomotives, however, is equal either in weight or drivers or in draw-bar pull to the single-phase locomotive exhibited by the Westinghouse company before the International Railway Congress in its recent visit to Pittsburg.

Mr. Scott thinks that electrical engineers are, in the main, in substantial agreement on these points:

First—That the use of single-phase alternating current is essential for heavy and long-distance railway service.

Second—That a single-phase motor and single-phase system fulfilling the ideal requirements have been developed; and,

Third—That engineers all over the world are substantially agreed that one form of motor, namely, the series compensated single-phase motor, is the motor best adapted to meet the demands in heavy-railway traction.

Monroe, Mich., Lighting Plant Sold.

The City Council of Monroe, Mich., has passed a resolution to sell the municipal lighting plant to the General Construction Company of Detroit for $25,000, that company to give the city a 10-year contract at $56 per lamp a year. This has been ratified at a special election by the people. John J. Jackson and S. D. Fry of Detroit, and George T. Wolf of Three Rivers are among the principal stockholders of the purchasing company. The lighting plant was purchased by the city in 1899 and has not been a success. The present plant represents an outlay of about $50,000.

Proposed Pittsburg Subway.

Murray A. Verner and Mayor William B. Hayes of Pittsburg are reported to be at the head of a syndicate which hopes to construct an underground railway in Pittsburg at a cost of $10,000,000. Application has been made to the governor for a charter. The subway will start at Oliver Avenue and Smithfield Street, and will reach the surface at Neville Street, in Bellefield, where the system will become a surface line. Mr. Verner already has the franchise for the line through the downtown district.

Fire-alarm Signaling Systems and Their Effect Upon Fire Hazard.

The "Rules and Requirements" of the National Board of Fire Underwriters concerning the construction, installation and use of signal systems are very explicit and have much to do with the reduction of fire hazard. The following requirements, as specified by the underwriters, represent the most important of the rules:

Municipal Systems.—These must, under normal conditions, employ only closed all-metallic circuits for the transmission of fire signals; must not have more than 25 boxes on a single circuit, unless the circuit is part of an underground system; must have central office located in a building provided with fire protection satisfactory to the underwriters having jurisdiction, and central office must be equipped with necessary instruments for testing the lines and showing the condition of the current supply, and have plans of outside lines filed for the benefit of employes.

Municipal boxes must be installed in sufficient numbers to meet the approval of the underwriters having jurisdiction, and their installation inside buildings should be discouraged.

Automatic Systems Operating with Central Stations.—These must, under normal conditions, employ complete metallic circuits for the transmission of fire signals and depend upon an earth-return circuit, if at all, only for transmitting trouble signals.

They must automatically register distinctive trouble signals when any part of the wiring of the system is grounded, broken or otherwise impaired, so as to prevent the transmission of a fire signal.

Construction must be such that a single break or ground occurring at any point of the system will not prevent the transmission of a fire signal from any thermostat in the system.

They must be arranged to receive, record and transmit to the fire-department and insurance-patrol headquarters the box number of the building in which a thermostat has operated, and unless the floor number is transmitted with alarm to the fire department, must automatically register the floor number locally on an annunciator placed on the outside of the building equipped.

Not more than 15 buildings may be connected to a single circuit unless it is underground, and all the mechanism must be placed where it cannot be injured or displaced by outside influences.

Central stations must at all times have two competent persons in charge, and tests must be made at uniform intervals of not less than twice a day.

Automatic Systems Operating Without Central Stations.—These, when on open circuit, must be so arranged that one break of wires inside of a building will not prevent a fire alarm, or outside of a building will not disable more than one outside connection. When the system is on closed circuit a break must give immediate continuous alarm. Not more than 12 risks shall be connected to a single loop of any closed-circuit outside system.

When vibrating bells are used, all bells must be of the regular vibrating pattern (not single stroke), and the system must be so arranged that the failure of any one bell to vibrate can in no way interfere with the proper giving of alarm at other points. Where additional bells, not called for by the rules, are installed, they may be of the single-stroke pattern.

When several risks run to a common outside connection, with the outside connection there must be a separate vibrating bell for each risk, and when such risks run to an outside connection on closed circuit, the gong striking the numbers shall be of the tell-tale type to show how far the gong is run down.

When all wires of a system are not under constant battery test, there shall be a testing apparatus inside the risk, as near as possible to the annunciator.

Where the outside closed-circuit system with transmitter and electromechanical gongs is used, there must be a test of transmitter, outside circuit and gongs at least once a week.

The annunciator must have an index for each floor, and where floors are subdivided by fire walls, for each section of floor, located on outside of all risks equipped, in an accessible place where it will be readily seen by firemen responding to an alarm.

Installation of Thermostats.—These must be placed throughout the premises, including inside of all closets, in basements, lofts, elevator wells and under stairs. Special instructions must be obtained relative to placing them under large shelves, decks, benches, tables, overhead storage racks and platforms, and inside small enclosures, such as drying and heating boxes, caul boxes, tenter and dry-room enclosures, chutes and cupboards. No portion of the premises shall be excepted without written consent.

They must never be farther from the walls and partitions than one-half the distance between thermostats in the same direction, and under smooth ceilings must not be at a greater distance than 12 feet in either direction.

Under open joisted ceilings they shall not be at a greater distance than 10 feet in either direction; but when bays are formed by timbers, eight to 12 feet from center to center, supporting the joists, a line shall be placed as near as possible in the center of the bay, the distance between thermostats at right angles to joists not being greater than 10 feet. Thermostats shall be placed on a level with the bottom of joists.

Manual Alarms.—Manual-alarm boxes connected with the thermostat system must be located near all main exits and at each floor exit.

Watchman's Time-recording Apparatus an Central-station System.—Companies operating central-station systems must furnish daily reports to their customers and such reports as may be required to the underwriters having jurisdiction, showing record of all watchmen employed. They must also keep in their employ extra watchmen (runners) who shall visit promptly all buildings from which records are not received according to schedule.

The central station must be located in a building provided with fire protection satisfactory to the underwriters having jurisdiction, and be equipped with necessary instruments of an approved pattern for automatically receiving and recording all signals, and must have an approved connection with the fire department. The time of the receipt of all signals must also be recorded, preferably by an automatic device.

They must be arranged so that interference of signals will be impossible under any conditions likely to be met in practice, and these must not have more than 40 boxes connected on a single circuit, nor shall more than five watchmen report on a single circuit.

The apparatus must be so arranged that fire signals which shall be distinct from watch signals can be sent from each station installed.

Watch boxes must be of an approved pattern and must be located as required by the underwriters having jurisdiction, and must not be used for any other purpose.

Recent Foreign Orders for American Electrical Machinery.

Considerable activity in electrical lines abroad is indicated by recent orders received by the General Electric Company, through its foreign department, for electrical apparatus for use in foreign countries.

Mitsui & Co., Tokio, Japan, have purchased one three-phase revolving-field 200-kilowatt 60-cycle 2,300-volt generator, and one 110-volt seven-kilowatt direct-current marine generating set with switchboard.

The Kosaka Copper Mines, Japan, has ordered one motor-generator, consisting of a 100-horsepower 3,120-volt induction motor direct-connected to a 75-kilowatt 550-volt direct-current generator.

In addition to the above for Japan, a recent order includes 28 miles of single-conductor lead-covered wires of various sizes, and 22 miles of stranded lead-covered cables of various sizes.

Australian orders include six GE-58 double-motor railway equipments for the Perth electric tramways, and one 10-kilowatt, one 16-kilowatt and one 24-kilowatt storage-battery booster sets for the New Zealand Electric Construction Company.

The Siam Electricity Company, Bangkok, Siam, has purchased a 500-kilowatt 550-volt direct-current two-stage Curtis steam-turbine alternator, several direct-current pump motors and a switchboard.

South African orders include two 500-kilowatt three-phase 2,300-volt Curtis steam-turbine alternator sets and one 450-horsepower 2,080-volt two-speed induction motor for Robinson Deep Mine, one 1,000-kilowatt 3,300-volt three-phase Curtis turbo-alternator set and 16 200-volt induction motors aggregating 115 horsepower for the Consolidated Gold Fields of South Africa, Ltd.

Recent Brazilian orders include five two-motor GE-58 equipments with B-13 controllers and electric brake for Jardim Botanico, Rio de Janeiro; 11 440-volt induction motors aggregating 220 horsepower and 40 type H transformers, aggregating 400 kilowatts, with switchboard equipment, for Mococa, Brazil.

The Rio de Janeiro Tramway, Light and Power Company, Brazil, has purchased a 200-kilowatt 50-cycle testing transformer, with 150,000 volts as maximum, stepping up from 216 volts primary, and there have been ordered for Manaos, Brazil, two 150-horsepower 550-volt direct-current motors and one 400-kilowatt 575-volt direct-current generator for direct connection to a Harrisburg engine.

The Pueblo Compania de Luz y Potencia of Mexico has purchased two 220-volt induction motors, 50 and 35 horsepower, and four transformers of various capacities, for use on 2,300-volt transmission lines stepping down to 220 volts for distribution.

The city of Tepic, Mexico, will use two revolving-field three-phase 350-kilowatt 6,600-volt generators and two 22-kilowatt 25-volt exciters, together with generator and sub-station switchboard and small transformers aggregating 650 kilowatts.

The Mexican Light and Power Company has ordered one feeder panel and one mercury arc rectifier panel for its El Oro sub-station.

The Guanuato (Mexico) Power and Electric Company has purchased a horizontal revolving-field three-phase 3,000-kilowatt 2,300-volt alternator for direct connection to waterwheel, and four water-cooled 60-cycle 1,080-kilowatt transformers, stepping up to 60,000 volts for line transmission, and four 60-cycle water-cooled 970-kilowatt transformers, stepping down to 15,700 volts, from the line potential supplied by the first four transformers.

In the same city the Guanuato Reduction and Mining Company has ordered eight induction motors of various sizes, aggregating 375 horsepower, for use on 440-volt circuits.

Starting Rotary Converters or Motor Generators.

[From Question Box of National Electric Light Association.]

QUESTION.

An Edison three-wire system is fed by rotary converters or motor generators through transmission lines from a high-tension polyphase generating station. What is the best and quickest method of starting up after a partial or total shutdown occurring at the time of the peak?

ANSWER.

W. G. Carlton, Chicago Edison Company: This depends on the nature and extent of the shutdown. If the shutdown is complete and there are no storage batteries on the system, it will be necessary to start from the alternating-current end. This can probably best be done by closing the high-tension switches at both the generating and sub-station end, and then starting up tthe generator, letting the sub-station apparatus come up to speed with the generator. If the shutdown is only partial, or if there are batteries that keep the system alive, it will probably save time to start machines from the direct-current end. As a rule, a rotary or motor-generator supplying direct current can be run from the direct-current end and brought up to synchronous speed when the bus voltage is as low as 25 to 30 per cent. of the normal amount.

The limiting feature in connection with starting up from a low direct-current voltage is generally the voltage required to operate auxiliary apparatus, such as synchronizers and remote-controlled oil switches. Tests should be made to determine the lowest voltage at which the auxiliary apparatus used in connection with rotaries or motor-generators will operate. It is also desirable to have at least one rotary or motor-generator arranged for starting from the alternating-current end at full line pressure, since conditions are likely, to arise when one sub-station will be shut down and the system supplied by it practically dead, while, on account of other load on the generating station, it is not possible to start a generator at a low pressure for the purpose of getting in service the one sub-station that is disabled.

Public and Private Lighting in Indiana.

The following lists give the names of those cities in Indiana which are electrically lighted by municipally owned plants and by contract with private concerns. The names are taken from a list compiled by the Indiana Board of Statistics, and show a majority of 16 in favor of the cities which purchase their light.

Municipal—Attica, Auburn, Bluffton, Butler, Cannelton, Columbia City, Columbus, Covington, Crawfordsville, Decatur, Frankfort, Garrett, Gas City, Goshen, Greenfield, Huntington, Kendallville, Lawrenceburg, Marion, Martinsville, Mishawaka, Montpelier, Muncie, North Vernon, Plymouth, Portland, Rensselaer, Richmond, Rushville, Tipton, Union City, Veedersburg, Vevay, Whiting—34.

Private—Alexandria, Anderson, Aurora, Bedford, Bloomington, Brazil, Clinton, Connersville, Delphi, Dunkirk, East Chicago, Elkhart, Elwood, Evansville, Fort Wayne, Franklin, Greencastle, Greensburg, Hammond, Hartford City, Huntingburg, Indianapolis, Jeffersonville, Kokomo, Lafayette, Laporte, Lebanon, Ligonier, Linton, Logansport, Loogootee, Madison, Michigan City, Mt. Vernon, New Albany, Noblesville, Peru, Princeton, Rising Sun, Seymour, Shelbyville, South Bend, Tell City, Terra Haute, Valparaiso, Vincennes, Wabash, Warsaw, Washington, Winchester—50.

TELEPHONE MEN.

M. Fretz has been appointed manager of the Harlan and Avoca Telephone and Telegraph Company at Harlan, Iowa.

D. C. Bell has resigned as manager of the Union Telephone Company at Bonaparte, Iowa, and A. V. Buck will succeed him.

Earl Woodard, who has been connected with the Home Telephone Company at Crawfordsville, Ind., has resigned his position to go into the railroad business. He is succeeded by Burt Johnson.

John A. Duncan, assistant general manager of the Fort Wayne (Ind.) Independent Telephone Company, has resigned to accept the superintendency of the telephone system of Sioux City, Iowa.

T. H. Lyon, formerly district manager of the Michigan State Telephone Company at Jackson, Mich., has been promoted to the position of business manager at Houghton. Mr. Lyon was formerly in the Detroit exchange. Walter L. Stevens of Jackson succeeds Mr. Lyon as district manager at Jackson.

Telephone News from the Northwest.

The People's Telephone Company of Chatfield, Minn., has discontinued connections with the Northwestern Telephone Exchange Company and has taken up with the Tri-state Telephone Company for long-distance service. The Northwestern will install exchanges at Chatfield and St. Charles, and is installing a local exchange at Spring Valley, Minn.

Business men of Plankinton, S. D., have formed a company and will install a local telephone exchange.

The Mesaba Telephone Company will make extensive improvements to its exchange at Virginia, Minn. There will be a new switchboard with a central-energy system.

The Mankato Citizens' Telephone Company has completed a local exchange at Eagle Lake, Minn.

Certain farmers near Grand Forks, N. D., sought to restrain the Tri-state Telephone Company from building its lines along the highway adjoining lands owned by them, and the court has refused the injunction, holding that the company has a legal right so to build under the act of Congress governing telegraph companies. The case will be appealed.

The Fox River Valley Telephone Company of Green Bay, Wis., has been incorporated with $350,000 as a merger of the Valley Telephone and Telegraph Company of the Fox River Valley Telephone Company.

At Winona, Minn., the Northwestern Telephone Exchange Company made the City Council a proposition to furnish the police and fire stations with free telephone service. The council after due consideration refused it on behalf of the local Independent company.

The Brooten Telephone Company of Brooten, Minn., has been formed with $4,500 capital stock by T. O. Shelso and others.

The capital stock of the LeMars (Iowa) Telephone Company has been increased from $50,000 to $100,000.

The Council Bluffs (Iowa) Independent Telephone Company has let the contract for constructing its conduit system to E. A. Wickham at $20,000. About $50,000 will be expended in Council Bluffs. R.

Indiana Telephone Items.

The city of Anderson has been made defendant in a suit for $10,000 damages because of the death of John Keicher, a telephone lineman, who was killed while working at the top of a pole bearing light and telephone wires. The point is made that a city which permits its wires to be placed in close proximity to other wires with defective insulation, thereby causing fatal shock, is liable in damages. The outcome of the suit is of interest to cities owning and operating electric-light wires carried on poles used by other companies.

What promises to be a big fight in telephone circles commenced at Macy, when the town marshal arrested George W. Cloud, George W. Williams, Harvey Dewalt and Walter Dewalt, for constructing what purports to be the Macy and Deedsville telephone line, within the town of Macy. The telephone company asked the board of trustees for a franchise, but up to this time no action has been taken on the petition. The men arrested began work without permission, and their arrest followed. It is rumored that the building of the line to Macy is for the purpose of competing with the Home company, which is already established and has a good patronage.

No record has been found of a franchise granted to the Western Telephone Company, assigned to the Central Union company, under which it is operating at Kokomo. The authorities, however, have accepted as genuine a duly authenticated copy of the franchise which was produced by the Central Union Telephone Company, although the franchise does not appear in the book of ordinances.

The Central Union Telephone Company, which recently came into possession of the United Telephone Company's property in Huntington and adjoining counties, announces that $20,000 will be spent in Huntington and Huntington County at once in overhauling the system. A large amount of cable will be strung and much of the work will be placed underground, through the large Flint Creek sewer or in conduits to be put in by the company. Four new rural lines will be put in, and exchanges in the southwestern part of the county will be connected with the Huntington system. S.

Telephone Development in Texas.

The Timpson Telephone Company has been organized for the purpose of building and operating a system of telephone lines and exchanges at Timpson and other towns of the section. J. B. Bussey is one of the incorporators.

The central-energy system is being installed at the Marlin telephone exchange. C. R. Powell is in charge of the work.

The new long-distance telephone line which is being built between Dallas and Fort Worth by the Combination Telephone Company will soon be completed. The company will, it is understood, establish exchanges at towns between the two terminal cities. It is an Independent enterprise.

The Citizens' Telephone Company has been organized at Montell for the purpose of constructing and operating a telephone system from Uvalde to Barksdale. A. S. Baylor, T. S. Sutherland, James Whitecotton, L. V. Wallace and Travis F. Jones are the incorporators. It is an Independent company.

The Southwestern Telegraph and Telephone Company is making improvements to its telephone systems in Cleburne, Laredo and other towns of the state. The long-distance system is being extended to Rockport, Ingleside, Portland, San Diego and other places. H.

Illinois Independent Telephone Association.

Illinois was added last week to the list of states which have organized under the plan adopted by the National-Interstate Telephone Association in Chicago in June. At the convention of the Central Illinois Independent Telephone Association in Peoria, Ill., on June 7th and 8th, briefly mentioned in the Western Electrician last week, the Illinois Independent Telephone Association was formed. Under the new plan the state was divided into 11 districts, each having a presiding officer, who is a vice-president of the state association. The districts will hold separate meetings and choose their delegates to the state meetings, who in turn select the delegates to the national meetings. The Central Illinois association, which was the moving spirit for a state organization, was dissolved.

The Peoria meeting was opened by George H. Glass of Pekin, president of the Central Illinois association. Eight hundred invitations were sent to Independent telephone men, and a large proportion of these were accepted. Mayor A. B. Tolson delivered a welcoming address and C. B. Cheadle of Joliet responded. A number of valuable papers were read. The paper on "City Exchange and Underground Construction," by D. R. Craig of Aurora, was discussed at length, and the conclusion was that underground cables, properly installed, are a settled feature of modern telephone construction. Peoria, with 21 miles of underground cable, was given as an example where such a system is a success. "The Value of Independent Telephone Securities as an Investment," a paper by O. F. Berry of Carthage, Ill., also received much attention. Other papers on the programme were: "Rural Exchange and Line Construction," by E. S. Sterrett of Henry, Ill.; "Things that Are Necessary to Make Independent Telephone Business a Success," by C. W. Buffom of Louisiana, Mo.; "Toll Rates," by E. W. Murray of Aurora.

A number of prominent telephone men from outside the state were present and took an active part in the organization of the state association. Among these were J. B. Hoge of Cleveland and A. L. Tetu of Louisville, president and secretary, respectively, of the National association; C. S. Norton of Indianapolis and J. B. Ware of Grand Rapids.

The officers chosen to conduct the affairs of the new association are as follows:

President, E. R. Conklin of Aurora; secretary, C. B. Cheadle of Joliet; treasurer, C. S. Hankins of Decatur; executive committee, E. R. Conklin, C. S. Hankins, C. O. White of Princeton, Manford Savage and James W. Barrett of Pekin.

The vice-presidents of the 11 districts in order are as follows: Manford Savage of Champaign, A. J. Vernier of Kankakee, Frank Zinnell of Mt. Carroll, F. M. Ashe of Kewanee, B. F. Wasson of Clinton, G. H. Glass of Pekin, W. J. McQuiston of Monmouth, B. F. Ramsey of Auburn, H. H. Knipe of Marshall, William H. Basser of East St. Louis, and C. E. Hull of Salem.

Mr. Conklin, the president, is one of the most prominent telephone men in the state. He is identified with the Interstate Independent Telephone and Telegraph Company.

The executive committee will select the date and place for the next meeting, which is to be held this fall. Peoria, it is thought, will be selected as the place.

NEW COMPANIES.

The following-named telephone companies were incorporated recently: Codell Telephone Company, Codell, Kan.; Cedar County Farmers' Telephone Company, Hartington, Neb.; Farmers' Independent Telephone Company, Jewell City, Kan.; High Point Mutual Telephone Company, Nardin, Okla.

The Commercial Telephone Company of Austin, Tex., is to be reorganized by J. A. Quisenberry of Danville, Ky.; J. H. Goeke of Wapakoneta, Ohio, and F. Bimel of Portland, Ind., who have paid $100,000 for the telephone properties. It is said they will increase capital stock to $500,000 and extend the lines and improve the exchanges.

The North Texas Telephone Company of Sherman, Texas, has been incorporated with a capital stock of $10,000 to establish a long-distance telephone system between Sherman and Gainsville, Texas, by way of Whitesboro, with Sherman as the central station. Officers are S. W. Porter, president; S. D. Donoho, vice-president, and C. A. Shock, secretary-treasurer.

GENERAL TELEPHONE NEWS.

D. C. Bell has resigned as manager of the Union Telephone Company at Bonaparte, Iowa, and A. V. Buck will succeed him.

The Rural Telephone Association of Barnard, Kan., recently incorporated, has completed a small exchange and several rural lines.

The City Council of Everett, Wash., has granted a franchise to the Farmers' Mutual Telephone Company, which will begin putting in lines at Everett at once.

The city of Hattiesburg, Miss., has granted a franchise to J. A. Jones, George D. Winter and S. A. Jones to build an underground telephone system at a cost of $125,000.

The Sunset Telephone Company is now laying underground conduits for its wires in Los Angeles, Cal. The company plans to lay conduits throughout the section known as the University district.

The Belvidere (Ill.) Telephone Company has commenced work on the rebuilding of its entire telephone system, which when complete will be one of the most modern systems in that section.

Permission to withdraw the telephone measure granting to C. A. Thatcher and Ernest Mitchell a franchise to operate a telephone system in Nashville, Tenn., was refused by the City Council of Nashville because of objection to two telephone systems.

The rural telephone lines in the country around Girard, Kan., have organized and expect to build a rural exchange in the town. It is stated that no expense will be spared to put in an up-to-date exchange. Nearly 100 subscribers have been secured. H. S. Wood of Walnut, Kan., is the promoter.

The Mutual Telephone Engineering and Supply Company of Wellington, Kan., have nearly completed its contract with the Barber County Telephone Company. When this is completed the Barber County company will have two exchanges and over 200 miles of rural lines.

The Chesapeake and Potomac Telephone Company is having plans and specifications prepared for the constructions of additions to the main building and exchange on Madison Avenue, near Robert Street, Baltimore, Md. Additional switchboards will be installed, increasing its capacity to 12,000 telephones.

MANUFACTURERS AND DEALERS.

The Reelsboro Gin and Mill Company of Reelsboro, N. C., is preparing to erect additional buildings, which will be equipped for the manufacture of telephone pins, cross-arms and brackets.

The International Telephone Manufacturing Company, Chicago, is said to be having such a heavy demand for its high-class telephone equipment that it has found it necessary to equip its factory with a gas-engine power equipment and run an all-night shift of men to fill the orders promptly.

The Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y., has closed contracts for switchboards for Kansas City, Mo.; Decatur, Ala.; Boise, Idaho; Creighton, Neb.; Unadilla, N. Y.; Maquoketa, Ohio; Granite Falls, Minn.; Charity, Mo.; Greenville, Ohio, and Crystal, N. D.

The Sandwich Pole Changer Company, Sandwich, Ill., which recently purchased the business of the Illinois Electric Specialty Company, is more than pleased with the demand for its product. Under the energetic management of E. C. Hennis, the merits of the Sandwich pole-changer are being made known to the possible users in the telephone field, and as a result orders are being received daily. Several important improvements have been made in the Sandwich pole-changer which will appeal to the practical telephone man. The company is now preparing new printed matter which will be mailed on request.

The Kellogg Switchboard and Supply Company of Chicago has devised for its Iowa salesman, Mr. W. R. Hind, an advertising souvenir postcard, the illustration of which, greatly reduced, is shown by the accompanying cut. The picture shows very clearly that Mr. Hind is a traveling salesman for a telephone manufacturer, and with the Kellogg emblem the recipient can easily guess the name of the manufacturer, even if he did not know it before getting the card. These cards are attractive and ingenious and are provided with holes for filing. Mr. Hind says that they have been the means of obtaining a number of orders as well as compliments on the design. A message at the bottom reads: "I am waiting for your order. Yours truly, W. R. Hind." In the original the card is printed in two colors—black and buff, the latter for the suit-case.

CORRESPONDENCE.

Great Britain.

London, August 1.—The proceedings before the House of Commons committee in connection with the big power scheme have been considerably accelerated since my last notes and a decision is looked for this week. Put briefly, the promoters have settled the opposition of all the companies by certain agreements and amendments to the bill, and all that remains is the opposition of the local authorities, although as a matter of fact several of these have made a compromise with the company. It therefore seems most probable that the scheme will be sanctioned and that the main question which the committee will have to decide will be the one of the broad public policy of allowing a scheme to pass in which there is the element of a monopoly being created. From some points of view the expression of opinion by the London County Council that the water and telephone monopolies started in the same manner as this suggested electric power scheme must carry some weight, but on the other hand the present promoters have inserted such safeguards in the bill for the future that the committee has only to see that they are sufficient adequately to safeguard the public. Although in a few instances in London municipal electricity undertakings have been successful, it must be confessed that in the majority of cases the opposite applies; and seeing that in the future the local authorities have the right to purchase all the existing companies, the outlook from the consumer's point of view is not reassuring. Consequently some such scheme as the proposed one, under sufficient and proper parliamentary control, would not appear to be the evil that it has been made out.

As a sort of revenge upon the government for not resigning a few days ago in consequence of a defeat by a small margin the Nationalist party in the House of Commons adopted the tactics of objecting to any private bill being allowed to proceed, which they are enabled to do under the rules of the House. As several private bills involving considerable electrical and other works were thus held up, a serious condition of affairs was anticipated, especially in view of the present condition of the unemployed in this country. This policy was pursued for several days by the Nationalist party, and in view of the near approach of the end of the session a great outcry was made, with the result that the bills were not objected to any longer.

The committee which considered the agreement between the postmaster general and the National Telephone Company whereby the state acquired the whole of the undertaking of the National Telephone Company throughout the United Kingdom, has issued its report. It has not yet been published, but it is given out as a fact that the report is against the agreement in detail while being in favor of the principle of the state acquisition of telephones. A curious state of affairs has now arisen. The agreement contains a clause to the effect that should the agreement not be rejected by the House of Commons before August 31st it shall become law automatically. Now that the House of Commons is within a week of the recess, it is unlikely that the report of the committee will be discussed until after midnight—a course which many of the members will object to. If their objection is upheld the question arises, Will an agreement come into force which has been reported against by a committee of the House of Commons? At present this would appear to be likely.

The general electrical exhibition which will be held in London in a few months' time is making great progress and the wiring rules for the buildings have now been issued.

The rejection of the London County Council embankment and bridge tramway scheme has been the subject of much criticism and wild talk in the Radical press. The more sober-minded people, however, regard the action of the House of Lords as a distinctly prejudiced one and no more. The County Council has already passed a resolution to reintroduce the scheme next year, and in view of the report of the royal commission on London traffic it has ample justification for doing this. A proposal has also been made to bring in a bill next year for the construction of a large number of other tramways, many of them on routes recommended by the traffic commission.

The city of London corporation has recently given notice to the City of London Electric Lighting Company to remove its electric-light standards in several of the main thoroughfares, as it has been decided to substitute incandescent gas. Very peculiar conditions prevail in the city with regard to the electric supply and the contracts date back for many years so far as the street lighting is concerned. A legal action extending over several years has already been fought as to their validity, and it is quite possible that the company will question the right of the corporation to order the removal of the lamps and to discontinue the supply without some compensation. G.

New York.

New York city, August 12.—Charles P. McClelland of the board of United States appraisers returned from England on Tuesday and gave out the following interesting remarks about New York and London subways: "New Yorkers should stop kicking about conditions in the subway. The London underground roads do not begin to compare with our line here, and nowhere in my travels did I find a city so healthy and clean as New York. Glasgow was the nearest approach I found to an American city. The much-talked-of street-car system is comfortable, but not so fast as our American lines."

The Metropolitan Street Railway Company in conjunction with other traction companies is seeking to have the valuations under the special franchise tax law reduced for the years 1901, 1902, 1903 and 1904. Mr. Ernest Hall of New York has been appointed referee to take evidence in these cases.

Acting-mayor Fornes has signed the necessary papers to enable the city to acquire land for the improvement of the Brooklyn Bridge terminal. The terminal proper will ultimately extend to Duane Street and the switchyard for the elevated trains will go up as far as Pearl Street.

A pennyworth of paint is badly needed at certain points on Brooklyn Bridge, where it is possible for foot passengers to come into direct contact with the third rail for the elevated cars. This rail was originally marked in plain letters "Danger," but the vibration of the trains has caused the paint to disappear.

A few Brooklyn people have discovered that it is possible to ride over the Williamsburgh Bridge to certain points in New York and back for a single fare. This is due to the fact that transfers are granted on the Fourteenth Street line which are available either north or south on Broadway. On the other hand, transfers affecting the One-hundred-and-twenty-fifth cross-town line are very perplexing, the tickets given on some lines being available as retransfers and others not admitting this privilege.

A controller box was short-circuited on a crowded trolley car on the Brighton Beach line on Monday night and about six passengers were very badly hurt by the flames. One woman subsequently died, and curious allegations are made respecting claims for damages against the Brooklyn Rapid Transit Company. The woman died in a hospital, and it is averred that just before dying she signed a quit claim for $200. After some protest the company has agreed not to stand upon the quit claim.

Consequent upon the disappearance of, or rather "the continued absence" of William A. Belcher, mayor of Paterson, N. J., the City Council has decided to take no action at all affecting franchises until the installation of a new mayor next January. This resolution ties up several important applications for trolley lines.

The newly appointed state lighting commission met for the first time on Monday afternoon at Albany, when F. E. Gunnison of New York city was installed as chairman. The commission was appointed mainly as the outcome of recent investigations into the public-lighting question in New York city, and its business will be to deal with all future applications for charters and franchises for public lighting. Just before the new law went into effect some dozens of new companies were organized, but since then about six of these companies have expressed a wish to increase their capital stock, and these applications the commission will decide.

The Hutchison Acoustic Company of New York city has received an order to install 50 "acousticons" in the Westminster Chapel, London, England. The acousticon is a kind of telephone which enables partially deaf persons to hear a preacher.

The Kenny Electrical Manufacturing Company of 140 Nassau Street is wiring the Armory Building of the Second Battalion, Naval Militia.

H. Fiebig, electrician, of 120 East Fifty-ninth Street, is putting in electrical work at the new building of the Merchant and Bankers' School, Fifty-eighth Street and Madison Avenue.

Schedules in bankruptcy were filed on Wednesday in the affairs of the E. W. Hirsch Electric Company of 53 West Twenty-eighth Street. The liabilities are $6,028 and the nominal assets $3,017. Among the creditors are: Stanley & Patterson, incorporated, electrical supply dealers, 40 Cortlandt Street, $2,249; the Western Electric Company, $786, and Bernard Hirsh, $1,025. Among the tabulated assets are: Stock, $10; notes, $800; fixtures, $15, and outstanding accounts, $2,192.

The New York fire department is asking for bids, receivable until the morning of August 22d, for placing the conduits of the department underground in the borough of Brooklyn. D. W. W.

Southeastern States.

Charlotte, N. C., August 12.—The Georgetown (S. C.) Electric Company has completed arrangements for the installation of three large boilers to furnish its own power, which previously has been secured from the Atlantic Coast Lumber Company.

The Asheville (N. C.) Cotton Mills will soon be operated by electric power from the Weaver power plant on the French Broad River, five miles from Asheville, N. C.

A charter has just been granted to a company proposing to build an electric railway from Atlanta, Ga., to Macon, to be known as the Atlanta-Macon Interurban Railway Company, with a capital stock of $100,000. T. B. Felder of Atlanta and C. C. Canfield of Chicago are among the stockholders.

The stockholders of the new Hatton's Ford Power Company at Anderson, S. C., recently met and organized by the election of a board of directors, who then chose officers, with R. S. Ligon of Anderson as president. It is estimated that 6,000 horsepower is available at the shoals to be developed. The company is capitalized at $150,000 and will offer power for light and manufacturing purposes.

In a disastrous fire at Pocahontas, Va., on August 7th, much expensive electrical machinery was burned in the Pocahontas collieries, the total loss being estimated at $12,000. L.

Ohio.

Cleveland, August 12.—It is said the Fort Wayne, Van Wert and Lima electric railway will be opened for business with a limited service by September 1st. This road will parallel the Pennsylvania. It is also thought the Mayer line, between Toledo and Lima, will be completed by the first of the year 1906.

The Board of Public Service of Columbus has signed a contract permitting the Columbus Railway and Light Company and the Public Service Company to use the city poles for their lines at 15 cents a contract. The companies were refused the use of the poles some months ago.

The Smith Storage Battery Company of Zoar has been incorporated with a capital stock of $30,000 by John Bimeler, Peter Bimeler and others.

Notice has been issued to the effect that the capital stock of the Lima and Toledo Traction Company, the Schoepf company, has been increased from $50,000 to $3,000,000. Of this, $1,000,000 will be five per cent. preferred.

Seventeen bids were received for the $50,000 electric-light improvement bonds at Bellefontaine a few days ago. The highest was $53,672.

Tracks of the Cincinnati and Columbus Traction Company have been completed to Milford, giving a line between that place and Hillsboro.

There is some talk that the Northern Ohio Railway Company, whose tracks extend from Delphos to Akron, will be converted into an electric road on the supposition that with an extension to Youngstown and other points it will pay.

At the meeting of the National Electric Contractors' Association of Ohio in Toledo this week the following-named officers were elected: President, Charles S. Hall, Dayton; vice-president, E. Grah, Toledo; secretary, A. Oppenheimer, Cleveland; treasurer, J. C. McMasters, Columbus. "Fair treatments by the manufacturers" was the subject that received considerable attention. The meeting ended with a game supper at the Yacht Club Building.

The Lima-Eastern Railway Company of Lima was incorporated a few days ago with a capital stock of $100,000, to operate an interurban road on which gasoline cars are to be used. C. H. Chappelle, C. D. Shobe, A. A. Shafer, F. E. Baxter and others are the incorporators. This is the first road ever incorporated in this state that has indicated its intention to use gasoline motors for propelling cars.

The Columbus Railway and Light Company has put gutters along the sides of the cars, with drain pipes down the corners, thus greatly improving conditions in rainy weather when people are compelled to get on and off the cars. O. M. C.

Indiana.

Indianapolis, August 12.—An interurban electric railway between Corydon and Lincoln City, with connections from Corydon to New Albany, by the proposed line of the Louisville and Southern Indiana Traction Company, is among the possibilities. An electric line is now being built from Evansville to Boonville, and but a few miles would be required to reach Lincoln City, making a continuous electric road from Louisville and New Albany to Evansville. The proposed line runs along Blue River, which may be utilized for the generating of electric power to operate the line.

The management of the Indiana Northern Traction Company, which is operating the Wabash-Marion Interurban and is preparing to extend the line north to Warsaw, has submitted specifications to the rail mills and bridge companies for estimates for the steel needed on the extension from Wabash to North Manchester, 14 miles. All of the right-of-way has been obtained, and the franchises in all the towns are arranged for.

J. H. Roberts of Grand Rapids, Mich., is promoting an electric railway, to run between Fort Wayne, Ind., and Jackson, Mich.

The Lake Shore railway (steam) is now putting a gasoline engine through various tests in Northern Indiana. If it can develop 200 horsepower and carry a car full of passengers 50 miles an hour, it

is the intention of the Lake Shore to furnish most, if not all, of its branches, with this sort of equipment for the handling of suburban and interurban travel. The effort will be not only to regain the business taken away by the traction lines, but to forestall some of the plans to extend electric roads into the various territories along the line of the Lake Shore. The engine is said to work out to good advantage for low speed.

The promoters of the proposed electric railway from Columbus through Seymour and on to West Baden say that something definite may be looked for soon.

Indianapolis is to have an interurban electric railway that will connect it with Evansville, by way of Vincennes. It will be the Indianapolis, Vincennes and Evansville, and the capital stock will be $150,000. The articles of incorporation will be filed at Indianapolis. The first officers will be: President, W. N. Matthews; vice-president, Gilbert H. Hendren; secretary, W. S. Johnson; treasurer, W. H. Vollmer; general superintendent, A. N. Fisher. It is understood this road is to be part of the proposed system of interurban lines that is to be formed by the merger of roads in Ohio and Indiana, part of which has already been brought about. When this merger is finished, Indianapolis will be connected with Chicago, Louisville, Cincinnati, Evansville, and, it is said, the intention in time is to run a line directly from Indianapolis to St. Louis. The purpose of the Indianapolis, Vincennes and Evansville is to open the southern part of Indiana. In the start it will be for passenger service, but in time some of these lines will be coal-carrying roads.

Articles of incorporation have been filed for the Wabash and Southern Traction Company, which purposes to construct a line from Columbus, through Nashville, to Bloomington, and thence west to the state line. The capital stock is $10,000, and the directors are headed by Joseph W. Brown. The home office is to be at Bloomington.

As a climax to a fight between the Franklin (Ind.) council and the Indianapolis, Columbus and Southern Traction Company, the council proposes to prohibit the traction company from running freight cars into the city. This would compel the company to run its cars on new track, skirting the town.

The Indianapolis and Eastern Traction Company began a through freight service between Indianapolis and Richmond only two weeks ago, but was compelled by the volume of traffic to put on another car last week. The fast freight service, with quick delivery possible in either direction, has attracted a great many merchants in both cities.

Work will be commenced this week on the proposed Evansville and Boonville traction line, and will be pushed so that cars may be running by the first of next year, if possible.

The Indiana Union Traction Company will run an excursion to Peru next Saturday night to connect at that city with a Chicago excursion on the Chicago, Cincinnati and Louisville steam road. The arrangement emphasizes the fact that many steam roads are beginning to make some concessions to the traction lines, even going so far as to cooperate with them for special excursion business.

The Terre Haute Traction Company expects to begin running cars on the Sullivan interurban line by October 1st, as far as Farmersburg. The company has ceased construction work on the projected Paris (Ill.) line, and is making St. Mary's the end of the road.

Plans for Muncie's union traction terminal station have been completed and will probably be approved this week. Representatives of the Indiana Union Traction Company, which is to construct it, say ground will be broken for the building within two weeks. It will be located on a quarter of a block at Charles and Mulberry streets, but a square removed from the principal business district. All the traction lines entering Muncie will probably use the new station, which will cost about $50,000.

It is said that there are hundreds of violations of the state law in many Indiana cities relating to electric-light wires crossing each other. A section of the statute hearing on the subject is to the effect that guards must be hung between the wires by the company owning the lower circuit.

Citizens of Dana, Ind., at a special election voted to install a modern electric-light plant in that place.

Charles Sampson has been granted a franchise to install an electric-light plant in Mathews.

The Indianapolis and Cincinnati Traction Company has placed an order for five large boilers, to be installed in its power house in Rushville, to reinforce the three now in use. Two new turbine engines, which will more than double the capacity of the power plant, will also be purchased. S.

Michigan.

Detroit, August 12.—The Public Lighting Commission of Detroit has let the contract for a new turbine engine, with a capacity for 4,000 arc lamps, to the Westinghouse Machine Company of East Pittsburg, Pa. Of the bids put in for this unit several weeks ago, the Westinghouse was the lowest at $61,283.

Following the example of the Bay City street-car strikers, the Saginaw employes of the street-railway company have returned to work, and the strike in that city is at an end.

The Western Michigan Railway Company has been organized to build an electric railway between St. Joseph, Benton Harbor and Kalamazoo, with a branch line to Paw Paw, Dowagiac and Cassopolis. It is capitalized at $700,000 and will run through the best fruit district of the state.

The old factory buildings of the Kalamazoo Electric Company have been purchased by the Kievet and Lounsberry Company, manufacturer of engines and boilers. The plant will be remodeled and put in shape for the new company in a short time.

The Pontiac council has not yet settled the street-lighting proposition. The Pontiac Standard Lighting Company, the Pontiac Light Company and the Clinton River Power Company are bidders for the contract.

The Great Lakes Engineering Company of Ecorse, a suburb of Detroit, has commenced work on large boiler shops, which, it is said, will be the most complete of their kind on the Great Lakes. All machinery will be run by electricity, compressed air or by hydraulic power. The plant is expected to be finished next spring.

Detroit's aldermen will be asked to amend the ordinance which limits the size of electric street signs to three feet. It is argued that the large electric signs add to the appearance of the city, and several merchants wish to put up signs larger than now permitted.

The Detroit Edison Company is extending its service north of the city and is seeking a franchise in Marine City. It will also try to obtain franchises in Algonac and St. Clair. Each of these towns now has a municipal lighting plant, and some opposition is expected.

The building of the new electric railway between Lansing and Jackson is being held up by the refusal of the Mason council to allow the company to use certain streets. This new line is owned by the same people as control the Lansing and Suburban Traction Company of Lansing.

The United States Weather Bureau Service is laying a cable in Lake Michigan, between Beaver Island and Cheboygan, Mich., a distance of 36 miles. Storm signals will be displayed from a tower 120 feet high. The cable will also be used for commercial purposes.

The Auto Express Company of Detroit has been incorporated with a capital of $5,000. The principals are E. D. Trowbridge, I. S. Scrimger and R. G. George.

The Books Motor Company of Detroit has been incorporated at $100.000. C. G. W.

Northwestern States.

Minneapolis, August 12.—The Rushford Power Company has been granted a 30-year franchise for an electric-light system at Rushford, Minn.

The Pine City (Minn.) Milling and Electric Company has contracted for a new dynamo of 750-light capacity.

The Kaukauna (Wis.) Electric Light Company has applied for a lighting franchise in Little Chute, Wis.

A. S. Campbell is building a power plant near Austin, Minn., to supply that city with electricity.

The Greenwood (Wis.) council rejected all bids for the construction of an electric-light plant and will shortly receive new bids.

The Green Bay (Wis.) Traction Company has refused the council's offer for a 50-year franchise on the payment of $25,000 and a new arrangement will be attempted.

S. T. Hauser of Helena, Mont., announces that the necessary capital has been secured to build a dam across the Missouri River and the construction of a power plant. It is expected that the total expenditure will be close to $3,000,000.

Ground has been broken for the new power plant which the Livingston, (Mont.) Waterpower Company will erect on the Yellowstone River. The company expects to expend about $200,000. R.

Pacific Slope.

San Francisco, August 11.—The California Gas and Electric Corporation is now busy erecting its huge auxiliary plant at the corner of Walbridge and Schwerin streets, preparatory to furnishing the United Railroads with current early next year. Three gas engines are being installed, each of 5,333-horsepower capacity, each engine to be connected to a generator. It is the intention to use this plant as an emergency station, although one generator will be kept running constantly, the power being used in connection with that furnished from the high-tension transmission line from the interior. The plant will cover about 15 acres and will include three large gas holders, two with a capacity of 200,000 cubic feet each and the third of 1,000,000 cubic feet. These preparations on so large a scale suggest the fact that power might be supplied to others than the United Railroads, but this is denied by the California Gas and Electric Corporation.

Eastern capitalists, represented by Victor Engineer of San Francisco, have taken over the Reno Water, Light and Power Company, and the Washoe Power and Development Company, and extensive improvements are contemplated.

The Oroville Light and Power Company is soon to commence work on a large power plant near Prentz.

The United Railroads of San Francisco are contemplating the extension of their Mission district electric line from Twenty-fourth Street to Railroad Avenue.

The Oakland Gasa Light and Heat Company of Oakland will commence at once the work of putting its wires underground in the downtown district.

The electric plant of H. C. Flournoy at Quincy, Cal., has been sold to Miss A. L. Gasner of that place.

The Western Power Company, which has extensive power sites in Butte and Plumas counties, will soon commence work on a series of reservoirs.

The Benicia Arsenal, an important point in the government defenses, has been wired for electric lights by the Century Electric Company of San Francisco. The official quarters and barracks were included as well as the warehouses and shops.

The Century Electric Company is doing the electric work on the new Shreve Building at the corner of Post Street and Grant Avenue. The upper floors of the new skyscraper will be used for offices. There will be about 5,000 lights.

The details of the contracts let by the Edison Electric Company of Los Angeles for the equipment of Kern River No. 1 power plant include: Four 5,000-kilowatt three-phase generators, two exciters and step-up transformers for 75,000 volts and four Allis-Chalmers waterwheels, which are to be direct-connected.

The Ocean Shore Railway Company, which is constructing a standard-gauge electric road from San Francisco to Santa Cruz, a distance of 82 miles, has decided to double-track the entire length of its line. Considerable material has been ordered. A bond issue of $3,000,000 is to be authorized by the stockholders. The company will have its own electric power house at some point on the line near tidewater.

The Consolidated Stanislaus Water and Power Company, Charles T. Tullock, president and manager, is equipped with two 750-kilowatt three-phase generators. Current is transmitted to Modesta and other points from the generating station at Knights Ferry. R. W. Keeler is now in charge of the plant.

The Modesta town trustees have passed an ordinance granting H. B. Kinney a franchise for an electric street-railway line.

The California Electrical Works will move into its new factory and office building on Folsom Street, between Second and Third, in October next. The structure will have four stories, of "mill construction," of which there are few specimens in San Francisco. Everything is designed so as to facilitate carrying on manufacturing, and shipping supplies. A great deal of telephone work is done. A large order for electric-lighting supplies, received through the Hallidie Machine Company, is being completed for shipment to Alaska.

The Central California Traction Company, which has been incorporated in San Francisco and capitalized at $2,500,000, by M. Fleishhacker, H. Fleishhacker, H. H. Griffiths, W. J. Bartnett and others, will immediately construct 12 miles of electric road in Stockton, Cal., and will build a 15-mile line between that city and Lodi. It is proposed to extend the system later. The incorporation papers provide for building about 200 miles of road. The American River Electric Company will utilize some of its surplus power in operating the new road. A shipment of rails has been ordered. A.

PERSONAL.

According to a Buffalo report, Ralph D. Mershon is acting as chief engineer for the Niagara, Lockport and Ontario Power Company of Niagara Falls, N. Y.

Francis J. Green, the well-known space-telegraph inventor of Bloomington, Ill., was a visitor in Chicago early in the week. Mr. Green is deeply interested in the problem of applying "wireless" to train signaling.

James Stowell Anthony of the General Electric Company was married to Miss Alys P. Scott, daughter of Mr. and Mrs. Alfred Bowne Scott, on August 15th. The wedding took place at Geneva, Switzerland, the ceremony being performed by the Rev. Percy Gordon, assisted by the Rev. Mr. Belden. Mr. and Mrs. Anthony will return to this country early in the fall, and will reside in New York.

H. K. Payne has resigned as manager of the Houston Electric Company of Houston, Texas, and will be transferred to the home office of the Stone-Webster syndicate in Boston, which owns the Houston street-railway system. The change comes as a promotion and in recognition of Mr. Payne's ability as a practical street-railway man. Mr. David Daly has succeeded Mr. Payne in the management of the Houston property. Mr. Daly is a young man and for several years has been manager of the Stone & Webster properties at Ponce, Porto Rico.

T. F. Grover, vice-president and general manager of the Eastern Wisconsin Railway and Light Company of Fond du Lac, Wis., has placed his resignation in the hands of the directors, to take effect October 1st. He has not yet announced his future plans, but will continue as a stockholder in the Wisconsin company. Mr. Grover with his wife and son is at present enjoying a trip through the East, where he got his early education and electrical experience, having been born in Blairstown, N. J., in 1865. He went to the Northwest in search of health, and in 1893 became connected with the Milwaukee and Wauwatosa Electric Company. In 1896 he took hold of the Fond du Lac Electric Company and carried it through several reorganizations and consolidations, developing the property from an electric-light system valued at $40,000 to a lighting and street and interurban railway system valued at more than a million and a half. The Eastern Wisconsin Railway and Light Company is the result of his efforts. This company does the gas and electric lighting and street-railway business of Fond du Lac. It also built and is now operating the 19-mile electric road between Fond du Lac and Oshkosh, considered one of the finest interurban properties in Wisconsin. Mr. Grover has made a fine record and a host of friends in Fond du Lac. In addition he is well known to electrical men throughout the Northwest. He is a member of the National Electric Light Association, the American Street Railway Association and the Northwestern Electrical Association, having been president of the latter in 1904.

T. F. GROVER.

William B. Hale left Chicago on Monday last for the City of Mexico, where he will be general manager for the Mexican Telephone and Telegraph Company, which has a system of 17 exchanges in the principal cities of Mexico. Mr. Hale has been a resident of Chicago for over 15 years, and his high character, his unobtrusive kindliness, his genuine modesty and his thorough technical attainments have made him many warm friends. In 1890 he entered the service of the Western Electric Company, and for many years had complete charge of the laboratory work of the company. From 1893 to 1898 Mr. Hale superintended the installation of underground cable systems in Detroit, Toledo, Indianapolis and other cities. Mr. Hale speaks Spanish and French, and during the Chicago World's Fair of 1893 he acted as Spanish-speaking representative of his company at its exhibit in Electricity Building, his duties being to welcome Spanish-speaking visitors. During the last few years Mr. Hale has occupied the position of special engineer connected with the telephone engineering department of his company. He has recently designed the equipment of a high-tension testing room at the cable plant that is unique in that the operation of the 100,000-volt switches is entirely automatic, thus avoiding the risk of injury to the operator. Mr. Hale was secretary of the Chicago Electrical Association for several years, and was elected to the presidency of that body in 1904. He was active in bringing about the union of the Chicago Electrical Association with the Western Society of Engineers to form the nucleus of an electrical section. Mr. Hale was this year re-elected chairman of the electrical section of the Western Society of Engineers. He is an active member of that society, and an associate of the American Institute of Electrical Engineers and of the Canadian Electrical Association. He has contributed articles to the technical press from time to time, and has read papers before various scientific bodies. He obtained his collegiate training at the University of Toronto, graduating in 1889. Mr. Hale's wide telephone experience and his knowledge of the Spanish language will prove valuable to him in his new position.

W. B. HALE.

ELECTRIC LIGHTING.

The Franklin (Ind.) Water, Light and Power Company's building has been destroyed by fire.

The San Saba (Texas) Light and Ice Company has increased its capital stock from $15,000 to $30,000.

The St. John's Light and Power Company has been incorporated with $300,000 capital stock to operate an electric-light and power plant at St. Augustine, Fla. William D. Barnett is president, W. M. Bostwick, Jr., vice-president, and Thomas R. Osmond, secretary.

The Coweta (Indian Territory) Rolling Mill, Light and Power Company has been organized with a capital stock of $15,000.

The Nelson Electric Light Company of Nelson, Neb., has its power house enclosed, and will soon begin installing the machinery.

At a special election at Burlington, Wis., the proposition to vote $12,000 for a municipal electric-lighting plant was carried.

The Egan Electric Company of Dallas, Texas, has been incorporated with a capital stock of $15,000 by G. H. Egan, D. L. Gobble and G. G. Wright.

At a sale of securities of the Bigelow estate at the office of the referee in bankruptcy in Milwaukee John I. Beggs purchased 100 shares of the Kenosha Gas and Electric Company at $60 a share.

The Philadelphia (Miss.) Compress, Electric Light and Ice Manufacturing Company has been incorporated with a capital stock of $30,000 by A. M. Boyd and others.

The franchise for an electric-light plant in Belle Fourche, S. D., has been let to the Belle Fourche Power and Water Company, which is controlled by A. H. Marble, A. A. Moodle and others.

The Business Men's Association of Citronelle, Ala., will consider propositions for the establishment of an electric-light plant. C. W. Thomas is secretary of the association. The town has a population of 1,500.

The Gulf States Investment Company of Union, Miss., has been incorporated, with $200,000 capital stock, by S. M. Jones, F. L. Riley and R. W. Jones, to operate lighting plants, waterworks, sewerage systems, etc.

The question of issuing $50,000 of bonds for the purpose of erecting a municipal electric-light plant will be submitted to a vote of the people of Newport, Ky., at the next election. It requires a two-thirds vote to carry.

Notice of the merger and consolidation of 15 electric-light and gas companies in Luzerne County, Pa., into one company, with a capital of $1,000,000, has been filed in the State Department, with the approval of Governor Pennypacker.

The Dallas (Texas) Electric Light and Power Company has obtained sanction for the erection of its proposed electric-light and power plant, the permit stating that the building will cost $125,000 exclusive of the machinery. It is understood that the mechanical equipment will cost about $350,000. The building will be 75 by 100 feet, of brick and steel. Construction work has been begun.

The Commonwealth Electric Company of Chicago is enlarging its Hyde Park distributing sub-station at the corner of Fiftieth Street and Cottage Grove Avenue. The new building will be of brick, stone and steel, and two new 1,000-kilowatt motor-generator sets will be installed at present, room being provided for six sets. The new apparatus being installed will change the frequency from 25 to 60 cycles.

Henry C. Scott, president of the Edison Electric Company of Carondelet, St. Louis, has entered a protest with the Board of Public Improvement of St. Louis, alleging that the Union Electric Light and Power Company has violated its agreement with the city of St. Louis by refusing to allow the Carondelet company to string wires on the Union poles in South and West St. Louis. No room on the poles is given as the basis for refusal, but Mr. Scott offers to buy the poles and rent them to the Union company at the price stipulated by the city.

It would seem from a recent communication by Professor Wedding to the Electrotechnical Society of Cologne, reported in the Journal des Usines à Gaz of July 20th, that for the zirconium lamps patented about two years by E. Sander, 2.2 pounds of zirconium will furnish 100,000 filaments, and the lamps can be sold at 38 cents each, which is less than the price of osmium or tantalum lamps. One of the chief difficulties entailed by their use is, however, the fact that they need a low-tension current of only 37 to 44 volts. The normal consumption is two watts per French candlepower, and they will last for 700 to 1,000 hours.

The properties of the Knoxville Traction Company and the Knoxville Electric Light and Power Company of Knoxville, Tenn., have been consolidated into one company, which will be known in the future as the Knoxville Railway and Light Company. This company has been incorporated with a capital stock of $2,000,000, the incorporators being C. H. Harvey, E. E. McMillan, William S. Shields, F. L. Fisher and Leon Fender. Charles H. Harvey, president and general manager of both companies as they have existed heretofore, says that the charter was taken out for the purpose of consolidation of the two interests to expedite the work of improving the lines and service.

ELECTRIC RAILWAYS

According to statistics prepared by the Street Railway Journal, there were in the United States in 1904, 993 electric railways, with 29,548 miles of track and 66,525 motor cars and trailers.

A. Nelson of the electric-railway company of Wichita, Kan., is trying to interest capital in a proposed electric railroad to connect Joplin and Springfield, Mo., touching a number of intermediate points.

The City Council of Capitol Hill, Okla., has granted a franchise to the Oklahoma City, Lexington and Sulphur Springs Electric Railway Company. George A. Teague, secretary of the company, says that the entire road from Oklahoma City to Sulphur Springs will be completed by July, 1906. Contracts for the construction of 40 miles of the road are about to be let.

It is proposed to connect Atoka, Colgate, Lehigh and Phillips, I. T., with an electric railway. The Missouri-Lincoln Trust Company of St. Louis has agreed to finance the road if the people of these towns will give a bonus of $51,000. The total cost of the road is estimated at $255,000. The towns interested have agreed to raise their pro-rata share of the bonus demanded. The line will be through a rich agricultural section.

Charles J. Canfield and associates have been granted a charter to construct an electric railway from Atlanta to Macon, Ga., a distance of about 100 miles. The concern will be known as the Atlanta-Macon Interurban Railway Company, and will have a capital of $100,000. The line will run through Fulton, Clayton, Henry, Spalding, Pike, Monroe and Bibb counties. The construction of the new line will be begun within the next few weeks, the preliminary survey having already been made.

The Oconee County Railway Company proposes to build an electric railway from Westminster or Seneca, S. C., to Townville and Fair Play, S. C. The line will divide at Oakway with one branch via Tokeena to Townville and the other via Tugaloo to Fair Play. It will be 24 miles long. The company would like to have offers of rails by the mile; also for power plant of sufficient size to operate a plant which will propel two cars twice each way daily. Offers are also desired on wire and line construction.

The daily newspapers report that in connection with extensive improvements in what is known as the electric zone of the New York Central system, stretching to Croton and to White Plains, a large contract has been let for electrical equipment; 175 cars to be used in the suburban service have been ordered, and 35 electric locomotives have also been ordered. They are to be delivered within a year. The 35 electric locomotives will be of the type which performed so successfully last year under severe tests made by the New York Central. The contract for them has been given to the General Electric Company and the American Locomotive Company jointly.

The construction of an electric high-speed railway between Cassel and Cologne, in Germany, is suggested by Mr. Fränkel, a Breslau engineer, with a view to testing on a large scale the possibilities of electric long-distance railways. The line, which would considerably shorten the distance from Cologne to Berlin, would assume a high strategical importance, and would serve to relieve other lines of part of their passenger traffic. Assuming a maximum speed of 100 miles an hour, corresponding with a commercial speed of about 80 miles an hour, the electrified line Cologne-Cassell (112 miles) could be traversed in one hour and 27 minutes, while five hours are required to cover the present line of 171 miles, passing through Elberfeld.

Municipal transportation projects involving an expenditure of over $100,000,000 and intended to give the city of Berlin complete control of the traffic situation are now engaging the attention of the Berlin government. In addition to the fine surface system of electric railways which has already been decided upon, the city's engineers are working out a plan for extensive underground, elevated and suspension railways. These will traverse Berlin in all directions and link up with it the suburbs and surrounding towns. The lines of the Great Berlin Street Railway Company, the existing privately owned traction system, will not be paralleled, as those lines fall into the city's hands in 1919, at the expiration of the present franchise. Leopold Rosen is a leading member of the municipal traffic commission, which has the plans in charge.

On the recommendation of Superintendent Collins, the motormen of the San Bernardino Valley Traction Company of San Bernardino, Cal., have been ordered by the directors to wear overalls instead of the blue uniforms in which they have been working. It is explained that the men are out with their cars on long runs, during which the motors of the cars are in their exclusive charge, and that any disorder to the machinery would have to be repaired by themselves, which may soil the expensive uniforms and give them a slouchy appearance, while on duty. The overalls are to

be of a uniform cut and pattern, with a jacket of blue and white check, and the men will also wear a cap and necktie. It is considered that, as the motormen have frequently to crawl under cars to inspect machinery or for emergency repairs, overalls, as in the case of locomotive engineers, are more suitable.

POWER TRANSMISSION.

The Fidelity Milling and Power Company of Leadville, Colo., has been incorporated with a capital stock of $1,000,000.

The Westchester and Washington City Electric Railway Company of Westchester, Va., has opened bids for the construction of a dam, electric power house and raceway along the Shenandoah River near Millville, W. Va., which is to furnish electric current to Westchester and other towns. E. Purcell & Co. of Harrisonburg, Va., were awarded the contract, their bid of $56,322.50 being the lowest of nine submitted.

The S. S. Pearson Electric Power Company of New York has had a representative in Huntsville, Ala., relative to developing the water power of Muscle Shoals in the Tennessee River for supplying Nashville, Huntsville, Decatur, Florence, Sheffield and the Tennessee Valley with electric light and power. Judge Richardson of Huntsville purposes to offer a bill in the next Congress allowing some company the right to build a large power plant at the shoals.

It is officially announced that the control of the Niagara, Lockport and Ontario Power Company and of the Iroquois Construction Company, which has hitherto been vested in Joseph G. Robin and his associates, has passed by sale of the individual interests to a new syndicate, headed by H. H. Westinghouse of New York and John J. Albright of Buffalo. The purchasing syndicate is understood to represent a combination of the Westinghouse, Albright, New York Central and Vanderbilt interests, together with those of Horace E. Andrews of Cleveland and others. The executive office will be removed from New York to Buffalo.

SPACE TELEGRAPHY.

At a recent meeting in London the capital of the British Marconi Wireless Telegraph Company was increased from £300,000 to £500,000. The increase, it was announced, is to meet the expansion of the company's business.

According to a report received at the Navy Department, ships of the North Atlantic fleet have communicated with one another by space telegraph at a distance of about 262 miles. This is announced to be the greatest distance at which wireless messages have been sent from ship to ship in the navy.

A space-telegraph station is in course of construction on Mount Tamalpais, 10 miles from San Francisco, which is said to be intended for communication with the station on the Hawaiian Islands. The distance is 2,000 miles and communication by space telegraphy may be established within two months.

SOCIETIES AND SCHOOLS.

The Railway Signal Association will hold its next meeting in the Great Northern Hotel, Chicago, on September 12th. The committee on "Definitions and Nomenclature" will submit a number of new definitions.

The sixth annual convention of the Illinois State Electric Association will probably be held in Peoria on October 5th and 6th. E. B. Hillman of Warsaw is president of the association and D. Davis of Litchfield is secretary.

One of the most interesting discussions at the Denver meeting of the National Electric Light Association was that on the paper relating to protection from lightning and other static disturbances, presented by Alex Dow and Robert S. Stewart of Detroit. It was decided to have investigations on this subject continued throughout the year, and the results presented at the next convention, and President Blood has appointed for this purpose a committee consisting of Messrs. Dow and Stewart and Orville A. Honnold of Salt Lake City. Mr. Dow is chairman of the committee. All of these gentlemen have had abundant opportunity to gather experience that will be valuable, and it is expected that all the members of the association will send to Mr. Dow any data they may have that can be of use to the committee.

PUBLICATIONS.

The Railway Electric Power Company of New York has issued a fine 30-page publication which sets forth the characteristic features and advantages of the Ganz system of three-phase alternating-current traction for main-line railway traffic, rapid transit, suburban and interurban lines and mining and industrial railways. Particular reference is made to the results obtained from three years use of the Ganz system abroad. An interesting and complete illustrated description of the Valtellina line in Switzerland, which was electrically equipped by Ganz & Co. of Budapest, is given. The book will be of interest to railway officials and engineers.

The Aiton Machine Company has just issued bulletin No. 62, illustrating one type of its 18-drum stranding machines. Bulletins may be had upon application at the New York office, 126 Liberty Street.

The Peru Electric Manufacturing Company of Peru, Ind., has issued a bulletin on "Standard Porcelain." This illustrates and describes a complete line of porcelain insulators, cleats and tubes, and will be found a handy reference when ordering porcelain goods. The company will be pleased to mail a copy of this bulletin on request.

A series of new bulletins, prepared for filing, have been sent out by the Cutler-Hammer Manufacturing Company of Milwaukee. They contain illustrations, dimensions and full descriptions of the various types of crane controllers for hoist and traveling duty, with prices. Machine-tool controllers are given attention, and the drum dimensions and dimensions of resistance for use with the various drums are given.

H. M. Byllesby & Co. of Chicago have published in pamphlet form, with load curves and tables, the report of the economy test they made for the Oshkosh Gas Light Company of the 500-kilowatt Curtis steam turbine installed by that company last December. Mr. O. E. Osthoff, chief engineer for Byllesby & Co., wrote the report. He says that "The results were very satisfactory, both on steam consumption of the turbine and the steam consumption of the turbine and auxiliaries."

MISCELLANEOUS.

Owing to the restricted number of entries, the French Automobile Club has resolved to postpone the trials of electrical vehicles which were to have been held this month.

In a news item, "Public Lighting in Indiana," in the Western Electrician last week it was stated that "the total receipts of all public and private plants in the cities of the state for lighting and power for the year ended June 30, 1905, were $10,022,550.48." This is an error, the figure given representing the total receipts of all the cities of the state from all sources.

So far this year there has been a slight decrease in the exportation of electrical machinery from Germany, the returns for the five months ended with May last showing a total of 5,466 tons as compared with 5,640 tons in the corresponding period of last year. On the other hand, the imports of foreign electrical machinery into Germany show a slight increase—from 500 tons in the first five months of 1904 to 534 tons in the months ended with May last.

The government of New Zealand has decided to hold an international exhibition in Christchurch, Canterbury, beginning in November, 1906, and remaining open until the following April. It is intended to demonstrate the resources and possibilities of the colony and its vast mineral wealth. There are good openings for electric power plants in the development of the mineral resources of the country. All the nations of the world have been invited to participate.

Returns for the month of June show that the total value of electrical exports from the United Kingdom for June amounted to something over £129,552, a decline of about £9,000 from the figures for May. The decline is fairly distributed over the majority of items, with the exception of electrical machinery and telegraph material, the former showing a reduction of £15,000 on the month and the latter an increase in about the same amount. Imports of electrical goods for the month totaled £105,210, a reduction of £17,000 on the May returns. Declines are apparent under all heads except electrical machinery and batteries, the former showing an advance of about £11,000 in value.

Since the first telegraph line was established in the Kongo Free State in July, 1895, between Boma and Matadi, telegraph and telephone communication in that country has been largely developed. On September 15, 1898, both telegraphic and telephonic communication was established between Matadi and Leopoldville. At the end of the same year the wires ran for a distance of 425 miles, and in 1899 there were some 800 miles of wire in use. Since that time long-distance telephoning has been perfected, and communications are practically easy for distances of about 400 miles. Space telegraphy is now being successfully experimented with. The state is under the protection of Belgium, and King Leopold has manifested great interest in its development.

An engineer at Monaco while working in the open air with an electric machine had his attention called to recent experiments for destroying insects injurious to the products of the soil. Metal rods extended from his machine into the ground and were connected with a dynamo of 110 volts. He observed that insects in the vicinity left their hiding places and hastily came to the surface, suggesting to him that electricity might be used therefor to a large extent to exterminate these insects. An appliance for the destruction of animal life harmful to trees and plants was illustrated in the Western Electrician of February 4, 1905. The engineer above mentioned believes that further experiments will prove that for the killing of various kinds of insects different voltages should be used.

TRADE NEWS.

E. A. Hayter of Hastings, Neb., has sold out his electric-supply business in Hastings to H. S. Brown & Co.

The Burgess-Graden Company of Omaha, Neb., has succeeded to the business of the F. N. Russell Fixture Company.

The Universal Electric Storage Battery Company of Wilmington, Del., capitalized at $500,000, has been licensed in Illinois with a capital of $125,000.

The American Steel and Wire Company has temporarily shut down its South Sharon (Ohio) plant, pending the installation of an interior electric railway to be operated by trolley for handling the stock.

It is reported that the Pressed Steel Pole Company of Pittsburg, Pa., is seeking a site for the establishment of its steel-pole plant in Baltimore, Md. It is proposed to place the capital stock of the company at $125,000.

The Hall L. Brooks Company of Tomahawk, Wis., the well-known producer of white-cedar poles, reports having done a very good business so far this year. Hall L. Brooks is one of the most popular men in the cedar-pole business, and he is also one of the most energetic.

M. F. Wortham of Waco, Texas, has moved his general electric and supply business to larger quarters in Austin Street, Waco, where a construction and repair department has been added. Gasoline engines and automobiles will also have a department at the new headquarters.

The Pacific Light and Power Company of Los Angeles is reported as in the market for four 5,000-kilowatt steam-driven generating units, transformers, switchboards and auxiliaries. It will erect a complete oil-burning steam plant. This is the largest single contract of the kind ever called for on the Pacific Coast.

The Western Steel Gate Company has changed its location from Two Rivers to Green Bay, Wis., where it announces having in operation one of the finest machine shops in Northern Wisconsin. In addition to its regular line of Western steel gates and Western post-hole diggers, the company with its increased capacity, announces that it is prepared to furnish anything in the line of engines and machinery.

F. A. C. Perrine, B. A., D. Sc., A. M., consulting engineer, 49 Wall Street, New York city, has decided to go extensively into the general engineering and operating problems of electric lighting, power development and operation, affording to the small company or corporation the advantages of a well-equipped engineering office at a moderate fee. Dr. Perrine is directly assisted in this work by Edwin H. Seaman, E. E., M. E., who will attend to the minor details.

At Stoughton, Wis., sealed bids will be received by John Holton, chairman of the electric-light committee, until 2:30 p. m. on August 26th, for the following electrical apparatus and power equipment: (A) power house; (B) one 150-horsepower water-tube boiler; (C) one 150-horsepower steam turbine and generator; (D1) one 100-kilowatt generator and two exciters; (D2) two switchboards, arc-light transformers, 50 arc lamps; (E) one water-wheel governor for two 100-horsepower wheels; (F) one condenser, feed-water heater and pump; (G) old arc machine and switchboard for sale. Certified check for five per cent. of amount of bid must accompany each bid. Plans and specifications may be seen at 1636 Monadnock Block, Chicago, and blank proposals may be obtained at 31 Vroman Building, Madison, Wis.

The annual meeting of the stockholders of the National Battery Company was held August 4th at the general offices of the company in Buffalo. The old board of directors was continued unchanged. Mr. John R. H. Richmond, who was formerly treasurer, was elected president of the company. Mr. James Macnaughtan, under whose management the company has been brought to its present strong position, was continued in the office of vice-president and was reappointed general manager. Mr. Ralph Kimberly, formerly secretary, was appointed to fill the offices of both secretary and treasurer. Mr. Richmond and several associates have taken a large block of the increased capital stock, which will be used in the further extension of the business. Mr. R. L. Coleman, formerly president of the company, was elected chairman of the board of directors, and he still retains his large interest in the company. The company declares that it now ranks second in this country in the

electric storage-battery business. The results accomplished during the last year have encouraged the stockholders of the company beyond their expectations. Extensive plans for further development have been made and the field of activity will be broadened. The company has a fine organization, the sales manager being both an electrical and mechanical engineer, with extended commercial experience. The factory manager is a thoroughly trained technical man, who has been connected with this company from its inception. Other departments of note are the engineering, construction and publicity departments, all of which are managed by men carefully selected for their ability and training in their particular line of work.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) August 8, 1905.

796,435. Secondary Battery. Jacobus Langelaan, Oberschöneweide, near Berlin, Germany, assignor to Pflüger Accumulatoren-Werke Actiengesellschaft, Berlin, Germany. Application filed February 27, 1905.

The plates of the cell comprise a number of separate pieces of active material united together and surrounded by a protective envelope. Horizontal supports are provided with flanges, and connecting pieces embrace the envelope and the supports.

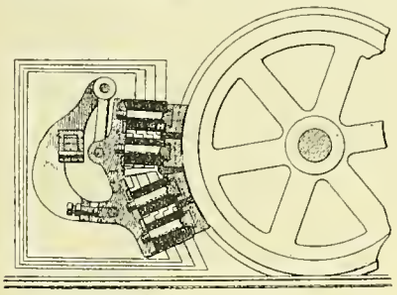
796,437. Door-securing Means. Libermond A. Léon, Montreal, Canada. Application filed August 4, 1904.

Electrical means are used to release a hammer adapted to drop on a trip by gravity.

796,441. Telephone System. Kempster B. Miller, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed February 4, 1901.

The first of 34 claims reads as follows: "The combination with a pair of telephone lines of a repeating coil through which the same are adapted to be united for conversation, a signal-controlling electromagnet bridged between the two limbs of the talking circuit of each of the lines, a source of electricity adapted to be connected in circuit with the electromagnet, and means for preventing the current therefrom from passing through the winding of the repeating coil associated therewith."

796,464. Car Brake. Charles J. Specht and Charles R. Krueger, New York, N. Y. Application filed June 24, 1904.



NO. 796,464.—CAR BRAKE.

An electromagnetic brake shoe is supported from a link held by a bracket. (See cut.)

796,467. Electric Arc Lamp. Bernard A. Stowe, Cleveland, Ohio, assignor to the Jandus Electric Company, Cleveland, Ohio. Application filed December 5, 1902.

One feature is the combination with a hood and internal framework supported thereby, of a sheet-metal shell having a closed peripheral wall and means for removably connecting the shell to the hood, whereby the shell can be lowered bodily to expose the internal framework.

796,470. Base-making Machine. Alfred Swan, New York, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 11, 1903.

This is an ingenious machine for making bases for incandescent lamps. A reservoir for insulating material has a feed outlet open during the entire operation of the machine whereby a continuous stream of molten material flows therefrom; a mold is arranged to receive the machine, whereby a continuous stream of molten relative position; there are means for shifting the mold intermittently into the path of the stream and maintaining it under the stream for uniform periods; also means for compressing the molten material into a definite shape in the mold, while speed-varying devices adjust the dwell of the mold under the stream.

796,474. Motor-control System and Switch Therefor. Leonard A. Tirrill, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed April 15, 1903.

A switch in the circuit is operable to connect the motor for rotation in either direction; electrically actuated means included in circuit with the switch holds the switch in either of the operative positions; a secondary switch is located in circuit with each electrically actuated holding means and adapted to open the circuit through these means, while there are also means for returning the switch to open position when the circuit through the holding means is opened.

796,475. Illuminated Sign. George E. Turner, Denver, Colo. Application filed October 4, 1904.

In each letter depressed reflecting surfaces coincide with its outline. Incandescent lamps are placed in the bottom of these depressions.

796,482. Trolley. William P. Wiemann, Allegheny, Pa., assignor to the Empire Machine Company, Pittsburg, Pa. Application filed September 7, 1904.

A trolley-wheel lubricating device is described.

796,483. Feed-regulating Device for Electric Motors. Seward W. Williams, Lapeer, Mich. Application filed June 1, 1903.

In a feed-regulating device for electric-motor controllers the combination with the controller staff of a gear mounted thereon, means connected with the gear for imparting a rotation thereto, a pivoted lever independent of the staff for controlling the gear-actuating means, this lever being capable of an intermittent movement only in one direction, whereby an intermittent rotation is imparted to the controller staff.

796,491. Electrical Stop Motion for Warping Machines. Richard C. Borchers, Philadelphia, Pa. Application filed December 12, 1904.

There is a normally open circuit, by the closure of which the stoppage of the mechanism is effected. There is a contact mechanism in the circuit for each spool of the warping machine.

796,501. Conductor-rail Holder for Electric Railways. George L. Courtenay, New York, N. Y. Application filed February 14, 1905.

Details of a third-rail insulator are described.

796,512. Extension Circuit-closer. Jacob R. Hershey, Keokuk, Iowa, assignor to the Electrical Devices Company, Keokuk, Iowa. Application filed December 7, 1901.

Features of this invention are an insulating block, a contact plate mounted upon the front face of the block, a drop pivoted to the plate, a stop for the drop, a lever carrying a drop-engaging arm mounted upon the back of the block, means extending through this block mechanically supporting the plate in position and electrically connecting the plate with one terminal of an extension bell circuit, and also means for connecting the other terminal of the circuit with the stop.

796,517. Battery Holder for Automobiles. Frank Jackson, Denver, Colo., assignor to the Jackson Manufacturing Company, Denver, Colo. Application filed September 27, 1904.

In each compartment of the battery holder there is a resilient metal socket at one end and a spring clamp at the other. These clamps and sockets have suitable electrical connections.

796,528. Candy-spinning Machine. Ralph E. Pollock, Syracuse, N. Y. Application filed April 10, 1905.

An electric resistance coil is placed in the revolving cylinder, near the lower end, doubtless for the purpose of melting the candy.

796,533. Electric Bath Robe. Edwin B. Rayner, Piqua, Ohio, assignor to Clark B. Jamison and William J. Prince. Application filed October 2, 1902. Renewed January 27, 1905.

An electric therapeutic appliance comprises a robe for enveloping the body, a hood for the head and throat detachably connected to the robe, electrodes applied to a side of the robe and hood, means for throwing the electrode of the hood into and out of circuit with the electrodes of the robe, and means for closing the circuit through the electrodes of the robe when the hood is cut out of circuit.

796,550. Lightning Protector for Buildings. John P. A. Anderson, Madrid, Iowa. Application filed September 20, 1904.

A metal cap piece is fixed around the top of a chimney, likewise a metal band; strips of metal are connected with the cap piece and band on the outside of a chimney, and means are provided to connect the band electrically with the ground.

796,555. Apparatus for Distributing Alternating Currents. Arthur F. Berry, Ealing, England. Application filed November 6, 1903.

The combination with one or more main transformers of a supplementary transformer, short-circuiting means whereby the primary and secondary windings of the supplementary transformer can be coupled in series with the primary and secondary windings respectively of the main transformer, or of each main transformer, when the load does not exceed a predetermined amount and whereby the windings of the supplementary transformer can be short circuited when the load increases beyond a predetermined amount; also electromagnetic means adapted to operate the short-circuiting means, and means whereby the electromagnetic means can be caused to become energized in a temporary manner so as to actuate the short-circuiting means in one or other direction when the load rises above or falls below the predetermined amount.

796,559. Electric Sign. Charles T. Bradshaw, Philadelphia, Pa., assignor to the Attracto Company, Philadelphia, Pa. Application filed March 17, 1902. Renewed January 18, 1905.

A revolving, interior-illuminated sign is covered by this invention.

796,562. Telephone Call Mechanism. Tracy R. Campbell, Aberdeen, S. D. Application filed January 14, 1905.

One claim describes the combination with a magneto-generator, of a signal including an oscillatory clapper, the armature and clapper having separate spaced axes of movement, and relatively movable devices respectively connected to the clapper and to the armature, one of these devices having a seat disposed eccentrically to its axis of movement, the other having a projection located at one side of its axis of movement and movably engaging in the seat.

796,563. Warp Stop Motion for Looms. George E. Chandler, Taunton, Mass., assignor to the Mason Machine Works, Taunton, Mass. Application filed November 24, 1905.

A series of circuit-closing detectors is maintained inoperative by normal warp threads; there is an operating electric circuit with which the detectors are electrically connected; an elongated terminal of this circuit is extended transversely of the loom adjacent to the detectors; a released detector contacts with the terminal and closes the circuit, and a shield overhangs the terminal and the contact portions of the detectors to prevent the collection of lint thereupon.

796,568. Telephone System. William W. Dean, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago. Application filed October 27, 1902.

In a telephone system the combination with a telephone line of a relay at the central office in each line conductor and actuated thereover, a differential relay having a winding in each line conductor, and telephonic apparatus affected by the relays, when operated.

796,595. Telegraphic Transmitter. Alexander Muirhead, Shortlands, England. Application filed April 27, 1899.

In the sending circuit of a telegraph system there is an initial transmitter and a recorder coil; in the battery circuit of the transmitter a line battery, a loosely mounted local contacting device and means serving to constantly vibrate the latter in a plane coincident to that of its oscillation are provided.

796,596. Electric Telegraphy. Alexander Muirhead, Shortlands, England. Application filed October 14, 1901.

The combination, in a system of electric telegraphy, of a conductor, a sending condenser, a shunt across the sending condenser, a self-inductance shunt at the receiving end of the conductor, a receiver, and means whereby positive and negative currents of varying duration are applied to the conductor.

796,597. Telegraphic Receiver. Alexander Muirhead, Shortlands, England. Application filed December 13, 1901.

An oscillating receiver coil is combined with a stretched conductive wire movable therewith. There are contacts against which the wire works and a signal circuit is connected with these contacts.

796,606. Electromechanical Regulator. Joseph L. Routin, Lyon, France. Application filed July 17, 1901.

In a device for simultaneously regulating prime mover and current generators at central stations, the combination of a prime mover, a current generator driven thereby supplying current to a working circuit, an exciter circuit for this generator, means for gradually and progressively regulating the resistances in the exciter circuit, means for gradually and progressively regulating the driving power of the prime mover, and means for simultaneously actuating both the regulating means of the prime mover and of the current generator, whereby mechanical and electrical regulation can be simultaneously effected at a single operation.

796,607. Device for Applying Sterilizers to Mouthpieces. Orrin H. Savage, New York, N. Y. Application filed September 1, 1903.

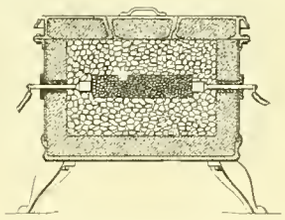
An absorbent diaphram extends across the mouthpiece of, say, a telephone.

796,628. Illuminated Sign. Daniel F. Duck, Chicago, Ill. Application filed June 27, 1904.

This sign has letters provided with outer and inner transparent side walls and opaque front walls. The light passes laterally from the sides of the letters to illuminate the front face of the sign panel.

796,629. Lamp Guard. Thomas A. Edison, Llewelyn Park, N. J., assignor to the New Jersey Patent Company, Orange, N. J. Application filed August 1, 1903.

This lamp guard is in two sections. One engages with the lamp and the conducting wires; the other is pivoted to the first.



NO. 796,684.—ELECTRIC HEATER.

796,637. Combined Electric Motor, Rheostat and Belt Tightener. Herman S. Graber, St. Louis, Mo. Application filed December 8, 1904.

This device comprises a pedestal, a motor surmounting the pedestal, a rheostat surmounting the motor, a switch mounted upon the motor, and a belt tightener consisting of an arm pivoted at one end to said motor, a roller journaled to the free end of the arm, and a spring supporting the free end of the arm.

796,646. Time-limit Circuit Controller. Edward M. Hewlett, Schenectady, N. Y., assignor to the General Electric Company. Application filed May 12, 1903.

A time-limit device comprises an operating solenoid, a timing device to regulate the movement of the core, a stop to arrest motion at a determinate core position, and means for varying the air gap in the magnetic circuit when the core attains this position.

796,675. Recording Instrument. Maurice C. Rypinski, New York, and Lewis T. Robinson, Schenectady, N. Y., assignors to the General Electric Company. Application filed March 30, 1903.

In combination, a moveable meter element, a curved marking element carried thereby, means for moving a record surface in proximity to the marking element, and means for causing different portions of the curved marking element to engage the record surface for different positions of the meter element.

796,684. Electric Heater. Elihu Thomson, Swampscott, Mass., assignor to the General Electric Company. Application filed January 13, 1905.

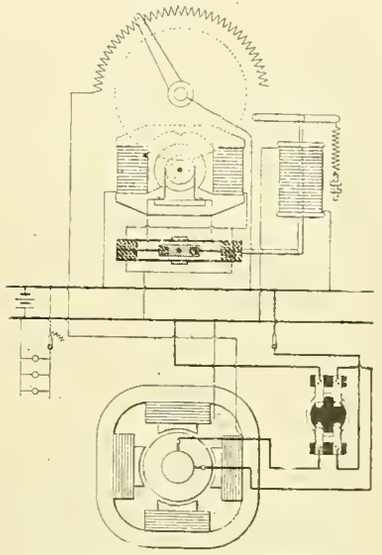
An electric stove comprising a lumpy mass of refractory material, an electrical resistance for heating this mass, and a heat-insulating jacket surrounding the mass. (See cut on preceding page.)

796,687. Circuit Controller. Howard B. Wilson, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed April 18, 1903.

In combination, a vessel, a quantity of liquid and a piston contained therein, a switch-actuating member, and a connection between the piston and the switch-actuating member so arranged that a movement of the piston in one direction only will operate the switch-actuating member.

796,697. Trolley Catcher. Seth J. Buckland, Springfield, Mass. Application filed January 30, 1905.

Features described are a case, a member mounted to reciprocate therein, a reel carried by this member, a mainspring adapted to rotate the reel in one direction, and a stop to prevent rotation in the opposite direction when the reciprocating member is moved out of normal position.



NO. 796,749.—CAR LIGHTING.

796,701. Electric Clock. Ragnar Carlstedt, Jersey City, N. J. Application filed September 1, 1904.

This electric clock has a base, two hollow columns supported on the base, an electromagnet having its pole pieces supported on the tops of the columns, the coils of the electromagnet being inclosed in the respective columns, and a frame for the clock mechanism supported on the pole-pieces.

796,702. Pole-piece. Alexander Churchward, New York, N. Y., assignor to the General Electric Company. Application filed October 25, 1902.

In a dynamo-electric machine, a pole-piece having a triangular slot formed in it, this slot being located near the face of the pole and drawn parallel to the axis of the armature of the machine, with one flat side of the slot substantially parallel to and closely adjacent to the pole-piece.

796,728. Railway Signaling Device. Joseph Irwin, St. Louis, Mo. Application filed September 13, 1902.

One of the rails of the track is bonded and divided into sections or blocks insulated from one another to provide stations. The other rail is provided with insulation at all the joints. A partial circuit connects two sections and a partial circuit on the train comprising electrical instruments, while a wire gives connection with wheels riding over the bonded rail of the track.

796,749. Electric Car Lighting. James F. McElroy, Albany, N. Y., assignor to the Consolidated Car Heating Company, Albany, N. Y. Original application filed February 20, 1899. Divided and application filed September 9, 1901. Again divided and this application filed October 6, 1902.

The combination of a storage battery, a self-excited and reversible dynamo driven by an axle and having its field-magnet coils in a shunt circuit derived from the armature circuit, a switch for connecting the dynamo to the battery, a reversing switch in the armature circuit at a point between the armature terminals and the point of derivation of the field-magnet circuit, a mechanical connection between the switch and a reversible shaft, and means for interrupting the connection when a given speed is reached. (See cut).

796,753. Machine for Treating Ores. John R. Park, Spokane, Wash. Application filed August 20, 1903.

In this machine there are combined an outer shell forming a chamber and provided with an inner metallic portion and a second metallic element mounted adjacent to such inner metallic portion insulated therefrom and forming a chamber between such parts for containing a mixture having pulverized ore therein to be operated upon. There are means for connecting metallic elements to the negative and positive poles respectively of a source of electric supply, means for agitating the mixture containing pulverized ore to be operated upon, and means for forcing air into the chamber formed by the shell.

796,754. Process of Treating Ores. John R. Parks, Spokane, Wash. Application filed August 20, 1903.

The process of treating ores which consists in intermixing pulverized ore, cyanide of potassium and a fluid electric conductor and simultaneously passing a current of air and a current of electricity through the mixture and retarding the escape of the air from the mixture.

796,757. Electric Incandescent Lamp. William J. Phelps, Detroit, Mich., assignor to the Phelps Company, Detroit, Mich. Application filed April 25, 1902. Renewed June 5, 1905.

There are two or more filaments or sections, a base therefor, an axial internally-threaded nut and an axially-movable piece mounted on the lamp base constituting the two lamp terminals and arranged to engage with a central and an annular concentric terminal of a lamp socket for the reception of current, and a contact coacting with the movable terminal and arranged to receive current therefrom for modifying the flow of current to the separate filaments or sections.

796,760. Lightning Conductor. Frank E. Price, Chicago, and William H. McCullough, River Forest, Ill. Application filed March 6, 1905.

A cluster of points made of copper, the body of which is plated with gold, has a number of screw holes in it, into which are screwed the points, plated with platinum: body of the cluster has a neck through which is bored a hole lengthwise, and along the outside of which are bored a number of grooves in such a way that the strands of the conductor may be laid in them with the center strand going into the hole in the center, the neck and strands being covered by a copper collar which is sweated in.

796,797. Clamp for Attaching Ground Wires. George R. Blackburn, Cleveland, Ohio. Application filed October 21, 1904.

In a clamp for connecting a ground wire to a pipe a flexible strip is adapted to be looped around the pipe, a screw engaging the ends of the strip and arranged to bear at its foot against the pipe to tighten the strip.

796,817. Trolley Appliance. Frank P. Criner, Fort Wayne, Ind., assignor of one-third to Charles W. Stein, Fort Wayne, Ind. Application filed December 19, 1904.

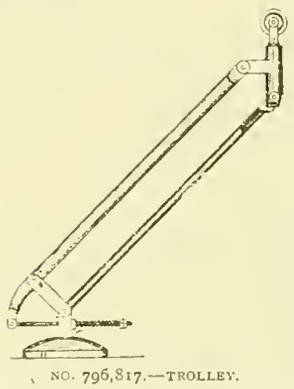
The essential feature of the device is the use of two parallel poles arranged as shown in the cut.

796,821. Switchboard for Meter Tests. Russell A. Dangler, New York, N. Y. Application filed December 9, 1904.

A switchboard for meter testing comprising switch means for cutting out the meter substantially without stopping the current flow, and means for inserting a testing instrument in the gap thus formed, the switchboard adapted, upon further manipulation, to cut in both instrument and meter.

796,851. Ruhmkorff Coil. John McIntyre, Jersey City, N. J. Application filed December 8, 1904.

A Ruhmkorff coil provided with a spring armature lever carying a contact portion, a bar arranged at an angle to the armature lever and carrying a contact portion for engagement by the armature contact portion, and a bearing for the bar to slide in and for holding the bar against turning to maintain the faces of the contact portions at all times in the same straight-line registering portion.



NO. 796,817.—TROLLEY.

796,853. Combined Fixture Support and Canopy. William H. Nichols, Bennington, Vt., assignor of one-half to Elmer Ellsworth Larrabee, Bennington, Vt. Application filed January 9, 1904.

Details are described.

796,867. Synchronizing System. Paul Ribbe, Halensee, near Berlin, Germany. Application filed December 16, 1904.

The first claim is given in full: "In a synchronizing system, the combination of a revoluble disk located at a transmitting station and provided upon its periphery with an armature, means for actuating the revoluble disk, an electromagnet disposed adjacent to the path of the armature, a line connecting the magnet with the ground, a revoluble disk disposed at a receiving station, the last-mentioned disk being provided with a radial slit and also provided with an armature mounted upon its periphery, an electromagnet disposed adjacent to the path of the last-mentioned armature, a screeen provided with a slit and disposed adjacent to the last-mentioned disk, a light-controlled cell disposed at a distance from the slit of the last-mentioned screen, a source of light upon the opposite side of the last-mentioned revoluble disk and in alignment with the slit of the last-mentioned screen, a conductor connecting the light-controlled cell with the ground, another conductor connecting the light-controlled cell with the electromagnet at the receiving station, a transmission line connecting together the electromagnets at the different stations, and a battery for energizing the conductors and the line."

796,869. Trolley Wheel. John C. A. Riecke, Baltimore, Md. Application filed January 14, 1905.

Guard plates on the sides of the trolley wheel have beveled edges to direct the wire to the wheel.

796,872. Electroplating Device. Henry Schuessler, Peru, Ill., assignor of one-half to Emil Stroemer, Peru, Ill. Application filed September 17, 1904.

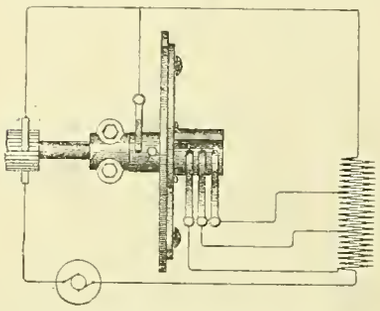
Features are a horizontally inclined tank, an anode supported therein, a plate-receiving carrier movable longitudinally of the tank and adapted to enter beneath the anode, and means for establishing an electric circuit through the latter and the carrier.

796,904. Thermostatic Circuit Controller. Henry A. Fiske, Newton, Mass., assignor to the Eastern Fire Protection Company. Application filed November 16, 1903.

In a thermostatic circuit-controlling device, the combination of a cup-shaped body portion, providing a solder-retaining receptacle, a ring of fusible solder contained therein and located adjacent to the walls thereof, and circuit terminals located at the interior of the ring in position to be electrically connected by contact with the solder when melted.

796,922. Electric-light Fixture. Robert W. Morgan, Yonkers, N. Y., assignor to the Providence Gar Burner Company, Providence, R. I. Application filed March 9, 1905.

Details are described.



NO. 796,935.—CURRENT GOVERNOR.

796,935. Electric-current Governor. Henry K. Sandell, Chicago, Ill. Application filed December 21, 1904.

In combination with an electric circuit containing resistances having contact terminals, a current governor having a head formed of relatively separable and approachable contact making and breaking members actuated by variation in the speed of rotation of the governor to approach one another under increasing centrifugal force and thereby contract the head away from the terminals, and to separate and expand the head toward the terminals under decreasing centrifugal force. (See cut.)

796,944. Heater. Harry S. Stewart and Margaret A. Wilcox, Chicago, Ill. Application filed December 19, 1903.

This heater comprises adjacently-located boilers, electric-heating coils submerged in the water contained in the boiler when in operation, hot-water pipes located in the steam spaces of the boilers and a cut-off-controlled connection extending between the boilers.

796,972. Rail-bond. Edward B. Hunter, French Village, Ill., assignor of one-fourth to Frank Simonin, French Village, Ill. Application filed December 15, 1903.

Details are described.

796,977. Insulator Pin. Fred M. Locke, Victor, N. Y. Application filed September 25, 1902.

A pin for high-potential insulators, comprising a shaft secured to and projecting from the cross-arm, and a sleeve closed at its upper end, and resting on the shaft and having a portion of the upper end of equal diameter and fitting snugly with the shaft and its lower end resting upon the cross-arm, but separated from the base of the shaft to form an air space between the sleeve and shaft and to afford a broad bearing on the support around the base of the shaft.

EXPIRING PATENTS.

Following is a list of electrical patents (issued by the United States Patent Office) that expired recently:

EXPIRED AUGUST 7, 1905.

387,276. Electric Clock Synchronizer. A. G. Wiseman, St. Louis, Mo.

387,286. Apparatus for Treating Noxious Gases with Electricity. Hartley Fewson, Buckingham, County of Bucks, England.

387,310. Electromechanical Movement. R. H. Mather, Windsor, Conn.

387,343. Dynamo-electric Machine and Electric Motor. R. E. B. Crompton, London, England.

387,347. Amalgamator. A. H. Eysaman, Dayton, Nev.

387,365. Electric Switch-lock. E. L. Orcutt, Somerville, Mass.

387,382, 387,383. Electric Railway System. D. G. Weems, Baltimore, Md.

387,432. Armature for Dynamo-electric Machines. A. W. Meston, St. Louis, Mo.

387,463. Electric Regulator. J. A. Vansant and F. S. Anderson, Easton, Md.

387,464. Regulator for Electric Currents. J. A. Vansant and F. S. Anderson, Easton, Md.

387,505. Method of Measuring Electricity. G. Forbes, London, England.

387,526. Electric Switch. J. F. McElroy, Lansing, Mich.

387,610. Electrically Driven Car. J. Weis, Jersey City, N. J.

387,615. System of Combined Arc and Incandescent Electric Lights. H. P. Brown, Chicago, Ill.

EXPIRED AUGUST 14, 1905.

387,636. Mechanical Telephone. M. Garl, Canton, Ohio.

387,642, 387,643. Galvanic Battery. E. M. Hewett, Boston, Mass.

387,645. Multiple Switchboard. M. G. Kellogg, Hyde Park, Ill.

387,654. Jar for Galvanic Batteries. B. Overlack, Boston, Mass.

387,679. Electrolite for Galvanic Batteries. D. H. Fitch, Cazenovia, N. Y.

387,714. Electric Motor. B. A. Fiske, U. S. Navy.

387,732. Electric Cut-out. J. A. Powers, Lansingburgh, N. Y.

387,830. Galvanic Battery. G. T. Woods, Cincinnati, Ohio.

387,853. Regulator for Dynamo-electric Machines. C. L. Buckingham, New York, N. Y.

387,888, 387,889, 387,890. Multiple Switchboard. M. G. Kellogg, Hyde Park, Ill.

387,974. Electric Clock Synchronizing System. A. H. Hexamer, Philadelphia, Pa.

387,988. Apparatus for Charging and Discharging Secondary Batteries. M. Pfatischer, Philadelphia, Pa.

388,004. Method of Measuring Alternating Electric Currents. O. B. Schallenberger, Rochester, Pa.

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Hydro-electric Development of the Lakes of the Joux.

By C. Smith.

Among the recent important hydro-electric installations in Switzerland, that of Lake Joux and the River Orbe deserve special mention. The valley of the Joux, situated in the Jura Mountains, at an altitude of 1,000 meters, forms a natural reservoir whose area is about 211 square kilometers. The water collecting in this valley forms a lake of about 10 square kilometers area, with a maximum depth of 34 meters. A peninsula divides this lake into two smaller parts, called Lake Joux and Lake Brenet. The Orbe, which unites with small streams and the large rivers of Brassus and Lyonne, is the principal river flowing into these lakes, which are also fed by many subterranean streams. The water level varies greatly during the year, being extremely high in spring on account of the snow melting on the mountains, and also in autumn after the heavy rains. The lowest level is in the middle of the summer and in winter. The variations take place, however, very rapidly, rising as high as two meters in 10 days.

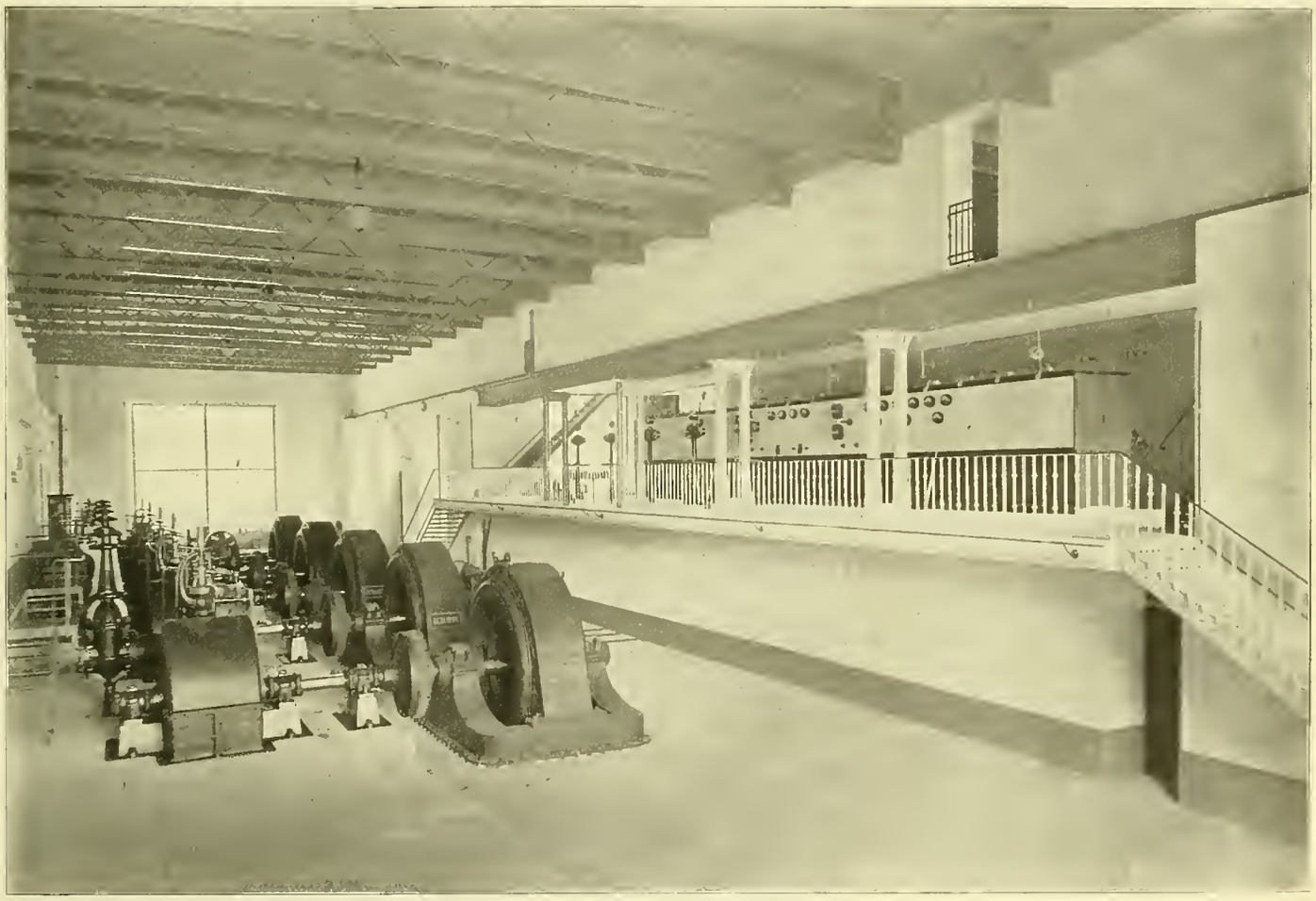


FIG. I. HYDRO-ELECTRIC DEVELOPMENT OF THE LAKES OF THE JOUX.—VIEW SHOWING INTERIOR OF LA DERNIER STATION.

There are many subterranean exits which aid in controlling the height of the water, some allowing it to flow through them when the level is higher than their mouth, while others constantly permit the passage of the water. But in order to avoid all danger of an inundation of the valley of the Joux, due to these rapid variations in level, it was deemed advisable to create a means of artificial drainage, as it might be called, and the next step was naturally to utilize the water for generating electrical energy, since a head of about 220 meters existed between the lakes and the River Orbe.

The problem to be solved was to construct a canal with regulated output, allowing sufficient water to pass through to prevent all danger of a flood in the valley and at the some time maintaining the water level of the lakes constant; also supplying the power for a hydro-electric station. The works have been constructed according to this plan by Mr. Palaz, an eminent Swiss engineer. In considering the plans, Mr. Palaz took into consideration the changes in level for the last 50 years, and calculated from that, the area of the lakes being known to be 10,000,000 square meters, the amount of water which the canal would have to care for as a maximum. It amounted to about 18,000,000 cubic meters of water in 10 days, or about 21 cubic meters per second, and on this figure he based his estimates of the size of the canal. Taking into consideration also the fact that in time of low water the power house would have to be supplied with water, he provided for a minimum output of 1,600 liters per second, or a flow of three cubic meters per second. The fact that the subterranean exits and the amount of water flowing through them were also items of great importance clearly show that the problem was not by any means a simple one.

In order to regulate the flow as closely as possible, it was decided that these subterranean tunnels would have to be closed up, and dams were erected for this purpose, with gates controlling the regulation of the output. At one of these places a saw mill driven by a 12-horsepower turbine waterwheel and dynamo has been installed.

The intake of the large canal is located at the northern extremity of Lake Brenet at La Tornaz. The channel has a width varying from one meter to 1.80 meters, with masonry sides inclined at an angle of 45 degrees. In order to facilitate the construction of this channel the water level of Lake Brenet was lowered considerably by means of the subterranean exits. The bottom of the bay is over 1.5 meters below the level of the lake at low water, and this assures a good output at all times of the year. A dam at the end of the channel permits the closing and opening of the intake. An attendant is constantly in charge of the apparatus at the intake, being in telephonic communication with the power house.

The canal which leads from the intake is entirely subterranean and is 2,632 meters in length. It traverses the chain of mountains which separate Lake Brenet and the valley of the Orbe, having a length of 971 meters in this part. It has a uniform gradient of three per cent. The rock through which it is cut is varied in character, but is principally limestone, which has been reinforced. The mean section of the tunnel is about 5.7 square meters, being 2.2 meters in width and 2.6 meters in height. It has an output of 20 cubic meters per second. A wooden foot bridge with iron supports has been placed in the tunnel, 50 centimeters above the bottom, to facilitate inspection. The last part of the canal, near the reservoir, forms a settling basin. The reservoir into which it empties is constructed out of the solid rock and is 13 meters long; the water at a slow speed flows from it into a gallery which conducts it to two conduits. The water also flows into a rectangular chamber, and thence into a high-pressure conduit, the flow of water being regulated by valves. An attendant is continually in charge here.

The two conduits are each 722 millimeters in length, and between their mouth and the exit the water has a fall of 237 meters. Their interior diameter is 0.850 meter throughout the entire length, exclusive of the first 100 meters, which is a conical section, with a diameter of 1.4 meters. Each conduit has an output of about 10 cubic meters per second. The steel plates of which the conduits are constructed have a thickness of nine millimeters. This thickness is said to be rather high for a low-pressure conduit, but enables the pipes to withstand

the shocks and concussions produced by the rapid entrance of water. A special valve controls the flow. The pipes are supported on masonry foundations.

The fall at the power house is 236 meters in all, but in reality only amounts to a useful head of 234 meters. With an efficiency of 75 per cent. for the turbines and a flow of 430 liters per second, this produces 1,000 horsepower, but since the flow is always greater than this, the power developed amounts to from 6,740 horsepower to 3,720 horsepower. A much greater load, however, can be easily carried for a short time. In Swiss plants like this

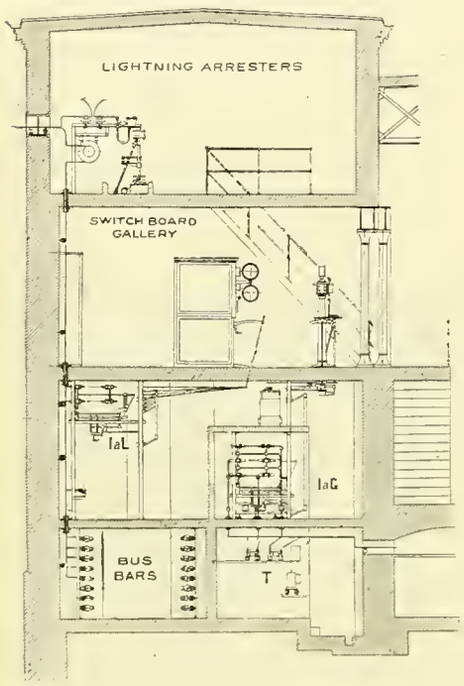


FIG. 2. CROSS SECTION OF SWITCHBOARD GALLERY IN LA DERNIER STATION.

one at La Dernier the electric-lighting load is an important factor, and the station has to produce a maximum of power each evening, especially in December and January, 9,000 to 17,000 horsepower being generated at the shafts of the turbines at times of heaviest load. In winter, when the mountains and valley of the Joux are covered with snow, the rivers supplying the lake are at their lowest level, while at the same time the demand for power is at a maximum. This has been provided for, and an average output of approximately 4,000 horsepower can be reckoned upon, with a maximum of 10,000 horsepower, for which 10 1,000-horsepower turbo-alternator sets will be ultimately installed. The third conduit, mentioned before, will then serve as a reserve.

The station proper is situated at La Dernier, on the right bank of the Orbe, with the engineers' dwellings on the left bank. The main room (Fig. 1) is 55 meters in length and 12.5 meters in width, with a height of 10 meters. It is served by a 10-ton traveling crane. The water from the turbines leaves through an underground tunnel, another conduit placed beside it being utilized to carry the cables. Space is provided for 10 turbo-alternator sets and three exciter groups. The switchboard gallery is installed in the front of the building, apart from the machines. The building has three floors and an underground room, and is of iron construction.

At present seven turbines are installed. Five of them are of the horizontal type, with a capacity of 1,000 horsepower each, at a speed of 375 revolutions per minute and a head of 234 meters. They are direct-connected to the alternators. The two other turbines are also of the horizontal type, with a capacity of 150 horsepower each at a speed of 750 revolutions per minute. They drive the exciters (Fig. 4). Escher, Wyss & Co. of Zurich supplied these Pelton wheels, which are furnished with automatic governors. They are guaranteed to have an efficiency of 78 per cent. at full load, 76 per cent. at three-quarters load, and 74 per cent. at half load. Tests have shown, however, that the efficiency of these 1,000-horsepower turbines is 80 per cent. The speed variation is one per cent. at normal load and four per cent. for a variation of 25 per cent.

The alternators were supplied by the Oerlikon Company of Zurich, Switzerland, and generate a three-phase current at 13,000 volts pressure and with a frequency of 50 periods. They have a fixed field, and the diameter of the armature is 1,980 millimeters, the air gap being 10 millimeters across. They have 16 poles (see Fig. 3). The machines were tested, after being installed, at an overload of 30 per cent. for eight consecutive hours. The rise in temperature was 35 degrees over the surrounding air. The insulation was also subjected to tests at a tension of 30,000 volts for one hour. Two new machines of the same type, but 1,600-horsepower capacity, are now being constructed to supplement those now installed.

The two exciters are eight-pole machines and are directly coupled to the 150-horsepower horizontal turbines. They have an output of 800 amperes at a pressure of 90 volts. Their efficiency is 92 per cent. at full load.

The accompanying drawing (Fig. 2) is a cross-section of part of the station, showing the arrangement of the switchboard gallery, lightning arresters, bus-bars, etc. The gallery is slightly above the level of the main floor, so that the attendant can look over the room. The high-tension apparatus is on the first and second floors, while the lightning arresters are on the fourth. Fig. 5 shows one of the high-tension circuit-breakers.

Another plant has been erected at Montcherand very recently to work in conjunction with the one at La Dernier. It also utilizes the waters of the Orbe. A canal 3.6 kilometers in length and a conduit 780 meters long produce a fall of 98 meters, the amount of power available varying between 3,000 horsepower as a minimum and 8,000 as a maximum. There are four 2,000-horsepower turbo-alternator groups to be installed in all, one of which will be held in reserve.

A reservoir of 15,000 cubic meters will assure a constant flow. This Montcherand plant is now nearly constructed and will be finished by 1906.

In considering the transmission of the current it is necessary to bear in mind that Switzerland is the home of many small industries, scattered over a wide area. The power must consequently be transmitted at a high tension to numerous small transforming stations, where it is reduced in pressure and distributed. The tension used in this case for transmission over the primary line is 13,500 volts, and the large area over which it is distributed in this particular instance is even noteworthy for Switzerland. The two plants supply a population of about 92,000 in 212 Swiss communes, and the principal village contains but 4,900 inhabitants. There are in all 235 sub-stations utilized. The total high-tension network of wires is about 600 kilometers in length. The tension chosen, 13,500 volts, was deemed the best in this case, on account of the numerous sub-stations and the fact that air-cooled transformers could be used, only one transformation, moreover, being necessary before redistribution.

These transforming stations are of two distinct types. They all consist of a ground floor and upper room, in which the lightning arresters and bus-bars are installed. The lower room contains the transformers. They are 10 and 20-kilowatt single-phase machines in stations of the first type, although some have a capacity as high as 50 kilowatts. They are of the oil-insulated type and have been tested at a pressure of 30,000 volts. The current is stepped down to 230-260 volts. In stations of the second class the transformers used are three-phase and vary in capacity from 20 to 50 kilowatts,

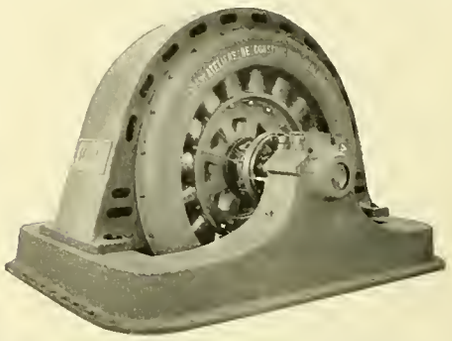


FIG. 3. 1,000-HORSEPOWER ALTERNATOR IN LA DERNIER STATION.

reducing the pressure to 400 volts. This current is used for power purposes more particularly. Part of the current is also utilized for agricultural purposes, specially constructed single-phase motors being utilized. The canton of Vaud, in which these two new stations have been installed, has developed its hydro-electric resources to quite an extent, over 43,000 horsepower being at present available, and it is noteworthy to what an extent this has aided in the development of this section of Switzerland.

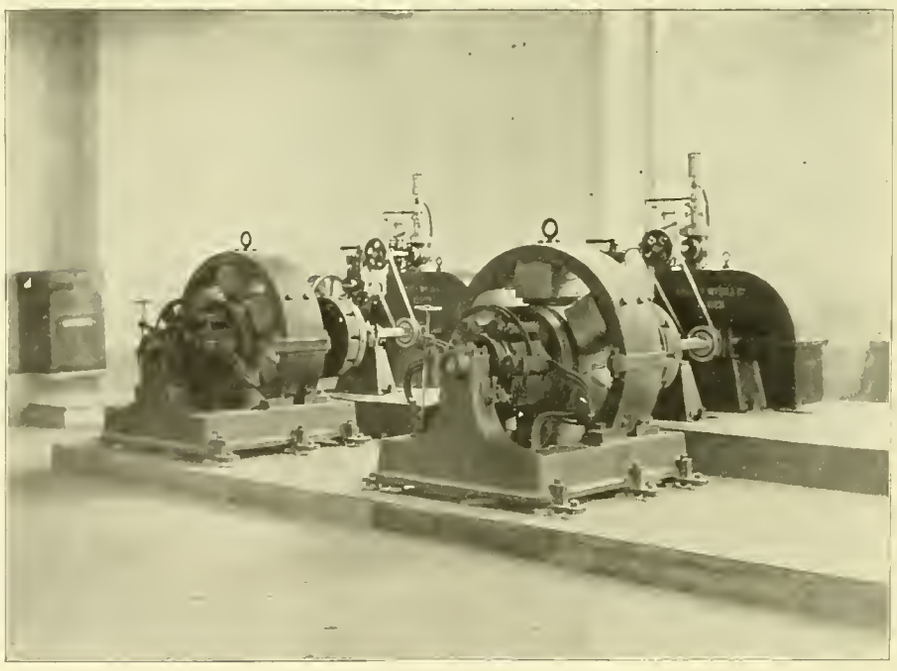


FIG. 4. EXCITERS IN LA DERNIER STATION.

Engineers' Report on Chicago Freight Tunnels.

The noticeable sinking of streets in certain parts of the Loop district of Chicago and the settling of a few large buildings was thought by some engineers to be due to the existence of tunnels in this part of the city. To find out what relation the tunnels bore to the depressions in the streets and to ascertain if the Chicago Subway Company (controlling the Illinois Tunnel Company) has been fulfilling the requirements of its franchise, Commissioner of Public Works Patterson appointed a commission of three engineers to make a thorough investigation of the subways. The commission was composed of John M. Ewen, E. C. Shankland and L. E. Ritter, and the results of their investigation were made known in a letter addressed to Mr. Patterson a few days ago.

Readers of the Western Electrician are acquainted with the development of the tunnel project, but it may be well to mention a few points before summarizing the report made by the investigation commission. The original franchise for the construction of the subway was granted in 1899 to the Illinois Telephone and Telegraph Com-

pany. This company was given the right to install a telephone system—the present automatic system—and the object of the tunnel as then stated was for a convenient underground passageway in which to string cables and wires, and in which the city could also place its pipes and wires. Permission to rent space to other wire-using companies was also granted. The bore was to be six feet by six feet seven inches, and about 30 feet below the surface of the street. Permission was later granted to put in certain "trunk tunnels" about 12 by 14 feet. The walls and floors of the entire tunnel are of substantial concrete construction.

A number of miles of the subway had been constructed and the work of installing the telephone cables was well under way when the officials of the company conceived the idea of combining the telephone project with an underground freight service and using the tunnels as a subway in which to operate small electric cars. Application was made to the City Council, and in 1903 a new franchise granting, besides the telephone privileges,

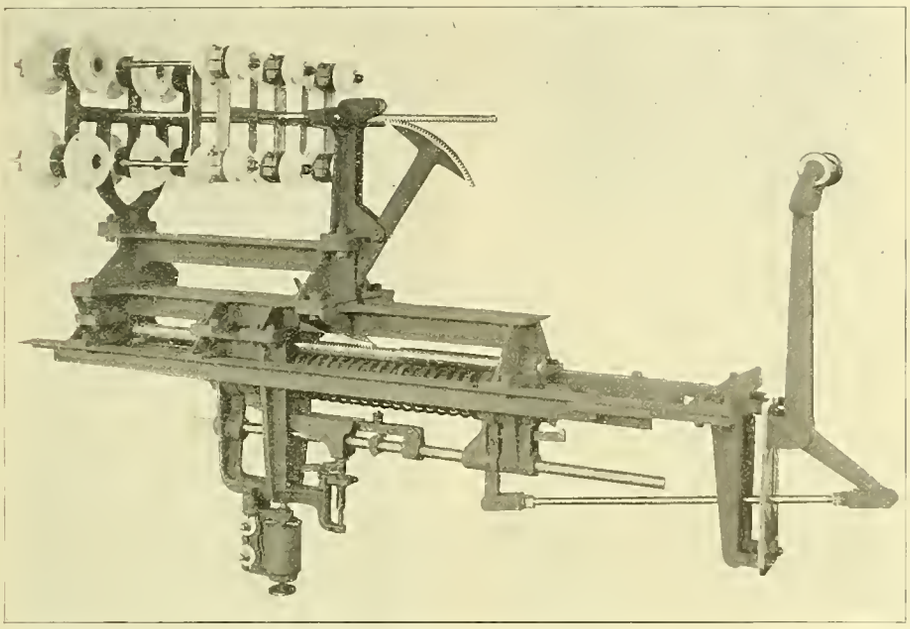


FIG. 5. HIGH-TENSION CIRCUIT-BREAKER IN LA DERNIER STATION.

the right to operate underground cars for carrying newspapers, parcels and merchandise was given to the Illinois Tunnel Company, which company about this time took over the Illinois Telephone and Telegraph Company.

Under its new grant the new company continued to develop and extend the subway until now it has an extensive system of underground electrically operated railways. Thousands of tons of excavation and building material are being hauled from and to the sites of new buildings in the Loop district through the tunnel; contracts have been made with various firms for transporting merchandise between their basements and the railroad terminals, and preparations have been made for transferring the United States mail through the tunnel instead of by wagon. Complete illustrated descriptions of the tunnel, including the telephone and freight features, together with the electric-railway system, have been printed from time to time in the Western Electrician.

In November, 1904, the Illinois Tunnel Company was taken over by a holding company known as the Chicago Subway Company and capitalized at $50,000,000. The new company is backed by the leading steam railroads entering the city, and many of the steam-railroad terminal yards have been connected with the subway.

Figures taken from the report of the investigation commission indicate that the company now has 33 miles of completed tunnel, and extensions are being made at the rate of 500 feet a day. Telephones to the number of 6,725 are now in use and cables and wires have been placed in buildings and connected with the tunnel system for 30,000 subscribers.

The report of the commission charges the company with practicing deception on the city and public and also says that the city government has been lax in regulating the construction of the system. The entire system of tunnels, says the report, has been constructed without the submission to the city of proper plans and specifications.

Other charges which the commission makes are: Tunnels and various sections of underground work have been found to exist for which no permits are on record at the City Hall; City Engineer Erickson was deceived into granting permission for the construction of the 12 by 14-foot tunnels, which were without authority of ordinance; there are no regulations for the protection of life and limb in the tunnels, and there are no emergency exits; settling of a number of down-town buildings and portions of streets may be traced to the construction of certain portions of the tunnel without air pressure. The commission expresses its inability to pass on the strength of the construction on account of the absence of specifications.

Further the investigators say: "In regard to the effect of these tunnels on the streets and buildings of Chicago, we would say that the work in the downtown, or Loop district, may be properly divided into two parts—first, the construction of tunnels, built chiefly between 1900 and 1902, which were constructed under air pressure; and, second, the construction of connections and by-passes from these tunnels, which have been built more recently and without air pressure.

"The commission is unable to find any evidence of any settling due to the first part of the work—that is, the building of the main line tunnels under air pressure. Any such settlement would result from two causes: First, a movement of the clay above during the process of excavation, or through faulty ramming of the concrete. Such a movement would take place at the time the work was being done or soon afterward.

"The other cause of settlement would be the shrinkage of the clay due to the drawing therefrom of the water. This seepage would be slow, as would also be the resultant settlement. The seepage through the tunnel walls would be apparent of course in the tunnels. As a matter of fact, the tunnels were found to be fairly dry and much of the moisture to be due to condensation. We have information from trustworthy sources that the tunnels at all times have been fairly dry and, as a large part of the tunnels in the downtown district have been finished for three years, it would seem that the danger of settlement, due to the drainage of the clay, has little evidence to support it.

"In regard to settlement due to the second part of the work, that is, the building of connections, by-passes and new drifts, without air pressure, the evidence is at hand and convincing. A number of cases of the settlement of streets and buildings were traced to this part of the work, and unless some other means of operation are adopted or the greatest care used in construction, there may be further settlements. The commission has not had sufficient time to prepare a plan for minimizing the danger, and therefore has no remedy to offer at present.

"If the tunnels have been built in accordance with the cross-section submitted," continues the report, "and if the work has been properly carried out, we consider their strength to be ample But the physical condition of an engineering structure is manifested by its plans and specifications and the evidence that these plans and specifications have been carried out. This evidence is not available in this case, but we would say that the concrete work appears to be of the best material and workmanship and we have no reason to believe it otherwise.

"The control and supervision by the city of the work of building these tunnels has been lax when compared with similar work done for private individuals or corporations. Ordinary practice demands definite official plans and specifications and a sufficient force to supervise the work properly at all points and at all times; while in this case there were no definite plans and specifications and there was but one city representative in supervision of the entire work.

"We find the city records of the work incomplete. For example, we have been unable to find any written specifications either of the cement or the concrete. We also find the city has no official survey showing the exact location of the tunnels. We also find that no attention has been paid to the time clause in the ordinance."

The engineers also investigated the financial condition of the company, stating in their report that as a result of the investigations of an expert employed by them the company is overcapitalized to the extent of probably 85 per cent. of its total issue of $57,000,000 stock and bonds. The entire cost of the tunnels and acquired property is said to be not more than $8,000,000.

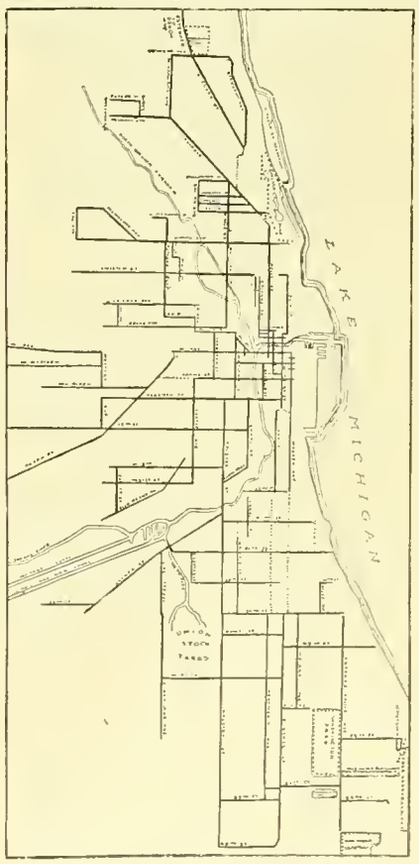
When questioned in relation to the report of the investigating engineers Albert G. Wheeler, president of the tunnel company, expressed surprise that the commission should examine into the company's financial affairs. "This talk of overcapitalization is without foundation," said he. "Why, we have distributed over $12,000,000 in salaries and wages since we began the construction of the tunnels, and that is only a fraction of the total cost. As for the sinking of the streets, the tunnel is not to blame. Only an infinitesimal amount of excavation has been done without air pressure. At the worst $5,000 would cover the damage wrought by the settlement."

It is interesting to note that the Board of Review, which reviews assessments for taxation, has placed a valuation of $500,000 on the property of the company. On the report of an engineer the board placed the assessment as follows: All apparatus in exchange and at subscribers' places, including power, switchboards, automatic switches, service wires, etc., $275,000; cable in tunnels, $150,000; electric freight railway, including track, conductors and rolling stock, $75,000. Mr. Lewis, the corporation counsel, says, however, that the reviewers have failed to assess the tunnel as a property and, in his opinion, the company should pay taxes on at least $20,000,000.

City Engineer Ericsson has made some recommendations for the better supervision of the work which are being considered, and it is probable that a further investigation of the financial methods of the company will be made before final action is taken on the engineer's report.

Chicago Street-railway Situation.

Negotiations between the street-railway companies and the city were broken off last week without accomplishing anything. It is intended to have another meeting of the traction representatives with the local transportation committee next Monday and in the meantime the committee is considering Mayor Dunne's plan for a competing municipal street-railway system which he proposes to have the city build in case no satisfactory agreement is reached with the companies.



OUTLINE OF CHICAGO'S PROPOSED 264-MILE MUNICIPAL STREET-CAR SYSTEM.

The report of A. B. Dupont, the traction expert

who has been working out the plans for the mayor's proposed municipal system, will not be handed to the transportation committee of the council until the Western Electrician is on the press, but some of the details contained in the report have become public. The accompanying map shows the proposed route of the Dunne-Dupont system. It is a system of about 264 miles, the dotted lines showing streets on which there are now no tracks, but which it is proposed to use as connecting links.

The map shows the most radical changes on the south side. On the west and north they follow the Grosscup decision as to the rights of the companies under the "99-year act," except that it is proposed to use Wells Street as part of the municipal system, and Judge Grosscup held this street was protected by that act. La Salle Street, however, is offered as an alternative if Wells is not available.

The entire south-side system hinges on the city's

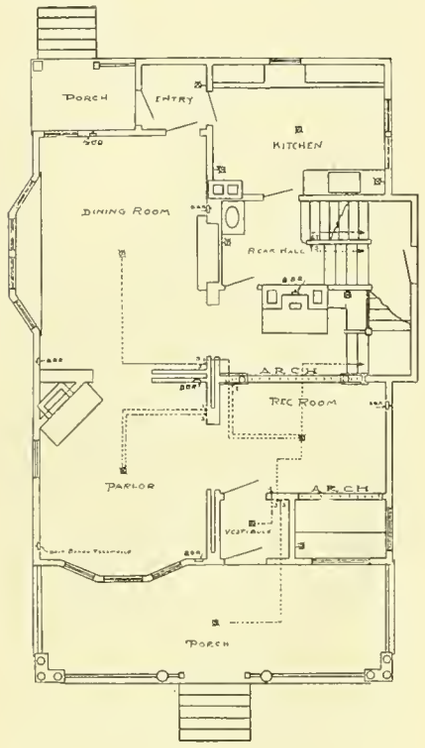


DIAGRAM OF LIGHTING ARRANGEMENT FOR FIRST FLOOR.

being able to use Wabash Avenue from Lake to Twenty-second Street, a thoroughfare the Chicago City company says it will not give up without a legal fight carried to the courts of last resort. The plan is to carry the municipal line down Wabash Avenue to Thirty-ninth Street, then branch in Thirty-ninth Street to Cottage Grove Avenue and State Street, continuing south in these streets to Seventy-first and Seventy-second streets. Cross-town lines are also contemplated in Thirty-first and Thirty-fifth streets, where the city claims the franchises have expired. It is said, however, that if legal difficulties arise in the attempt to use Wabash Avenue the report will recommend the construction of a subway. A complete system of subways for the downtown terminals is also one of the possibilities of the plans.

On the southwest side it is planned to use Harrison Street to Halsted and Halsted south, across the bridge to Sixty-ninth Street, also Archer Avenue from Halsted Street to Western Avenue. It is also proposed to use Twelfth Street west to Ogden Avenue and Ogden Avenue to Fortieth.

On the west side the streets west of Western Avenue are available, with Grand Avenue as a part of the municipal system, but the northwest side is practically omitted from the plan of the proposed municipal line.

The north side will be served by utilizing either the present lines in Wells Street or a parallel one in La Salle Avenue, a diagonal line in Evanston Avenue reached by connections made in North Halsted Street, and the Wabash Avenue line on the south side extended by way of North State Street to the north side. There is a chance for another legal fight in this last plan, however, as Judge Grosscup decided that the rights of the Chicago City Railway Company in State Street extend to the middle of the river.

The cost, in a lump sum, is placed at $25,000,00. The profits are estimated to be in the neighborhood of 10 per cent. on this investment.

Mr. Dupont favors the overhead trolley and on this point spoke of the report as follows:

"Cables are admittedly an antique and costly method of operating a street railway. Underground trolleys are exceedingly expensive to install and are not successful except where the sewerage system is excellent. It would be hardly possible for Chicago to install a fine sewerage system in the outlying section in order to make practicable the operation of an underground trolley line. In the downtown section the ultimate method of street-railway transportation will undoubtedly be by subways. It will take years to devise, finance and build a system of downtown subways, yet any method of street-railway operation which is put in now must be installed with the realization that sooner or later it will have to be torn out and thrown away to make room for the subways. The costliness of underground trolleys would make that system too expensive to install for merely temporary use.

"Trolleys are the cheapest to put up and to operate. Besides they are not as dangerous as generally supposed. Most trolley systems now are maintained with a power of 500 volts. That voltage would not kill anybody in case a wire breaks except under most peculiar conditions. The overhead wires are an artistic drawback, but the poles need not be an eyesore if they are straightened and kept painted. They could also be made very useful by using them to carry small clusters of incandescent lights to take the place of the arc lights that are now usually a block apart."

Some Practical Suggestions on the Wiring of Residences, and Facilities for Increased Use of Electricity.[1]

By J. Kermode.

The novelty of electricity in the household for illumination or for other purposes has worn off, and in most cities where there is an electric-light company with any degree of enterprise, it has become a usual form of illuminant in competition with gas. This in different cities is so to the degree which the central stations have, by one means or another,

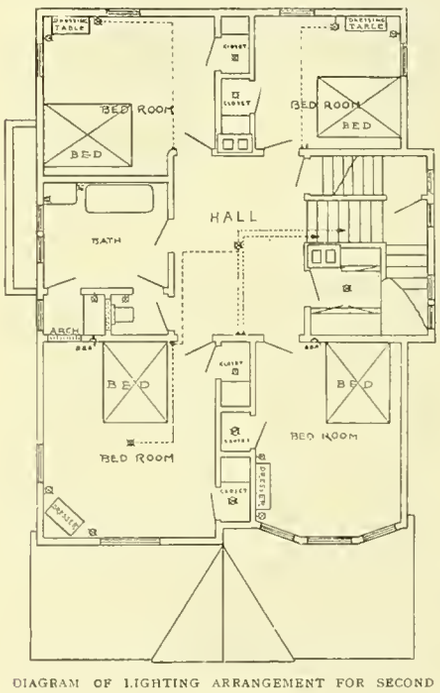


DIAGRAM OF LIGHTING ARRANGEMENT FOR SECOND FLOOR.

advertised to their consumers the advantages of electricity.

It is generally conceded that if the advantages which can be attained by the use of electricity as an illuminant, as a motive power and for general household purposes, can be drawn to the attention of the consumers of the supply company, so that they can realize these advantages, electricity in a residence field would become a source of profit.

Outside of presenting these matters to the public through advertising mediums, probably the most advantageous way of introducing electricity for general purposes in homes is by the inauguration of a policy which will supply to the prospective customers properly drawn-up plans and specifications for the use of electricity in their residences. The department which, or man who, is in charge of this business should be capable not only of figuring the size of wires and laying out the wiring of a new or old residence, but should be capable of suggesting to the consumer the most modern way of artistically and economically lighting his premises, and the treatment which will most effectually and pleasingly light each room.

In order that I may make myself more clear in pointing out the work which has to be done by this department, I have prepared a set of plans for a modern medium-sized residence, with suggestions as to the best arrangement of the lighting and other utilities.

The cost of wiring a house is not so important as the operating expense; therefore, the wires and their appliances should be properly installed. Lighting effects in each room must be studied, that the number of outlets and switches and their location may be decided upon. Before this can be determined in a new house the man drawing the specifications or plans for the wiring must be capable of determining the relative position of the heavier furnishings in each room. When the outlets and switches are located for the entire house it may be found servicable to write out a classification of lights by tabulating the centers, sides and baseboard outlets, also drop lights and switches, and by keeping a record of classification for several

A CONVENIENT LIGHT TO READ BY.

houses and comparing their relative cost for different classes of wiring a fairly close estimate can be made by simply glancing at the tabulation.

A prospective customer usually makes his first inquiry at the office of the supply company, and someone should be in a position promptly to inform him what would be most suitable for lighting his residence, with the approximate cost, which must necessarily be fairly correct. To be successful in this capacity the man must be thoroughly versed in the several methods of wiring that are employed, and the kind of appliances that would be best adapted for this purpose, and, in a general way give information that will assist. Undoubtedly the relations thereafter between the customer and the supply company will be more satisfactory than if the customer were to be misinformed by an outside person seeking additional profit for unnecessary or extra work.

With the inauguration of a policy of this kind better workmanship can be secured at a lower cost from competing contractors desiring the opportunity to submit an estimate or proposal on work of this character.

The work should be inspected from time to time as it progresses, and any deviation from the specifications brought to the attention of the owner, with a recommendation of the necessary procedure to rectify the mistake before the work has been completed.

The design of electric fixtures suitable for most living rooms usually brings the lamp close to the ceiling, and where this style of fixture is used two or more switches should be provided, and the fixture wired in sections to enable one to light part or all the lamps, as desired.

LIGHTING ARRANGEMENT FOR THE LIBRARY.

In addition to the center fixture, baseboard receptacles are necessary to make the system flexible. Lighting the rooms too brilliantly is a mistake too frequently made by users of electricity. Invariably this will be found true where only one switch has been provided on a fixture designed for several lights.

Referring to the diagram for the lower floors, the parlor has a center fixture controlled by two switches. If the fixture has five lamps, then a

1. A paper read before the Ohio Electric Light Association at Put-in-Bay, Ohio, August 18, 1905. The author's residence is in Cleveland.

combination of one, four and five, or two, three and five lamps can be used, depending upon the wiring of the fixture, by the operation of one or both switches. So-called electrolier switches are not advisable for this purpose.

Ordinarily designing for center lighting is comparatively easy; placing baseboard receptacles to obtain the best effects becomes more of a problem. The three squares in the parlor represent baseboard receptacles at widely separate points. These will allow the rearrangement of lamps without destroying the results to be obtained. Some of the most beautiful effects and best lighting results have been obtained from oil lamps that have been converted into electric lamps.

Usually the light from a table lamp is sufficient for general illumination, while on special occasions a few or all the lamps may be necessary.

In smaller residences the reception room is generally drawing room, library and living room combined. A center chandelier in harmony with the style and character of this room will be suitable. As the lamps on this chandelier are more frequently used than any other lamp in the house it is thought best that they be controlled from as many of the most convenient points as possible, and the lamps arranged on two circuits. A good way for switching the reception-room lights is

BRACKET LIGHT FOR THE BEDROOM.

shown on the plans. Complete control of one lamp is assured from three separate points, viz., vestibule, reception room and upper hall. In this way one light can be turned on or off from any or all of these points; the fourth switch operates the remainder of the lamps on the fixture.

An odd bracket over a cosy corner, a small lamp well shaded directly over the music sheets, an ornamental fixture over the fireplace, or on the newel post, are suggestions suitable for a reception room. The best way of connecting odd brackets and portables is to install receptacles in the baseboard or floors near the point or place where the light will be most effective.

In the dining room a dome fixture hung low and over the center of the table gives very pleasing results. One 16-candlepower lamp under a dome of this kind gives sufficient light for all ordinary occasions, at other times a 32-candlepower frosted lamp, or a Meridian lamp may be used.

After the dinner hour a soft, low light can be readily maintained from a side bracket, or by a candelabra placed on the china cabinet, which can readily be connected to a baseboard receptacle. One switch on the center outlet of a dining room is usually all that is required, although in larger residences it is sometimes advisable to place two switches, as lamps are sometimes extended from the canopies of fixtures.

The kitchen is a work room, and good light is needed, especially over the sink and range. A side bracket near the sink, and another near the range, is an excellent way to light it. This will be appreciated by those who have to work in their own shadows.

Drop cords have been the general practice in basement lighting, one of which is controlled by a switch at the head of the stairs. This is good in small basements without partitions, but, as a suggestion, if all the drop lights in the basement were placed on a switch at the head of the stairs and a Hylo lamp placed in each socket, then, on entering the basement every room would have a low light, enough to see the way to any particular point where more light could readily be produced. To those who have experienced a second trip to the basement to turn out a light that had been forgotten it does not require any argument, other than their own experience, to convince them that this arrangement has a value much in excess of its cost.

As electricity has many more comforts to offer in a home besides its lighting features, sufficient outlets should be installed at various points in the

LIGHTING ARRANGEMENT FOR BATHROOM.

house, where curling-irons, hot-water heaters, heating pads, sewing-machine motors, refrigerator motors and many other devices which are being extensively used can be attached. The economic value of Hylo lamps has been well recognized, and their use should be extensively advocated in bedrooms, bathrooms and halls, where an all-night light can be maintained at a low cost.

The size and arrangement of bedrooms in most modern houses does not permit the rearranging of furniture. For this reason dressers and beds should be located on the plans as near as possible to the place they will permanently occupy. The second-floor plans show four bedrooms with the beds and dressers located. On each side of the dresser provision has been made for a side bracket. This is undoubtedly the best method of lighting a bedroom, but where this is not permissible one light over the center of the dresser has been found to work out satisfactorily. When one center outlet is used in the bedroom a light placed in close proximity to

PORCH LIGHT BEARING HOUSE NUMBER.

the ceiling is better than two or three lamps suspended lower. This, of course, requires a switch to operate the lamp. In rooms where side brackets are installed the chain-pull socket has many advantages over the ordinary key socket.

In sickrooms nothing equals electricity. The light may be arranged by or over the bed in such a manner that the patient may turn it off or on at will. Here also the turn-down lamp will be found a great convenience, and so, too, will the electric stove, used to heat water and other sick-room necessaries in which heat is used. An electric fan may do more for a child than all the doctor's medicines. Hot-water bags were a boon to humanity when they were invented; the electric bag has superseded them. None of these devices is expensive, and there is not the slightest danger in their use.

Bathrooms are very often poorly lighted. They should be properly lighted. A lamp on each side of the mirror is very helpful to the man who shaves. They are separately controlled, and usually one only will be used. Small electric stoves to heat water can readily be attached to the lamp socket and hot water obtained in a very few minutes. Side brackets are advised for bathrooms, lavatories and rear halls.

Clothes closets, to be complete, should be equipped with drop lights, and when lighted in this manner a chain-pull socket is better adapted than a key socket, as the former can readily be operated with one hand, while with a key socket both hands are commonly required.

An electric pressing iron, sewing-machine motor and good light are three factors highly important in the modern sewing room. The electric pressing iron has sounded the note of comfort for the laundress. It can be used in the kitchen or laundry, and the work done in three-quarters the time taken by other irons, and the room in which it is used all day will be just as cool as though no ironing was being done.

A porch light looks hospitable and makes a house look habitable; besides the owner is a benefactor to the traveler in guiding him on his way, especially if the house number is printed on the globe. A wrought-iron bracket or fixture suspended from the ceiling with a low-candlepower lamp will make the porch an ideal spot in which to entertain on a summer evening.

In presenting the scheme of lighting which I have roughly outlined for this eight-room house, my idea has been to bring out the fact that a

DROP LIGHT FOR CLOTHES CLOSET.

moderate-sized house may be lighted in this most modern and satisfactory manner, and at an expense for lighting that would compare favorably with any other illuminant. The arranging of the wires, the use of three-point or four-point switches makes the wiring cost somewhat higher than it could be installed without these switching features and baseboard receptacles. The poor results which are often obtained from electric light and the high cost for current used are very often due to the improper arrangement of lamps and the means of controlling them.

Wiring plans should provide for the attachment of portable devices, as many of these appliances are appreciated by those using them more than the light itself. The working detail of three-point and four-point switches, also the emergency switch, have been omitted in this paper.

Wisconsin Electrical Contractors' Association.

The Electrical Contractors' Association of Wisconsin held its summer meeting while enjoying an outing on Wolf River. The trip was started at Oshkosh on the afternoon of August 10th and was continued up the river as far as New London, the party returning to Oshkosh on the afternoon of August 12th. The business meetings were held en route, and the excursion was greatly enjoyed. Those present or concerns represented were Kurz & Root of Appleton, J. L. Acker and J. D. Warden of Sheboygan, J. H. C. Buerstatte of Manitowoc, Electric Construction Company of Racine, Central Construction Company and Meter Electric Construction Company of Oshkosh, L. A. & W. F. Briggs of Fond du Lac, George F. Rohn, H. Andrae Electrical Company, Wisconsin Electrical Construction Company and Albert Petermann of Milwaukee.

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DATES AHEAD.

Old Time Telegraphers' and Historical Association (annual meeting), New York city, August 29th to September 1st.

Railway Signal Association, Great Northern Hotel, Chicago, September 12th.

Colorado Electric Light, Power and Railway Association (annual convention), Glenwood Springs, Colo., September 18th, 19th and 20th.

American Electrochemical Society (general meeting), Bethlehem, Pa., September 18th, 19th and 20th.

American Electrotherapeutic Association (annual meeting), Academy of Medicine, New York city, September 19th, 20th and 21st.

American Street Railway Association (annual convention), Bellevue-Stratford Hotel, Philadelphia, September 25th to 29th.

Illinois State Electric Association (annual meeting), Peoria, Ill., October 5th and 6th.

IN A paper read by Mr. G. Wood before the North of England Institute of Mining and Mechanical Engineers the results were given of a large number of experiments to determine the specific resistance of coal and various ores. These results showed that the resistance of coal is so high that it may be considered a fair insulator, a fact which is of practical value in connection with electrical work in mines. It was found that the coal had even a higher resistance than Barton ballast, which was discovered by the North Eastern Railway of London to be particularly effective in preventing the return of electric current to the earth.

TREES from which rubber is obtained are grown in Ceylon from the seeds of the Para hevea. The seeds were imported from India several years ago with great difficulty, owing to their germination during the long voyage. The number of trees which will be planted on the island during the forthcoming year is set at 20,000. The area so far planted is 36,000 acres, a similar amount being now under cultivation in the Malay states. It is predicted that it will be about 15 years before the quantity of rubber produced increases by 40,000 tons per annum, which would represent an increase of about 65 per cent. on the present production. As the demand for rubber practically doubles every decade, owing to its importance in the electrical and other industries, the view that the rubber-producing industry is a promising one for the energetic and scientific planter seems well justified.

JUDGE FRANCIS F. BAKER of the United States Circuit Court in a recent decision held that the city of Indianapolis has not the right to acquire and control the Consumers' Gas Company of that city. By some this has been thought to have a direct bearing on the question of municipal ownership of street railways in Chicago, while others are equally as confident that it can have no bearing on conditions in the state of Illinois. The Mueller law permits traction companies to sell their properties to the city, and possibly also gives the city the option to buy. Whether such an option contract is enforceable in the courts is, however, a question. By Judge Baker's decision a public-service corporation may be witheld from asserting the invalidity of a contract beyond its charter powers, provided the subject matter of the contract does not effect the discharge of its duties to the public, but that it cannot be estopped from setting up the illegality of the contract if the subject matter be in violation of a statute or a declared rule of public policy. Thus the traction and the city lawyers in Chicago have still another cause for dispute.

INFORMATION concerning the tantalum lamp and the possibilities of its extended use as an illuminant is received with interest by central-station operators, most of whom are following its development with careful attention. The paper read by Mr. William Ambler before the Ohio Electric Light Association, which appears elsewhere in this issue, contributes some valuable information on the subject and is founded upon some tests which the author made upon two of the lamps obtained from Siemens & Halske of Berlin. One of the tests was made to ascertain the change in resistance with the change of voltage across the lamp. The results of this test showed that the resistance of the tantalum lamp increases with the increase of voltage, or with the increase of temperature. This is exactly opposite to the effect on a carbon filament and has an important bearing upon the change in candlepower with the voltage. An increase of four per cent. in the voltage of a carbon-filament lamp caused an increase of 24 per cent. in the candlepower, while with the tantalum lamp there was only a nine per cent. increase under similar conditions. In other words, more than twice as great a change in voltage is required across the tantalum lamp to bring about a certain fluctuation in the light as is required in the case of the carbon-filament lamp. This fact is of much importance and is one of the strong arguments in favor of the tantalum lamp as a source of uniform light. Another interesting test showed the distribution of light from the tantalum lamps, one provided with a clear and one with a frosted bulb. The horizontal distribution in the two cases was practically uniform. The lamp with the clear bulb gave 22.0 mean horizontal candlepower and the one with the frosted bulb 19.8 at 1.75 and 2.0 watts per candlepower, respectively. While the tantalum lamps gave much more light in a horizontal direction than did the carbon-filament lamps, the light from the tips was much less, though the carbon filaments had only one curl. The cost of the lamps in Germany is now 80 cents apiece, in barrel lots, as against 16 cents for the ordinary lamp. It is evident that the success of the lamp will depend much on the ability of the manufacturer to reduce the cost of the filament. And it is probable that this may be accomplished with improved chemical and physical processes, the high cost not being so much dependent upon the price of the raw material as upon the difficulty of working the metal into a fine wire.

DURING the year 1900 Germany became involved in an economic crisis which came about as the natural recoil from the previous brilliant period of industrial progress. Like all other branches of commercial affairs, the electrical industry during the following three years experienced a period of severe depression, from which it is now rapidly recovering. In 1900 there were seven principal electrical concerns which had promoted, during the period of activity, many unprofitable subordinate undertakings. Many of these smaller undertakings became bankrupt, leading to enormous losses to the promoting companies. This state of affairs placed the electrical industry in Germany in a difficult position and led ultimately to the formation of two large companies—the Allgemeine Elektricitäts Gesellschaft and the firm of Siemens & Halske. These two companies, through the discontinuation of the previous ruinous competition, were enabled to prosper, and eventually absorbed the small concerns, placing them on a sound financial footing. The year 1904 therefore became one of reconstruction.

In spite of the fact, however, that the years 1900 to 1903 brought grievous injury to the electrical trade in Germany, German engineers were confident that a brilliant future awaited the development of electricity, and they sought in every way—by the acquisition of fresh technical knowledge, by the perfecting of scientific methods and by the improvement of methods of working—to counteract as far as possible the evil influences of the general trade depression. It was then that the great importance of the steam turbine first began to be recognized; the value of waste gases from blast furnaces for the production of electrical power through the medium of the gas engine led to a rapid advance in the development of that type of prime mover, and in every way the introduction of the motor for power purposes was encouraged.

Although business activity in the line of electrical products was greater in 1904 than ever before, there is a feeling in Germany that the ultimate results are not yet quite what they should be. The only plausible reason for this seems to be the low prices which have recently been obtained for goods by electrical manufacturers, for the development of central stations and electric railways has been on the increase ever since the period of depression in manufacturing lines first began. The increased requirements no doubt caused at the very first a rise in prices, but this advantage had to be sacrificed in consequence of the enhanced cost of raw material, especially copper, which is so essential in the electrical industry.

Glancing at the present position of the electrical industry in Germany, it is evident that the late crisis was free from any lasting harm at least. The electrical business is now placed upon a firmer basis than it was before, and added to this is the remarkable increase in engineering knowledge. Great technical problems are now pending, chief among which, probably, is the electrification of the railways, but with a sound financial basis and increasing knowledge of the technicalities of the business it is to be hoped that these problems will be successfully solved.

OHIO ELECTRIC LIGHT ASSOCIATION.

The eleventh annual meeting of the Ohio Electric Light Association, held at Hotel Victory, Put-in-Bay Island, Lake Erie, Ohio, August 16th, 17th and 18th, amply fulfilled both in attendance and in range and quality of the papers presented the favorable prediction made last year upon the election of President Turner. The large proportion of the younger element, which is a noticeable feature of all electrical conventions, for obvious reasons had full swing in perfecting the arrangements for the convention, and the task was carried out ably and well. A feature of the programme was that quite a number of the papers presented a collaboration of several authors. A larger number of new faces than usual were noticeable among the central-station people, and the disproportion between these and the material men was not as pronounced as usual. Taken altogether the convention was probably the best in the history of the association. A large number of ladies took advantage of the outing and for them appropriate entertainment was provided.

President M. E. Turner, of the Cleveland Electric Illuminating Company, in his annual address, after referring briefly to the present rate regulation agitation in some of its phases, recommended that a committee be appointed to investigate this and the subject of cost determination. He further recommended a committee being appointed to investigate the best styles of records in use by different companies with especial reference to the availability of such records for use of smaller companies and the promotion of uniformity in records. President Turner referred to the fact that manufacturers are meeting the demand for higher efficiency in electrical illumination and that this will have a tendency to aid electrical companies in meeting outside competition. He also outlined in brief some of the work done in preparation for this convention and paid his acknowledgments to all who had assisted the efforts of the officers in this behalf.

The recommendations were concurred in by the convention and the committee suggested and authorized, in pursuance to the report of the committee on president's address, consists of Messrs. E. J. Bechtel, F. E. Valentine and John H. Maxon.

Reading of Papers.

J. A. Bendure, general manager of the Lima and Toledo Traction Company, in a paper upon "Waste Products of a Central Station," gave the results of personal and other experience, holding that there is an inherent necessity for the utilization of by-products, especially by quasi public-service corporations, inasmuch as if they neglect to improve all means of profit at their command they must make up any deficiency in increased price charged to the public for their commodity, and will be likely to suffer from some competitor who is more enterprising, as well as suffer in dividends. Mr. Bendure referred briefly to different methods of utilizing exhaust steam for heating and different bases of charge, suggesting that if a plant has engines already operating as condensing units the condensers can be detached during the heating months and during the summer months operated condensing, and at times when the full amount of steam is not required for heating operate part condensing and part non-condensing as the most profitable plan. He held that the only safe and reasonable rate is that based on the cost of supplying heat direct from the coal pile—that is, on a live-steam basis. Managers have sometimes made the mistake of viewing any revenue received from this source as net gain. A little steam heating for a central station of large capacity is not to be tolerated unless the inside piping at the station is so accomplished that the exhaust from only a sufficient amount of engine capacity is being delivered under back pressure to the heating system as is required in the heating.

In concluding the speaker said that the results of operation of heating systems by a large number of electric companies has demonstrated that it is reasonable to expect a revenue from the sale of steam at least equal to the cost of fuel used at the power plant in the manufacture of all the commodities, electric light and power and extra for steam.

In the discussion of this paper W. E. Russell, president of the Massillon Light, Heat and Power Company, as one of those not at present using an exhaust-steam heating system, stated that he had been investigating the subject and considered it of great importance to towns of under 20,000. He expressed his disappointment that Mr. Bendure had not gone further into the hot-water side of the question and wished to know more on that head.

D. L. Gaskill of the Greenville Electric Light and Power Company asked Mr. McKnight and Mr. Bendure what would be the difference as to financial success between plants operating a railway and those exclusively electric light; whether either a steam or hot-water plant can be operated successfully in a purely electric-light plant.

E. H. McKnight of the Middletown Electric Light and Power Company gave it as his opinion that he would not operate a hot-water plant if he could not have day service. At Middletown he has a motor-load equivalent to that of a 20-mile interurban railroad load, about 300 horsepower, in daily service. At Bowling Green he started in with a hot-water service with a very light day load and is operating a railroad that makes it a success and takes care of all the hot-water heating he has.

W. P. Engel, manager of the People's Gas and Electric Company, Defiance, Ohio, put in a system circulating hot water with an ordinary boiler feed pump through a two-inch main for 1,800 feet, taking the water from a cistern heated by the exhaust from the engine to an open heater 160 degrees in the cistern. The next winter he put in a small closed heater with one-half-inch copper tube, sufficient to heat about 25 houses, including his own house, using a four-inch pipe, the farthest house away being 2,500 feet distant. He believed that a central-station plant can make money out of exhaust steam for residence heating. He had a railway in connection that furnished ample exhaust steam; any ordinary plant running daytimes with from 25 to 30 amperes on an engine of 200 horsepower will furnish enough exhaust steam to heat 25 houses. His rate was based on square feet of radiation. His street railway at present is about double his alternating or commercial load. Mr. Bendure in closing stated that his company had arrived at the conclusion that the circulation of steam at low pressure for heating was preferable to hot-water heating after investigating various plants throughout the country four years ago.

H. L. Wallau of the engineering department of the Cleveland Electric Illuminating Company read a paper on "Some Notes on the Use of Barriers in Alternating-current Switchboard Construction of Potentials Below 4,000 Volts," in which he briefly pointed out some of the advantages of barriers in the construction of such switchboards, as he had become familiar with the same from personal experience. The paper describes in detail the method of application and use of such barriers, and the writer concluded that in some plants switchboards that are a trifle antiquated may be remodeled in a similar manner and made good for many more years. The writer recommended soapstone as the best material for barriers, as it can be sawed very thin, cut and drilled with perfect accuracy and is absolutely non-absorbent.

The paper on "Mercury Arc Rectifiers," by P. D. Wagoner of the General Electric Company, was read by R. E. Russell in Mr. Wagoner's absence. The apparatus was seen in use during Mr. Ryan's lecture Friday evening and at other times. In concluding his paper the writer said: "The mercury-arc rectifier makes possible the operation of the magnetite lamp from the well-known constant-current transformer, the alternating current of which is rectified into direct current by the mercury-arc rectifier. Such a system of street lighting has been operated by a central station for some time with remarkably satisfactory results. Systems are about to be installed at other points. It

Electric Motors Discussed.

will readily be appreciated that this means a revolution in street lighting."

E. H. Beil, superintendent of construction of the Gas and Electric Company of Youngstown, Ohio, read a paper on "The Operation of Alternating-current Motors on the System of an Electric-light Plant of 1,000 Kilowatts or Less Capacity." The paper will be taken up in a future issue.

Following Mr. Beil, G. Percy Cole of the engineering department of the Wagner Electric Manufacturing Company of St. Louis read a paper on the "Recent Developments in Single-phase Alternating-current Motors." Mr. Cole referred to the Arnold-type motor as particularly adapted to all constant-speed service and available where the direct-current shunt motor is used. He considered some aspects of single-phase distribution and holds that in the construction of single-phase motors not cost but simplicity is the controlling feature in the situation. In conclusion he said that the fact that many of the limitations of the single-phase motor are now a matter of past history is a cause for general congratulation.

In connection with the two foregoing papers was discussed the paper on "Electric-motor Applications," by J. Henry Klinck of the Westinghouse Electric and Manufacturing Company. The writer enumerated some of the difficulties incident to the use of motors under various conditions, and especially emphasized both in his paper and in the discussion that a successful motor application can be made only when the characteristics of the driven machine are thoroughly known and a motor of sufficient size and suitable design is used to operate it. The requirements of the machine must be supplied by the motor, not the reverse, the machine being installed to do certain work of a definite character. It is therefore necessary to make a thorough investigation of the characteristics of the driven machine before making any recommendations as to the type of motor and motor control to be used.

Use of Voltage Regulators.

W. E. Richards of the engineering department of the Toledo Railways and Light Company read a paper, entitled "Where It Has Been Found a Distinct Advantage to Use Voltage Regulators," in which he held that where electricity is used for illumination there are but few instances where it would not be an advantage to automatically control the voltage, and the smaller the plant the greater the need of automatic apparatus, as it is well known that switchboard attendants in small plants supplying commercial lighting usually have to perform a variety of duties. Especially important is such automatic control when lighting machinery is operating from the same source of power supplying fluctuation power circuits, railway systems, etc. On the whole automatic regulators are to be preferred to hand regulators in all classes of work where steady voltage is a requisite.

The next paper included a discussion on "Meter and Billing Records," contributed to by F. E. Valentine, manager of the Miami Light, Heat and Power Company, Piqua, Ohio; D. W. Low, superintendent of the Alliance Gas and Electric Company; C. E. Inman of the Warren Water and Light Company, Warren, Ohio, and George Hayler, Jr., of Joplin, Mo. Mr. Valentine expressed surprise that although the subject of a uniform system of billing and recording has been thoroughly discussed among electrical people and its vital importance set forth abundantly in various state and national conventions, it is a matter of surprise that more general interest has not been aroused. The conservative attitude occupied by most station managers he attributed to the great amount of labor necessary—first, in developing a system adapted to various conditions, and secondly, in placing a new system in operation in an individual station, which means a radical change in the system of bookkeeping, vouchers and sundry business forms. Such changes are bound to create great confusion and upset the old-fashioned methods prevailing in many companies. He believed, however, that the effort to get out of the old ruts necessarily would bring about all that it costs in benefit to a live central station.

Mr. Inman submitted a paper form of bill showing a perforated stub attached, which stub is kept on file in the office; also a sample of meter card on which is kept a record of meters similar to those in use elsewhere. All meters are numbered.

Mr. Low presented for criticism two systems he had used for both gas and electricity, one being a customer's register and the other a card ledger form. The gas and electricity accounts are distinguished by different colored paper being used. He also exhibited a leaf from a customer's register and a leaf from a customer's meter book; also a form of postal-card bill, etc. Further forms and details were shown in the paper.

Mr. Hayler commented on the heterogeneous assortment of record forms that are prevalent and thought that the attempt to devise some one system to meet all conditions and satisfy all station managers would be a hopeless task. He presented his conclusions concerning meter records, meter test records, meter inspection records, meter readers' records, bill forms and customers' ledger after an examination of a collection of blanks obtained through the courtesy of about 50 companies located in the United States and Canada. Mr. Hayler stated that the life of any central station is its meter system, to properly take care of which is no mean task.

By invitation H. A. McKee of Chicago, representing the Library Bureau, appeared before the convention and explained the work his company is doing in designing and furnishing proper blanks and appliances for office records for central stations.

H. C. Ayres, superintendent of the Greenville (Ohio) Electric Light and Power Company, read his paper on "Methods of Selling Current as Applied to Cities of 20,000 Inhabitants," in which after commenting on the extremely wide range of rates charged by central stations supplying electric light and power, both in rates per kilowatt-hour and flat rates, due to many causes which he enumerated, he concluded that the main cause lies in the fact that the stations are entirely ignorant of their true cost of production and have adopted their rates without careful figuring. The writer held that the two general methods of charging just referred to and in use among the smaller stations are both open to very serious objections. The purpose of his paper was to describe the combination system using a fixed charge which is similar to the flat rate in combination with the meter charge. The objections to the flat rate, he thought, are well known, the principal one being that consumers will waste current if it costs nothing to be careless. The objections to a straight meter basis are that it does not accurately distribute among consumers their proportionate share of the costs of supplying them, and compels some customers to pay in excess by an amount necessary to make up the deficiency occasioned by the short-time user. He urgently recommended every central station to discover its fixed and running cost and suggested a careful study of the paper pre-

sented by M. E. Turner last year, which treats the subject very fully.

The paper next read was by Messrs. R. L. Johnston of the Northern Ohio Traction and Light Company, Akron, Ohio; Warren E. Russell, president and treasurer of the Massillon Light, Heat and Power Company, and J. H. Maxon, superintendent and manager of the Gallipolis Gas and Coke Company, on "Methods Employed for Getting New Business and Retaining Old Business Where Natural Gas Competition Exists."

The report of the committee on cost determination, consisting of E. J. Bechtel, chairman, superintendent of the Toledo Railways and Light Company; W. E. Miller, Mt. Gilead Water, Heat, Light and Power Company, and J. H. Perkins, past president of the Ohio State Association and now of Wilkesbarre, Pa., was read by its chairman, and was characterized by President Turner as perhaps one of the best reports on this subject that ever went before any association, and deserving of a great deal of consideration as an important topic at this particular time.

Discussion of this and several of the above papers was made a special order for Friday morning, Friday afternoon being given over to social entertainment.

The first paper read Friday morning was that on "Line Construction," by B. L. Chase, superintendent of lines for the Columbus Railway and Light Company. The paper will appear in a later issue.

A. E. Noble, superintendent of construction for the Cleveland Electric Illuminating Company, read a paper on "Resuscitation from Electric Shock." This paper will also be printed in a future issue of the Western Electrician.

The paper by J. Kermode of the Cleveland Electric Illuminating Company, entitled, "Some Practical Suggestions on the Wiring of Residences and the Facilities Given to Consumers for Increased Use of Electricity," was an extremely practical one, showing as it does the advance that has been made by some electric-lighting stations in presenting to the public in attractive form suggestions which, through such a medium, can be made with greater persistence and less officiousness. This paper is discussed elsewhere in this issue.

The paper reporting results of tests on tantalum, prepared by William Ambler, professor of engineering in the Case School of Applied Science, Cleveland, Ohio, was an interesting one and space is given it elsewhere in the Western Electrician this week. It was discussed in connection with the following two papers: "The Utility of the Nernst Lamp to the Central Station," by E. R. Roberts of the Nernst Lamp Company, Pittsburg, and "High Efficiency, High-candlepower Incandescent Lighting Units," by F. W. Willcox of Harrison, N. J.

Illuminating Engineering.

The closing event of the convention was the lecture on "Illuminating Engineering," delivered on Friday evening by W. D'A. Ryan of the General Electric Company, Lynn, Mass. The hall was crowded with ladies and gentlemen, who paid close attention to the lecture and accompanying illustrations. The lecture was a general treatment of the subject of light and color, with some reference to illuminating engineering, the various points being illustrated by special apparatus designed expressly for the purpose. A number of interesting and instructive color experiments were performed which had a practical bearing on the lighting of large areas, such as stores and the like. At the conclusion of the lecture a pari-chromoscope, or color booth, was exhibited, which showed the effect of the incandescent, arc, Nernst and mercury lights upon various textile fabrics exposed to these various lights and the change in color of certain materials when transferred from the mercury to the arc-light booth. Probably the most important point brought out by Mr. Ryan was the improvement in arc lighting by the use of the light-balancing selective diffuser, giving a considerable increase in the efficiency on the counter level when arc lights are used, producing a perfectly steady and white light.

The ladies were given an opportunity to compete for a prize, donated by President Turner, of a luminous General Electric radiator heater, awarded to the lady who would make the greatest number of correct guesses as to the color fabrics exposed to the mercury light would exhibit when exposed to the arc light.

Election of Officers.

The election of officers, which took place on Friday, resulted as follows:

President—F. E. Valentine, Piqua.

Vice-president—W. E. Russell, Massillon.

Secretary-treasurer—D. L. Gaskill, Greenville.

Advisory Committee—Samuel Scovil, Cleveland; J. A. Bendure, Lima; D. L. Gaskill, Greenville.

Executive Committee—M. E. Turner, Cleveland; E. J. Bechtel, Toledo; M. C. Hull, Columbus; W. E. Miller, Mt. Gilead; W. P. Engel, Defiance.

Finance Committee—E. H. Beil, Youngstown; Fred W. Bauer, Sandusky; W. E. Richards, Toledo.

Publicity Committee—B. S. Young, Ada; John H. Maxon, Gallipolis; C. C. Collins, Columbus.

New Members Elected.

The following new members were elected during the meeting:

Active—Fremont Gas, Electric Light and Power Company, Fremont, Ohio, W. M. Adams, superintendent; Alliance Gas and Electric Company, Alliance, Ohio, D. W. Low, superintendent; Jamestown Electric Light Company, Jamestown, Ohio, S. A. Brown, superintendent; Columbus Public Service Company, W. H. Sharp, secretary; Ada Water, Heat, Light and Power Company, Ada, Ohio, B. S. Young, manager.

Associate—Library Bureau, T. E. Crawford, manager, Cleveland, Ohio; Allis-Chalmers Company, G. C. Colwell, district manager, Cincinnati, Ohio; American Circular Loom Company, T. H. Bibber, Boston, Mass.; Warren Electric Manufacturing Company, Sandusky, Ohio.

Entertainment Features.

Entertainment both for the ladies and the gentlemen was well looked after. The ladies were entertained by lawn tennis, bowling, croquet, bathing, boat rides, trolley rides, etc., and appropriate prizes were given to those who excelled in the various games. A ball was given in Hotel Victory on Wednesday evening and on Friday evening there was a banquet.

On Thursday evening at 9:45 p. m. candidates for initiation in the Sons of Jove reported at the rendezvous in the Hotel Victory, and after being robed in sackcloth and ashes and with hands fastened with a stout rope they marched as lawful prizes in the wake of the already juvenated rejuvenators, who were costumed in the flaming garb of the order, escorting the original Jupiter himself. The happy candidates who were duly iniatiated were the following: George L. Porter, Chicago; Louis Griesser, Cleveland; H. H. Cudmore, Cleveland; Laurence Clark, Chicago; O. E. Kenney, Toledo; L. G. Read, Sandusky; F. W. Bliss, Cleveland; H. C. Kelley, New York; Lawrence Moore, Detroit; R. C. Stueve, Cincinnati; E. L. Booth, Bellaire; E. Reynolds, Pittsburg; H. B. Rogers, Columbus; W. E. Russell, Massillon; A. E. Buckenberg, Sandusky; William J. Beutel, Sandusky; E. Garrick, Sandusky; Hunter Morrison, Cleveland, and James L. Anderson, Pittsburg.

Those in Attendance.

Following is a list of central-station men, representatives of manufacturers and supply houses and guests who were in attendance at the convention:

Central Station Representatives.

B. S. Young, Ada Water Heat and Light Company, Ada; R. L. Johnston, Northern Ohio Traction and Light Company, Akron; D. W. Low, Alliance Gas and Electric Company, Alliance; E. L. Booth, Bellaire Light and Power Company, Bellaire; E. H. McKnight, L. E. B. G. and N. Railway Company, Bowling Green; M. E. Turner, J. Kermode, H. L. Wallau and Edward E. Noble, Cleveland Electric Illuminating Company, Cleveland; George C. Bohn and A. N. Cope, Columbus Public Service Company, Columbus; B. L. Chase and C. C. Collins, Columbus Railway and Light Company, Columbus; W. P. Engel, Peoples Gas and Electric Company, Defiance; O. B. Welch, United Electric Company, Dennison; T. L. Schrantz, Fremont Gas and Electric Company, Fremont; John H. Maxon, Gallipolis Gas and Coke Company, Gallipolis; D. L. Gaskill, H. C. Ayres and Samuel Harnish, Greenville Electric Light and Power Company, Greenville; S. A. Brown, Jamestown Electric Light Company, Jamestown; J. A. Bendure, Lima and Toledo Traction Company, Lima; E. M. Bendure, Lima Electric Railway, Lima; Ira Clifford Bean, New Lisbon Gas and Electric Company, Lisbon; Warren E. Russell, Massillon Light, Heat and Power Company, Massillon; E. H. McKnight, Middletown Electric Light and Power Company, Middletown; E. T. Selig, Ohio Railway and Light Company, Mount Vernon; W. E. Miller, Mount Gilead Water, Heat, Light and Power Company, Mount Gilead; Melville Gillett, Licking Light and Power Company, Newark; F. E. Valentine, Miami Light, Heat and Power Company, Piqua; J. H. McCrosky, Urbana Light Company, Urbana; Fred W. Bauer and Emil A. Bechstein, Sandusky Gas and Electric Company, Sandusky; E. J. Bechtel, T. Douglas Buckwell, John Gilmartin, W. E. Richards, J. W. Sharp and C. N. Jackson, Toledo Railways and Light Company, Toledo; S. F. Messer, Warren Water and Light Company, Warren; W. F. Hubbell, Wauseon Electric Light Plant, Wauseon; E. B. Beil and S. C. Rogers, Consolidated Gas and Electric Company, Youngstown; Charles S. Johann, Peoples Light, Heat and Power Company, Springfield.

Representatives of Manufacturers and Supply Houses.

F. C. Colwell, Cincinnati, H. Morrison, Cleveland, Allis-Chalmers and Bullock companies; Thomas H. Bibber, American Circular Loom Company, Chelsea, Mass.; John A. Bechtel, Atlas Engine Company, Cincinnati; Fred. W. C. Baily, consulting engineer, Cincinnati; R. T. Hamilton, Banner Electric Company, Youngstown; S. R. Fralick, Benjamin Electric Manufacturing Company, Chicago; F. M. Knierim, The F. Bissell Company, Toledo; F. W. Godfrey, Bryan-Marsh Company, Chicago; Elliott Reynolds, Doubleday-Hill Electric Company, Pittsburg; C. W. Hobson, S. A. Hobson, Duncan-Hobson Electric Company, Dallas, Texas; Perry R. Boole, George Porter, Electric Appliance Company, Chicago; H. B. Rogers, The Ernest & Hopkins Company, Columbus; A. Amos Serva, Fort Wayne Electric Works, Fort Wayne, Ind.; Harry R. Fowler, mechanical engineer, Toledo; W. J. Hanley, Cincinnati, John I. Solomon, F. W. Wilcox, Harrison, N. J., W. D'A. Ryan, G. H. Stickney, Lynn, Mass.; H. J. Mauger, N. R. Birge, R. E. Russell, Schenectady, N. Y.; General Electric Company; Kuhlman Electric Company, Elkhart, Ind.; C. S. Kuntz, F. D. Lawrence Electric Company, Cincinnati; T. E. Crawford, Cleveland, Horace A. McKee, Chicago, Library Bureau; H. E. Adams, Ernest J. Paradis, Nagel Electric Company, Toledo, O.; A. G. Summerell, National Carbon Company, Cleveland; J. L. Anderson, Columbus, W. H. Hoover, Cleveland, Charles H. Davis, Detroit, Mich., Max Harris, Pittsburg, Pa., E. E. Roberts, Pittsburg, Pa., Nernst Lamp Company; J. W. Brooks, John A. Roebling's Sons Company, Cleveland; Leo A. Phillips, Sanderson & Porter, New York, N. Y.; G. F. Meyers, R. C. Stueve, Standard Electric Company, Cincinnati; Laurence Clark, Chicago, W. A. Ekberg, Cincinnati, Stanley-G. I. Electric Manufacturing Company; F. J. Alderson, Stanley Instrument Company, Great Barrington, Mass.; L. G. Read, Turbine Engineering Company, New York, N. Y.; L. G. Read, Warren Electric Manufacturing Company, New York, N. Y.; G. Percy Cole, Wagner Electric Manufacturing Company, St. Louis, Mo.; T. R. Newburn, Westinghouse Air Brake Company, Cleveland; R. W. Beebe, N. C. Draper, George B. Dusinberre, W. E. Egert, Cleveland, Laurence Moore, Detroit, Mich., T. H. B. Whipple, New York, N. Y., J. Henry Klinck, East Pittsburg, Pa., Wesley P. Jend, Columbus, Westinghouse Electric and Manufacturing Company; J. C. McQuiston, Westinghouse Companies' Publishing Department, Pittsburg; J. H. Wagenhorst, Westinghouse Machine Company, Cleveland; L. G. White, electrical engineer, Columbus; F. W. Bliss, Buckeye Electric Company, Cleveland; S. Griesser, Cleveland Electrical Supply Company, Cleveland; W. H. Sinks, Duncan Electric Manufacturing Company, Lafayette, Ind.; J. W. Leech, Burke Electric Company, lessee of Keystone Electric Company, Erie, Pa.; W. H. Selden, Jr., Miller-Selden Electric Company, Detroit, Mich.; E. L. Van Winkle, P. J. Williams, Post-Glover Electric Company, Cincinnati; W. M. Lenhart, H. B. Warren, Warren Electric Manufacturing Company, Sandusky, O.; Dean Emerson, Cincinnati, Lehman B. Hoit, Cleveland, Wagner Electric Manufacturing Company; W. C. O'Kane, O'Kane-Hull Company, Columbus, O.; Arthur J. Howard, Medina, N. Y.; J. F. Hoover, Electric Storage Battery Company, Cleveland.

others present.

W. C. Broadhurst, Brooklyn, N. Y.; J. W. Ryan, Kentville, N. S.; H. Bozarth, Pittsburg, Pa.; Douglas A. Brown, Cincinnati, O.; James R. Cravath, Chicago; C. A. Newning, J. H. La Roche, Houston, Tex.; J. H. Smith, Pittsburg, Pa.; Amos Paine Fisk, Ashtabula, O.; A. W. Field, Columbus, O.; W. S. Smith, Toledo, O.; Wright B. Thompson, Detroit, Mich.; H. C. Dye, Galion, O.; C. M. Hart, Sandusky Telephone Company, Sandusky, O.

Convention Notes.

Mr. A. A. Serva had charge of an exhibit from the Fort Wayne Electric Works—the new prepayment integrating wattmeter, for which the company claims great things. This was designed by J. J. Wood, the well-known inventor.

Mr. S. R. Fralich was in charge of the exhibit of the Benjamin Electric Manufacturing Company of Chicago, showing its line of arc bursts, both ceiling and pendent forms; also samples of its regular lighting specialties. Mr. Fralich within the last year reports good success, one installation being the United Railways of St. Louis, an installation of two-light series car clusters.

The Library Bureau, represented at Cleveland by Mr. T. E. Crawford, Ohio agent, showed an interesting line in one of the parlors on the ground floor of card-record-keeping systems, showing samples of outfits in use by the Cleveland Electric Illuminating Company and the Northern Ohio Light and Traction Company, being card-meter-reading systems and meter-record systems, billing systems and miscellaneous central-station accounting of all kinds. Mr. H. A. McKee of the Chicago office was also in attendance. They also showed vertical systems of handling correspondence for electric-lighting companies, and forms used by Chicago Edison Company and Peoria Gas and Electric Company, Peoria, Ill.

At the parlor of the General Electric Company could be found at all times the smiling face of that well-known veteran, W. J. Hanley of Cincinnati. With him were the following: H. J. Mauger, N. R. Birge and R. E. Russell, Schenectady; F. W. Wilcox, J. I. Solomon of the Edison Lamp Works, Harrison, N. J., and W. D'A. Ryan and G. H. Stickney of Lynn, Mass. The piece de resistance of the General Electric Company at this meeting was, by all odds, the illustrated lecture by Mr. Ryan; but the exhibit directly under Mr. Hanley was an interesting one, covering a complete line of electric cooking devices, including also flatirons, cigar lighters, glue pot, etc. Indestructible and interchangeable as to parts, these devices are rapidly growing in favor.

The exhibit of the Westinghouse Companies occupied a large parlor on the ground floor of the Hotel Victory, and was attractive and complete, comprising a full line of portable electrical measuring instruments, alternating and direct-current lamps, transformers, lightning arresters, switches, ammeters, voltmeters and wattmeters. The prepayment wattmeter which was on exhibition attracted considerable interest. A complete line of Sawyer-Man incandescent lamps was displayed in a glass case. On a large display board were shown fuses of sizes suited to various voltages. The corridor of the hotel on the ground floor, where all of the exhibits were made, was illuminated by Westinghouse alternating-current arc lamps. Samples of Nernst lamps were also exhibited. The Nernst lamp people have recently supplied the American Oak Leather Company's plant in Cincinnati, which maintains its own lighting plant. The following representatives of the various Westinghouse interests were in attendance at the convention: From the Westinghouse Electric and Manufacturing Company, C. B. Humphrey, manager Detroit sales; G. B. Dusinberre, manager Cleveland office; R. W. Beebe, N. C. Draper, U. C. Egert, Cleveland; J. W. Schrantz, Cincinnati; Laurence Moore, Detroit; W. P. Jend, Columbus; J. H. Klinck, Pittsburg. From the Westinghouse Air Brake Company, T. W. Newburn, Cleveland office. From the Westinghouse Machine Company, J. H. Wagenhorst, Cleveland office. Nernst Lamp Company,

Max Harris, sales manager, Pittsburg; E. R. Roberts, Pittsburg; James Anderson, Columbus office; J. F. Hoover, Buffalo; C. H. Davis, Detroit. J. C. McQuiston, superintendent of the Westinghouse Companies' Publishing Department, Pittsburg.

Tests on Tantalum Lamps.[1]

By William Ambler.

My attention was first called to this lamp by an article which appeared in several of the engineering magazines about the first of the year. Fortunately I was able to obtain two of the lamps from the maker, the Siemens & Halske Company of Berlin. I have made a number of tests upon these which have shown quite satisfactory results.

First, in regard to their construction. As you see from Fig. 1, they closely resemble the common incandescent lamp in shape and size. The great peculiarity of the lamp is the filament. This is made of the metal tantalum. In regard to this metal I have procured from a number of sources the following facts which I cannot vouch for, but which are probably approximately correct. It is obtained by the Siemens & Halske Company from an ore in the form of potassium tantulo-fluoride. This is reduced to powder and heated in a vac-

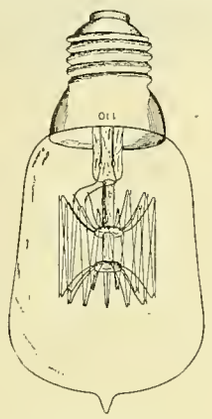


FIG. 1. GENERAL VIEW OF TANTALUM LAMP.

uum. Under these conditions the metallic tantalum will separate out in the form of small globules which can be fused together. The chemical properties of the pure tantalum are remarkable. When cold the metal resists chemical agents strongly; and it is not attacked by boiling hydrochloric acid, aqua regia, nitric acid or sulphuric acid, and it is also indifferent to alkaline solutions; it is attacked only by hydro-fluoric acid. Heated in the air it assumes a yellow tint at about 400° C. like steel, and also like steel the tint changes to dark blue when the tantalum is exposed for some time to 500° C., or for a shorter time to 600° C. Thin wires of it will burn in the air when ignited with low intensity and without any noticeable flame, It greedily absorbs hydrogen as well as nitrogen, even at a low, red heat, forming with them combinations of a metallic appearance which are rather brittle. It combines with carbon very easily, forming several carbides, which, as far as they are at present known, are all of a metallic appearance and which are rather brittle. When purified by fusion and drawn into wire tantalum has a specific gravity of 16.8. This is about twice the specific gravity of iron and about three-fourths that of platinum. It is somewhat darker than platinum and has a hardness about that of mild steel and shows even greater tensile strength than steel. The tensile strength of the fine wire is remarkably high, amounting to 133,000 pounds per square inch, while the corresponding value for good steel is 100,000 to 112,000. The metal is malleable, though but slightly, and it requires considerable time and care to roll or draw it.

The electrical resistance of tantalum at ordinary temperatures is practically the same as that of platinum, the specific resistance being 6.06. To obtain a filament for a 110-volt lamp of 22 candlepower requires a wire 65 centimeters long and 0.05 millimeters in diameter. The weight of the filament in one of these lamps is 0.022 grain, so that about 20,000 lamps can be made from one pound of the metal. Computed from the cost of the lamp one pound of tantalum in the form of wire must be worth between $150.00 and $175,000.

When the lamps were first made considerable difficulty was experienced in mounting the long filament in a bulb of ordinary size. This was finally accomplished as shown in Fig. 1. The filament is bent back and forth through the small hooks at the ends of the wire supports, these being rigidly fused into the glass supports. The wire supports do not form part of the electrical circuit. Other methods of mounting the filaments have been tried, but this method has been adopted as standard except where a particular distribution of light is desired. This form of mounting is necessary because tantalum wire like all other metallic filaments which have hitherto been used for incandescent lamps, softens sensibly at the temperature of incandescence. For this reason the tantalum filament breaks more easily than the carbon filament. These lamps would not be at all suited for places where they would be subjected to jars and vibrations as in cars. To test the strength of the filaments the makers shipped several barrels of lamps a number of times across the Atlantic, the lamps being packed in the ordinary way. These tests showed that new or unused lamps will withstand ordinary vibrations, but the filament becomes weaker with use, so much so that the makers advise that the lamps be not removed from one socket to another after they have been used more than a few hours. I may say, however, that no particular care was taken in handling the lamps

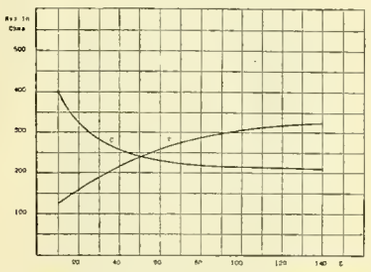


FIG. 2. CURVES SHOWING CHANGE OF RESISTANCE WITH CHANGE OF VOLTAGE.

which I tested and no filaments were broken, though the lamps were changed repeatedly.

The first test made was to find the change in resistance with change in voltage across the lamp. This was done by impressing different voltages on the lamp in series with which was connected an ammeter. Fig. 2 shows the results in the form of curves. Resistance values were taken as ordinates and voltage values as abscissæ. Curve (T) is for the tantalum and curve (C) for a 3.1-watt carbon-filament lamp, each 110 volts. The important difference in the two filaments in this respect is that the tantalum increases in resistance with an increase in voltage, that is, with an increase in temperature, while the resistance of the carbon decreases with increase in voltage, the increase in resistance of the tantalum being much greater than the decrease in the resistance of the carbon, near 110 volts. This increase in the resistance of the filament in the tantalum lamp has an important bearing on the change in candlepower with the voltage which will be considered later.

Measurements were made on the distribution of light from the tantalum lamps with both clear and frosted bulbs, and comparisons made with the light distribution from a 16-candlepower 110-volt lamp with clear bulb and with a single-curl carbon filament. The horizontal distribution of light from both of the tantalum lamps was found to be practically uniform. The lamp with the clear bulb gave 22.0 for the value of the mean horizontal candlepower. The current at the rated voltage, 110, was 0.35 ampere, making 385 watts, or 1.75 watts per mean horizontal candlepower. The frosted lamp gave a mean horizontal candlepower of 19.8 and took 0.36 ampere at 110 volts, making 396 watts and 2.0 watts per candle. The rating given on the lamps is in the German or Hefner units, one unit of which amounts to about 0.8 of our

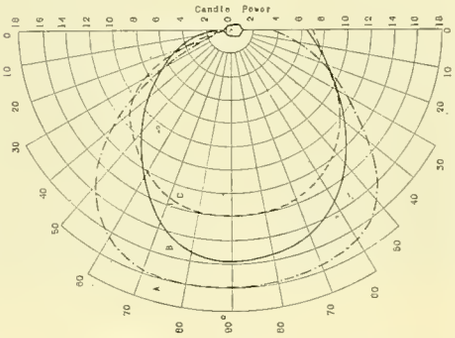


FIG. 3. CURVES SHOWING VERTICAL DISTRIBUTION OF LIGHT.

unit of candlepower. Values of candlepower will be given throughout in English units.

In Fig. 3 is given the curves showing the vertical distribution of light from the three lamps. Curve (A) is of the tantalum lamp with clear bulb, curve (B) of the tantalum lamp with frosted bulb, and curve (C) for the carbon-filament lamp. Data for these curves were obtained by taking measurements of candlepower every 10 degrees from the horizontal. While the tantalum lamps give much more light in a horizontal direction the amount from the tip of the lamps is much less than from the carbon-filament lamp, though this is one with a single-curl filament. The tantalum lamp with the frosted bulb gives a much better distribution of light than the one with the clear bulb, as shown by the curves.

The mean spherical candlepower of the tantalum lamp with clear bulb was 17.2, giving 2.23 watts per mean spherical candlepower. The frosted lamp gave 14.82 mean spherical candlepower, being 2.67 watts per candle. The carbon lamp gave 13.32 mean spherical candlepower, this being 3.72 watts per candle. Comparing these values we find that the tantalum lamp takes 57 per cent. and the frosted lamp 64.5 per cent. as many watts per horizontal candlepower as the carbon lamp. The carbon-filament lamp has an efficiency of 3.1 watts per horizontal candlepower. Also the tantalum lamp with clear bulb takes 60 per cent. and the frosted lamp 72 per cent. as many watts as the carbon lamp per spherical candlepower.

Measurements were next made to determine the variation in the candlepower with the voltage. The results are shown in the form of curves in Fig. 4. Values in per cent. of normal voltage are taken as abscissæ and values in per cent. of normal candlepower as ordinates. Curve (T) is for the tantalum and curve (C) for the carbon-filament lamp. The curves are similar but the curve for the tantalum lamp is more nearly horizontal, showing that the change in candlepower is much less than the change in the candlepower

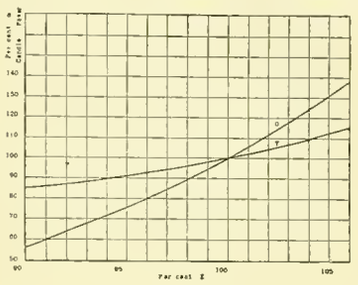


FIG. 4. CURVES SHOWING VARIATION OF CANDLEPOWER WITH VOLTAGE.

from the carbon lamp for the same change in voltage. An increase of four per cent. in the voltage caused an increase of 24 per cent. in the candlepower from the carbon lamp, while the same increase in voltage caused only a nine-per cent. increase in the candlepower from the tantalum lamp. It requires practically twice the per cent. change of voltage across the tantalum lamp that it does across the carbon lamp to cause the same change in light. This wide difference in the variation of candlepower with voltage is due to the decrease in resistance of the carbon and the in-

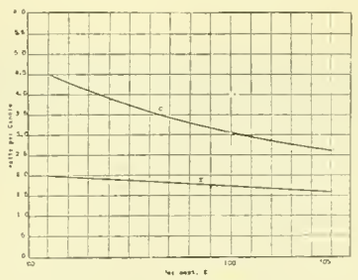


FIG 5. CURVES SHOWING VARIATION OF EFFICIENCY WITH VOLTAGE.

crease in resistance of the tantalum with the increase in voltage.

Fig. 5 shows the variation in efficiency with the voltage. Values of watts per candle are taken as ordinates and per cent. of normal voltage as abscissæ. Referring to the curve (C) for the carbon lamp, it is seen that an increase in voltage of five per cent. will cause a decrease in the number of watts per candle from 3.1 to 2.62, an increase in efficiency of 30 per cent. The same increase in voltage across the tantalum lamp will cause a decrease in watts per candle from 1.75 to 1.62, an increase in efficiency of about 12 per cent. With a decrease in voltage there results a corresponding decrease in efficiency.

The relation between candlepower and life of the carbon and tantalum lamps is shown in Fig. 6 by the two upper curves. Candlepower values are taken as ordinates and time of burning in hours as abscissæ. The curve for the tantalum lamp was the average of three lamps, the curve for each lamp differing only slightly from the average. The curve for the carbon lamp is the average of a large number of 3.1-watt lamps. During a life of 1,000 hours the tantalum lamp decreased in candlepower from 22.0 to 15.8, while the carbon lamp decreased in candlepower from 16.5 to 11.5. This amounts to about 28 per cent. in each case. These results show, then, that the falling off in the candlepower of the tantalum lamp is practically the same as in the case of the 3.1-watt carbon lamp.

The two lower curves in the same figure show the change in efficiency with life. The watts per candle taken as ordinates were obtained at the same time as were the measurements for the two upper curves.

1. A paper read before the Ohio Electric Light Association at Put-in-Bay, Ohio, August 18, 1905.

During the 1,000 hours the watts per candle increased from 1.75 to 2.4 in the case of the tantalum lamp and from 3.1 to 4.2 for the carbon lamp. This increase amounts to 37 per cent. for the tantalum and 33 per cent. for the carbon lamp. If we multiply the watts per candle by the corresponding candlepower we will find that the energy taken by both the tantalum and the carbon is practically constant during the life of the lamp, a slight decrease occurring in each case.

In regard to the cost of the tantalum lamp, the representative of the Siemens & Halske Company in this country states that the lamps had not been placed upon the market in this country and that consequently no figures on the cost here are available. The cost of the lamps in Germany in barrel lots is 80 cents, as compared with about 16 cents as the cost of the ordinary lamp. Assuming this same relation between values to hold in this country some interesting comparisons can be made. The useful life of each lamp may be taken as 500 hours. The average candlepower for that time is 19.87 for the tantalum lamp with clear bulb, 17.88 for the tantalum lamp with frosted bulb, and 15.37 for the carbon lamp. The average watts per candle

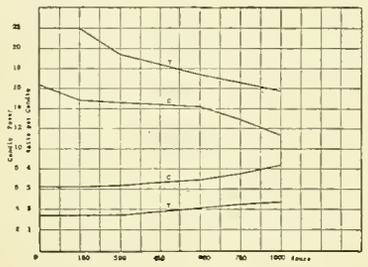


FIG. 6. CURVES SHOWING CANDLE-POWER AND LIFE.

are 1.86, 2.12 and 3.25, respectively. Assuming energy at 10, 5 and 3 cents per kilowatt-hour, the relation in cost can be expressed as follows:

Cost of energy per unit	$0.10	$0.05	$0.03
Tantalum light, clear bulb, cost	.80	.80	.80
19.87 × 1.86 gives 36.95 av. watts.			
36.95 watts for 500 hours costs	1.85	.93	.62
Cost of lamp and energy	$2.65	$1.73	$1.42
Tantalum lamp, frosted bulb, cost	.80	.80	.80
17.88 × 2.12 gives 38 av. watts.			
38 watts for 500 hours costs	1.90	.95	.63
Cost of lamp and energy	$2.70	$1.75	$1.43
Carbon lamp, cost	.16	.16	.16
15.37 × 3.25 gives 50 av. watts.			
50 watts for 500 hours costs	2.50	1.25	.83
Cost of lamp and energy	$2.76	$1.41	$0.99

Dividing the cost in each case by the average candlepower we obtain the relative cost and saving or loss by the use of the tantalum lamp.

Taking the cost of energy as 10 cents per unit, $2.65 ÷ 19.87 gives the cost per candle for 500 hours for the clear tantalum lamp as 13.3 cents. This amounts to a saving of 26 per cent. over the carbon lamp.

$2.70 ÷ 17.88 gives the cost per candle for 500 hours for the tantalum lamp with frosted bulb as 15.1 cents. This amounts to a saving of 16 per cent.

$2.76 ÷ 15.37 gives the cost per candle for 500 hours for the carbon lamp at 18 cents.

Carrying out the work in the same manner when energy is taken at five cents per unit, we find that the saving by the use of the tantalum lamp with clear bulb over the carbon lamp is 5.2 per cent.; by the use of the frosted tantalum lamp there is a loss of 6.7 per cent.

With energy at three cents per unit, there is a loss of 11 per cent. by the use of the clear tantalum lamp and a loss of 23 per cent. by the use of the frosted lamp.

These results show that there will be a saving by the use of the tantalum lamp only when the cost of energy is above or about five cents per unit.

If we speculate upon the possible value of this new lamp we should consider the value of burnt-out lamps. Allowing 50 per cent. of the original cost as the value of the lamp there will be found to be a saving when worked out as above of 35 per cent. in favor of the tantalum lamp with the clear bulb with energy at 10 cents per unit. With the energy at five cents, the saving amounts to 31.5 per cent., and at three cents to 13.5 per cent.

It is evident that the success of this lamp will depend upon the ability of the makers to reduce the cost of the filament. There seems to be a probability of this in the direction of improved chemical and physical methods of manufacture, as the present high cost is due not so much to the value of the raw material as to the difficulty of working the metal into a fine wire.

Duncan Meters: The Man and the Product.

Three years ago the Duncan Electric Manufacturing Company of Lafayette, Ind., commenced the manufacture of watt-hour meters and other electrical instruments; and the success which it has attained is proof of what may be accomplished in the electrical business under good management. From a beginning of 10 meters per day, with a small force of employes, the present output is 200 meters a day, and the business furnishes employment for 175 persons. The popularity accorded the direct-current watt-hour meters of this company is due to the new features which they embody, and no expense has been spared in giving to the direct-current station managers and superintendents a meter that is designed to meet all their requirements.

The factory buildings have a floor space of 67,250 square feet and comprise the main building, in which are contained the machine shop, winding department, assembling room, insulating room, armature department, tool room, tinsmith shop, magnet shop, dynamo room, box-making department, boiler room, engine room, plating department, drafting room, shipping department, storerooms and main office; the testing or laboratory building, in which all the meters are calibrated; the japanning building, in which all the meters are japanned and given artistic finishes, and a warehouse to contain the tons of magnet steel, copper wire, boxing lumber, excelsior, and other materials handled in car-load lots. The buildings are of brick, the main one being four stories high and measuring 50 by 200 feet. Every possible precaution is taken to prevent fire by having the buildings provided with automatic sprinklers, portable fire extinguishers, standpipe and hose, also barrels of saline water with accompanying buckets.

Each department is operated with an electric motor, and there are 14 such motors in use. The circuits are so arranged that the entire factory may be operated from the circuits of the local lighting plant by the simple throwing of a switch, thereby eliminating any fear of having to shut down in the event of anything happening to the engine, boilers, or power dynamo.

The buildings have recently been equipped with the most approved fire escapes, and nothing has been neglected that contributes to the comfort and safety of the employes.

In Fig. 1 is given a view of the machine shop, which is equipped with the most approved line of machinery obtainable, including numerous lathes, drill presses, automatic and semi-automatic screw machines; profiling, milling, grinding, shaping, tapping, screw-cutting and pinion-cutting machines. A novel form of automatic machine has been developed for cutting and polishing the worms on the shafts of the meters. The resistance cards employed in series with the armature of the meters are likewise wound by an automatic machine, which turns them out in a most perfect manner. This machine is so constructed that the cards can be wound wth any given number of turns of wire per section, the operation being perfectly automatic and absolutely accurate. The spindle points also are made automatically.

This matter of automatic machinery is also carried out in the gear and pinion-cutting machines as well as in the machines for winding the armatures. In the armature-winding machines the only work necessary on the part of the operator is to solder the joints and distribute the insulation on the spools upon which the wire is wound. The machine is automatically stopped when each coil has its proper complement of turns, and will also stop if a break or kink is in the wire. These machines are operated at a speed of 1,800 revolutions per minute, and one girl takes care of two of them, turning out 34 armatures per day.

The wire used in winding the armatures is No. 41 B. & S. gauge, which the company insulates for itself by reason of the difficulty experienced in using such small wire as is found on the market at such high rates of speed as that at which the armature-winding machines are operated. The ordinary run of No. 40 wire answered the purpose well enough for low speeds, but in order to make a satisfactory armature at high speed the company undertook the task of installing a wire-insulating department, which has proved to be a successful and profitable adjunct.

Fig. 6 shows the engine and dynamo room, in which a 100-horsepower automatic high-speed engine drives nine dynamos. The dynamos are for alternating and direct-current work throughout the factory and testing laboratory, and supply the necessary energy for all kinds of service required by these departments. The appointments of this department are in keeping with the rest of the factory, and all energy delivered to the various departments is accurately measured, so that each month is shown exactly the relative amount of power that has been consumed in the respective departments and compared with the respective output for prior months.

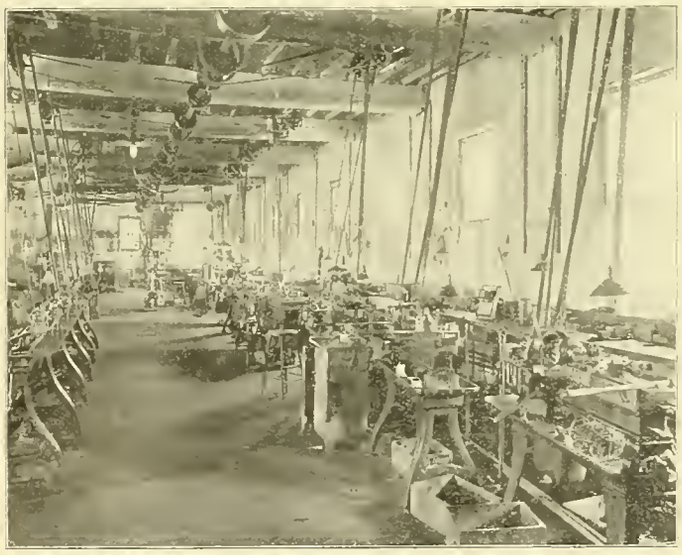


Fig. 1. Machine Shop.

Fig. 2. Testing Department.

VIEWS IN DUNCAN METER FACTORY.

A portion of the testing department is depicted in Fig. 2. On the work in this room largely depends the ability of a meter to give satisfaction to the purchaser, and in consequence the precautions afforded and taken are worthy of note. The success of the Duncan direct-current watt-hour meter is largely due to its extreme accuracy, and this is made possible by the use of a very expensive line of standard instruments. In addition to an ordinary complement of integrating standards, which are operated in conjunction with a mercurial wiping contact that operates a telegraph sounder, three sets of Weston standard instruments are used. These instruments comprise all sizes up to and including 10,000 amperes in ammeters, and to 7,000 volts in voltmeters. The

company is also fortunate in being able to acquire the assistance of the electrical engineering staff of Purdue University, which is situated in Lafayette, for special work. Fig. 3 shows one booth in the testing room.

Fig. 4 represents a portion of the assembling

FIG. 3. TESTING BOOTH IN DUNCAN METER FACTORY.

department. Here the different parts of the instruments are put together before being sent to the testing room.

Fig. 5 gives a view of one corner in the drafting and engineering department.

Fig. 7 is a picture of the magnet shop, with its gas and coke furnaces, bulldozer, grinding machinery and rumblers.

The present direct-current watt-hour meter of the Duncan company is presented as embodying everything that goes to make a satisfactory meter. Its design has been developed along practical lines, and with the idea and specific intention of supplying the central-station superintendent and meter expert

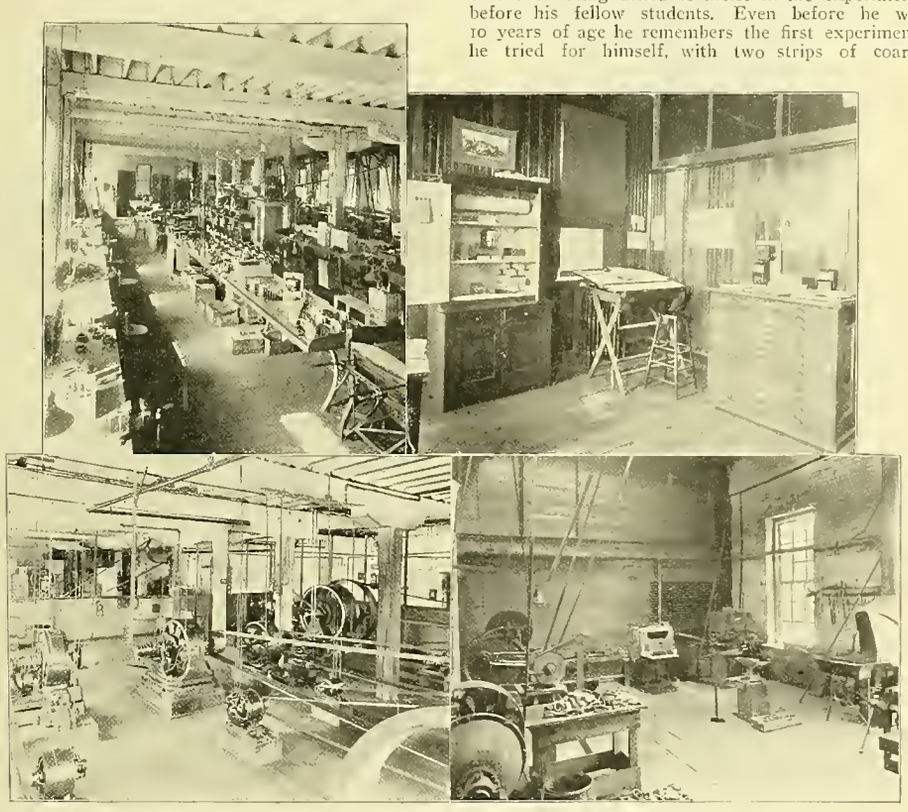


Fig. 4. Assembling Department.
Fig. 5. Draughting Department.
Fig. 6. Dynamo and Engine Room.
Fig. 7. Magnet Shop.

VIEWS IN DUNCAN METER FACTORY.

with an instrument to which he could refer as being built to his order, so to speak. It is contended that to Mr. Duncan belongs the credit of placing on the market the first thoroughly serviceable direct-current wattmeter, having these desirable features: Fireproof and dustproof binding posts; non-tension changing brushes; dustproof cover; permanent magnets of exceptional strength and permanence; hollow spindle; light moving element; extremely high torque; visual bearing; magnetically retained detachable spindle point, and double spring-cushioned jewel post.

The company also manufactures several types of ignition apparatus for automobiles, and for which there is a large and growing demand. This part of its product will soon be turned out in a three-story brick structure, that is now being erected for this purpose.

Thomas Duncan was born on December 26, 1865, at Drumrannie Farm, which borders on the town of Girvan in Ayrshire, Scotland. His birthplace is only a few miles from the birthplace of the poet Burns and of King Robert the Bruce. His father was civil engineer for the Marquis of Ailsa, and when Mr. Duncan was 10 years of age the family moved to Ireland, where his father was appointed as land steward to the Duke of Abercorn, Baronscourt, County Tyrone, and where the Duncans re-

THOMAS DUNCAN.

mained for seven years before returning again to the land of the heather.

Mr. Duncan received his education at the public schools of Girvan and Maybole, in Scotland; the Letterbin National School, Baronscourt, and the Model School at Newtonstewart, in Ireland. While attending the Model School he showed a natural aptitude and liking for the study of electricity and magnetism, and led his class in this branch to the extent of being asked to assist in the experiments before his fellow students. Even before he was 10 years of age he remembers the first experiments he tried for himself, with two strips of coarse brown paper, which he heated and dried, then, by rubbing one of them, and not the other, they would adhere tightly together; then, by rubbing both, they would repel each other. These experiments were again performed in a small dark closet underneath a stairway, which afforded an excellent opportunity to witness the miniature sparks that were drawn from the excited strips of paper with the knuckle of one of the fingers; likewise, the electrical or phosphorent glow that was produced at the line of separation when the dissimilarly charged paper strips were quickly drawn apart. Still another of his early boyhood experiments was to rub together two pieces of loaf sugar until they glowed in the dark under the friction.

After leaving school the youthful experimenter took up pharmaceutical chemistry, but, still being imbued with the idea of following an electrical profession, he decided to go to the United States, where great possibilities were developing in all branches of that business. Accordingly, he entered the employment of the Sun Electric Company, Woburn, Mass., in 1886. This company manufactured incandescent lamps, transformers and alternating-current dynamos, so he had ample opportunity to take up these lines of work in a thorough manner. The following year he accepted a position with the Fort Wayne Jenney Electric Light Company, Fort Wayne, Ind., in the manufacture of incandescent lamps. In the early part of 1890 he entered the meter department of the Thomson-Houston Electric Company, Lynn, Mass., where he became thoroughly acquainted with the different meters that were on the market at that time. His principal work was the testing of meters for direct currents; also for alternate currents, both primary and secondary, and many tales of woe can be related with reference to the shortcomings of the meters of that period.

In December of the same year Mr. Duncan again returned to Fort Wayne, and took charge of the laboratory and meter-testing department of the Fort Wayne Electric Light Company. In 1893 he was granted several patents on meters, and in 1894 the Fort Wayne company commenced to put the product of his inventions on the market, and for the eight years following the Duncan meters found a large and ready market in every country where alternating currents were in use.

The year 1901 found Mr. Duncan at the head of the present corporation, which is making direct-current meters exclusively, and enjoying a patronage that has already exceeded the founder's most sanguine expectations. He has been granted upward of 200 patents on electricity meters, and, in consequence, enjoys the reputation of being the most prolific and most successful inventor in his chosen art. His inventions cover the meter business in every detail, and a number of them are generic in character. To his ability as a meter engineer and inventor is due the magnetically retained spindle point, the double spring-cushioned jewel post, the multi-point-switch method of compensating for friction and vibration, the magnetic shield, the adjustable friction compensating coil, the fireproof and dustproof binding posts, the visual bearing, and the high driving torque, all of which combine to make a most successful meter. Mr. Duncan was also the first to discover that, by setting the permanent magnets, taken lengthwise, at a right angle to the magnetic axis of the series field coils, the weakening or demagnetizing effect upon the magnets is reduced to a marked degree.

Some of his recent patents, as mentioned briefly in the Western Electrician of August 12th, include monetary meters, i. e., they indicate the equivalent of the energy consumed in dollars and cents, so that any layman can readily understand the reading of his meter. Some of these meters are provided with a double-dial arrangement—one showing the watt-hours and the other the monetary equivalent in dollars and cents. These monetary meters are also constructed so as to permit the dial to be placed outside of the building, while the meter may be installed in either the attic or the basement, which fills a much-felt want to persons who object to having the employes of lighting companies enter their houses or apartments to read the meters.

Mr. Duncan's recent work has also given to the art something entirely new in multi-rate meters, which automatically vary the rate per kilowatt-hour as the load at the central station varies. For example, the meters will increase the rate as the load increases during the evening—then gradually reducing the rate again as the load on the plant decreases. This meter also has provisions for taking care of the various rates as met with in every-day practice and in different central stations. Some of his other inventions of recent date include multi-discount meters, which will open up new conditions in the selling of electrical energy for lighting and power purposes, and which have hitherto been considered as impractical. To illustrate the function of one of these multi-discount meters, it may be assumed that the central-station manager wishes to make a contract with one of his customers, in which the customer is to pay 10 cents a kilowatt-hour for the first 25 kilowatt-hours; eight cents for the second 25 kilowatt-hours; six cents for the third 25 kilowatt-hours; five cents for the fourth 25 kilowatt-hours; four cents for the fifth 25 kilowatt-hours, and so on. This meter accomplishes this integration at the different rates when the corresponding amounts of energy have been reached and consumed. At the end of the month the dial reading of the meter is taken, and this, multiplied by the highest, or 10-cent rate, gives the exact amount of the customer's bill, with the various discounts all taken care of. This meter, provided with a monetary dial, even eliminates the necessity of having to compute the amount of the bill for the month.

Bids for Arc Lamps.

Bids for supplying the city of Chicago with 1,000 new alternating-current arc lamps of 2,000 nominal candlepower each, 10 100-light transformers and 10 100-light regulators were opened by City Electrician Carroll a few days ago. Three companies bid for the contract, the Western Electric Company of Chicago, the Stanley-G. I. Electric Manufacturing Company of Pittsfield, Mass., and the Fort Wayne Electric Works of Fort Wayne, Ind. Each of the companies submitted samples, which will be considered in awarding the contract. The lowest bid for furnishing the arc lamps was $13.75 each and the highest $15. For 10 100-light transformers the lowest bid was $300 each and the highest $426. The bids for 10 100-light regulators ranged from $173 to $216 each. Bids were also asked for 10 50-light regulators, and for these the lowest was $116 each, and the highest $148.50. In the case of the lowest bidder for arc lamps the lamp offered operates at seven amperes, with lamp-terminal voltage of 77 and arc voltage of 72.

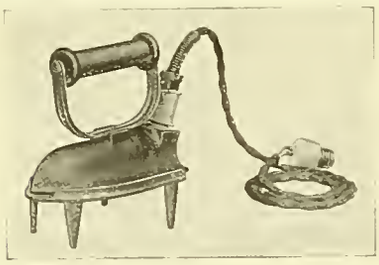
San Francisco Gas and Electric Company Changes Hands.

It is stated upon good authority that the actual transfer of the San Francisco Gas and Electric Company to the Rockefeller interests has taken place. It is understood that C. O. G. Miller is to be the head of the company from this time on. As soon as the San Francisco Gas and Electric Company has been taken over completely, it is said, the work of absorbing the San Francisco Coke and Gas Company will be undertaken.

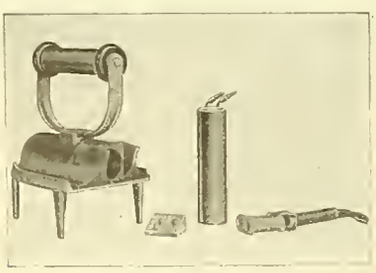
Bearing on this subject the San Francisco correspondent of the Western Electrician writes under date of August 18th: "The steady advance of San Francisco Gas and Electric stock during the last few weeks from $62 to $77 indicates that there are prospects of its purchase under some sort of a proposition, generally supposed to have the backing of the California Gas and Electric Corporation. All sorts of rumors are afloat as to the Standard Oil or railroad interests also taking a hand in the deal. Edwin Hawley has been mentioned as one of those who had made an offer for the holdings of the company. The consent of the holders of two-thirds of the capital stock must be secured before any transfer can be made. The majority of the stockholders of the Mutual Electric Light Company seem disposed to keep out of the combine, as its new modern plant is making a fine record and there is a good field for competition."

New General Electric Flatiron.

The important part which electricity is effecting in the case of performance of many household and business operations is well shown in the operation of the new electric flatiron which the General Electric Company has recently placed upon the market. This flatiron is so far superior to the old-fashioned iron that, in spite of its recent development, about 6,000 irons have been already shipped. One of the most completely equipped laundries in the world



ELECTRIC FLATIRON COMPLETE WITH CORD AND STAND.



PARTS OF NEW ELECTRIC FLATIRON.

is among the establishments using these irons exclusively, and many householders of widely varying means are using them.

The heating unit of this iron is a resistance coil of liberal cross-section enclosed in a metal shell. This coil is so designed that the heat flows to the work as fast as it is generated. The iron thus remains at an even temperature under constant use, and no work is delayed by a cold iron or scorched by an overheated one. A great saving in time is thus effected over the old-fashioned method, where several irons are needed and frequent trips to the stove are requisite to keep the iron hot. The resistance unit is of high efficiency and durability, and may be easily renewed when necessary. Only enough metal is used to carry the heat from the resistance unit to the work, the requisite weight being in the handle. This gives a far better balance to the iron than was possible in the old kind. The handle is made of fiber, and remains cool.

The iron is so shaped as to insure an even temperature at its face, and its high polish greatly facilitates the work. It is so designed as to meet practical laundry needs, and has been found to be easier to insert in plaits and ruffles than the ordinary kind.

The features of safety and convenience in this iron are especially noteworthy. There is no necessity for fire to heat the iron, and the insertion of the plug in a lighting socket gives a traveler an iron immediately available for use in any hotel room wired for electric lighting. Each flatiron is furnished with a stand, eight feet of special flexible cord and a porcelain detachable plug which fits the heavy brass contacts of the iron.

Repeated endurance tests, made by allowing the iron to remain 1,000 hours on its individual stand, with the current turned on, have conclusively proved the durability of the General Electric flatiron.

New Kellogg Harmonic Ringer for Party Lines.

The production of a polarized ringer for use with the "harmonic" system of selective party-line signaling that is both simple and efficient has been the aim for some time of the Kellogg Switchboard and Supply Company of Chicago, and the harmonic ringer which it is now placing on the market is said to meet all the requirements of a party-line ringer.

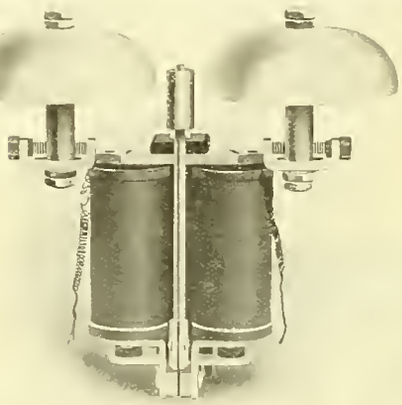


FIG. 1. FRONT VIEW OF HARMONIC RINGER

The principle of the harmonic system is now well known. In brief, it may be stated as follows: Every reed has a natural period or rate of vibration, and by applying small impulses of force to this reed it can be made to take up that particular vibration. If the same amount of energy were applied at a different rate, this particular reed would not respond. This being the case, it only remained to design a ringer having a reed or armature which would be acted upon by electrical impulses sent over the telephone line from a suitable ringing machine in the telephone exchange. This new ringer is the outgrowth of a considerable number of experiments along this line, and it is confidently asserted by the maker of this ringer that all the previous disadvantages have been overcome.

In Fig. 1 is shown a front view of this new ringer. The method of adjusting the positions of the gongs should be particularly noted. The studs to which the gongs are fastened are inserted in slots at either end of the yoke which joins the two cores of the ringer. Through these studs there passes a threaded set screw, on the outer end of which is a square head with two flanges. These two flanges rest in the upturned grooves on the ends of the yoke. The stud is held down to the yoke by means of two lock nuts and a spring washer, the spring washer being placed over the threaded end of the stud immediately under the yoke. This method of fastening the studs makes a firm and at the same time adjustable connection. In adjusting the positions of the gongs it is only necessary to turn the two set screws in either direction, thereby bringing the gongs either nearer or farther away from the tapper. This method of adjusting the gongs is without doubt one of the best means ever designed for this purpose.

The tapper, it will be noticed, is a cylindrical-shaped bar at the top of the tapper arm. It is securely fastened to the tapper arm, so that there is no possibility of that part of the ringer ever getting out of adjustment.

In order to furnish the four different ringers necessary for the different party lines, four tappers of different lengths have been made. The tapper arm is securely riveted to the armature, and the armature is riveted to the steel spring upon which the tapper mechanism vibrates.

In case it is desired to change the ringer in a certain telephone instrument to another party on the line, it is only necessary to loosen the locknuts at the lower end of the spools, which makes it possible to remove the whole armature and tapper mechanism, and another set can be inserted in its place. This simple operation does away with the old system of transferring wires to different clips in the different telephone instruments; also making it possible to connect every telephone on the line in exactly the same manner.

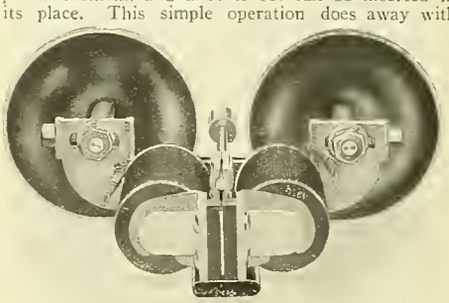


FIG. 2. END VIEW OF HARMONIC RINGER.

Fig. 2 shows the end view of the ringer and gives a fair idea of the construction of the armature end of the ringer. Fig. 3 shows part of the ringer disassembled and shows the general construction of this ringer. The adjustment of the space between the armature and the magnets is accomplished by the pole-pieces which are screwed into the cores of the magnets. These pole-pieces can be raised or lowered and any adjustment attained which is desired.

This ringer is made very efficient by the fact that the permanent bar magnet is in metallic contact with the armature of the ringer, which is a very great advantage and a result not yet obtained in the regular type of polarized ringer.

Another very important advantage which this harmonic ringer possesses is the fact that it can be placed in any common-battery telephone to take the place of an ordinary single-party polarized ringer. This is especially valuable to operating companies which wish to change their ordinary instruments to four-party instruments without the expense which would otherwise be necessary in the installation of entirely new telephones. It may also be stated that when this ringer is used in any telephone the appearance of the latter from the outside differs in no way from the ordinary ringer, and unless a person opened up the telephone and examined the ringer it would be impossible to tell the instrument equipped with this ringer from a single-party telephone.

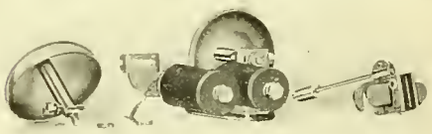


FIG. 3. HARMONIC RINGER PARTIALLY DISSASSEMBLED.

Inquiry Into Telephone Systems by Select Committee of Canada.

On March 17th the House of Commons of the Dominion of Canada appointed a select committee to inquire into and report regarding the various public telephone systems in operation in Canada, and elsewhere if the committee so determined, and to consider and report what changes are advisable in regard to the methods at present in force for furnishing telephone service to the public. The committee was given power to send for persons and papers, to examine persons under oath and to engage stenographers, clerical and other assistance.

The committee as appointed consists of Sir William Mulock and Messrs. Grant, Johnston, Maclean, Monk, Roche, Smith, Zimmerman, Bergeron and Goeffrion. The first meeting was held on March 20th in Ottawa and at that time Sir William Mulock was elected president. Reference has been made to the work of this body in the Western Electrician, but it is now possible to give more of the details, as the deliberations of the committee up to July 12th, at which date it was still in session, have been printed in pamphlet form. Up to this date the committee had done a large amount of work. About 60 witnesses were sworn and examined, among them some well-known men. Many of these were recalled several times. Besides the witnesses examined, the committee has received letters, statements, expert reports and various other documents from sources all over the world, all

bearing upon the operation of telephone systems, the cost of constructing plants, etc.

It is impossible here to give an outline of all the evidence produced, but a brief mention of some of the more important points will be read with interest. A clearer idea of the object of the committee will be gained from an abstract of the address of Mr. Mulock, following his election as chairman, which is as follows:

The question which we have been appointed to investigate is a most important one, and personally I approach it with an unbiased mind. There are several points which require the attention of the committee. First of all, there is considerable legislation under which telephones are operated, and I think it should be our object to acquire information regarding this legislation, whether passed by the Dominion Parliament, the provincial legislatures, or possibly by municipal bodies. This is a phase of the question which will require special investigation and study. I have, therefore, invited Mr. Pownall of the Department of Justice to prepare a report on the condition of the law regarding telephones in Canada, the mother country, the United States and elsewhere. I have also had a report furnished me by Mr. F. Dagger of Toronto on the working of some municipal systems in the western states. I think the members of the committee will agree with me that it would be advisable to know the exact position of the federal and the provincial laws in Canada, the laws of the United Kingdom, Australia and other countries.

I think it will be necessary for the committee to summon the officers of the various telephone company, to examine these officers, to ascertain the extent of their systems, the capital invested and the details of operation. The point, to my mind, and it is a very important one, is that, while there are many telephone systems in very thick settled districts, and some grievances in connection with their working, there is a grievance also from which that class of persons who have no telephones at all suffer. I do not think any analysis of the telephone systems will be completely satisfactory unless the committee is able to devise a scheme that will enable the isolated individual in his country home to secure the benefit of telephonic communication at a cost within the means of the average resident in the outlying district. Take a farmer, for instance. He is chiefly interested in having telephone communication with his immediate neighbors. While trunk lines connecting his district with the whole telephonic world might be useful, I fancy that the farmer, from the standpoint of usefulness, would prefer a telephone system that will enable him to be in telephonic communication with his neighbors and with his market town. He would prefer that to what might appear to be a much more extensive service, but which would not be so useful to him, namely, the long-distance. I, therefore, think that we should direct our attention to that phase of the question, to see whether it is possible to devise a system that will enable us to furnish to the people in the sparsely settled districts a telephonic service. This will depend, I suppose, to some extent upon the development of the automatic service—I mean a service which can be operated without the intervention of the central station. Now, I was told by this person who made a report to me on the workings of the telephone systems in the United States that about a dozen people could conveniently work a system without any assistance from without, and that they could have, and did have, some of these groups in connection with the market towns. For example, the connection could be put in the postoffice; we have postoffices everywhere anyway, and each man on that group would be able to speak by telephone with his neighbor, and also with his market town. I think that is a phase that is very important and that is worth inquiring into.

I have a plan in my mind on that point, and I will outline it for your information. I do not know whether it is practicable or not, but I will give it for analysis. I am not aware of there being any precedent for it, therefore I am quite ready to submit the plan for your criticism. It is this: That we should seek to organize and arrange for telephones to be brought within the reach of residents in a municipality, through machinery to be established by the municipality itself. There would be a practical difficulty in the way of the government of Canada establishing telephones in every man's house, keeping up repairs, collecting rates, and so forth. But if, by the co-operation of the municipalities, we could induce the municipalities to deal with the telephone service as a municipal service, charging their tolls as a tax in the ordinary tax bill, then the Dominion government would not be charged with the details of it. The group would make application to the municipality for telephone service, and the municipality could pass the necessary by-law, under the municipal law, for that purpose. Then the municipality would apply to the Dominion government, by a method to be taken up later, to establish a municipal telephone in that district. We would not deal with an individual, but we would deal with the municipality, and the municipality in turn would deal with the individuals as ratepayers, and there would be included in their tax bill an item for telephone service, the same as there now is for water rates.

Francis Dagger of Toronto, a practical telephone man, submitted a large volume of evidence. A letter from Mr. Dagger to Mr. Mulock, dated March 3, 1903, was presented, as the statistics were considered of value. Mr. Dagger explained before the committee that the figures in the letter need only slight change to bring them up to date. Some extracts from the letter are as follows:

In accordance with your instructions, I have the pleasure to report herewith upon the telephone situation in Canada, and in submitting the facts and figures which are herein set forth, I would point out that I have given only such information as has been obtained from reliable sources. The opinions expressed by me are the result of 20 years' experience in practical telephone operations, in which I have had an opportunity of watching the results of telephone working under the following conditions:

In Great Britain, as a monopoly owning and controlling the local and long-distance lines; as a company in competition with the postal telegraph department; as a company owning and controlling the local and long-distance lines, in competition with local and private enterprise; as a monopoly owning the local exchanges, with the government owning and controlling the long-distance lines; as a company in competition with municipal enterprise, the government owning and controlling the long-distance lines.

In Canada, as a monopoly owning and controlling the local and long-distance lines. I have further made an exhaustive study of the results of telephone competition in the United States and also of the telephonic conditions on the continent of Europe. Judged from the standpoint of the public good, there is no doubt that the telephone facilities of the Dominion are not satisfactory, the principal causes of complaint being (1) high rates in large cities; (2) disproportionately high rates in cities of from 25,000 to 60,000 inhabitants; (3) high long-distance rates; (4) lack of rural communication.

It is an undisputed fact that the number of telephones in use in the Dominion of Canada is out of all proportion to the population if we take the best telephoned countries in the world as a standard of perfection. According to the latest statistics, Norway, Sweden and Denmark have one telephone to every 14 inhabitants. If this standard were reached in Canada the number of telephones would be 393,000 instead of the 63,192 recorded in the 1902 edition of the statistical year-book of Canada.

Statistics for 1901 place the proportion of telephones to population in the different provinces as follows: Ontario, 1 to 89; Quebec, 1 to 102; Nova Scotia, 1 to 122; New Brunswick, 1 to 129; British Columbia, 1 to 63; Manitoba, no records; Prince Edward Island, no records.

It is significant that British Columbia, where the systems are operated by local companies free from the influence of the Bell Telephone Company, has the best record, notwithstanding the fact that the province has no long-distance facilities. Dealing with that territory served by the Bell Telephone Company it would appear that the cities and large towns have a fair service in point of numbers, though the rates are excessive, especially in cities smaller than Montreal and Toronto. The small towns, villages and rural communities have a very inadequate service and have hitherto been almost entirely left out of consideration by those upon whom the duty of supplying telephone facilities has been delegated, and this is further emphasized by the fact that in some districts the people themselves have made feeble efforts to provide their own service.

The rates charged in Canada at present for a modern telephone service are approximately as follows:

	Business.	Residence.
Cities over 30,000 inhabitants	$50	$30
Towns, 5,000 to 20,000 inhabitants	25	25
Small towns	20	20
Villages	20	15

In the cities extra mileage is charged, in most cases, beyond the first mile, at the rate of $15 per mile per annum; and in the towns and villages the rates only cover half a mile of single wire, extra mileage at the same rate being charged beyond that distance, and additional rates ($20 to $25) for a metallic line and long-distance instrument.

That these rates are excessive is evidenced by the records of other countries, notably the Independent companies in the United States, in Sweden, Denmark, Norway, Switzerland and other European countries, also the state of Guernsey and the municipality of Glasgow.

There is no doubt that the over-capitalization of the Bell Telephone Company of Canada is the cause of the high rates charged to telephone subscribers in the Dominion. It is on record that the American Telephone and Telegraph Company held stock valued at $1,928,900 out of the Canadian Bell company capital of $5,000,000 allotted to the former company for the use of patent rights long since expired. To pay eight per cent. upon this $1,928,900 the sum of $154,312 has to be provided out of the rentals paid by the Canadian telephone users, or in other words, an average tax of $3.60 per telephone has to be furnished over and above what is necessary to pay an eight-per cent. dividend upon the actual capital outlay upon the plant.

Another reason for the excessive charges is the fact that the development of the telephone has passed through several stages since the date of the original patents, and at each stage the apparatus in use becomes obsolete, rendering it necessary in the larger exchanges for the company to partially reconstruct its system and install improved plant. There being no adequate depreciation fund in existence to cover the cost of this reconstruction, the expenditure upon this work has been charged to capital account, thereby increasing the amount upon which dividends had to be earned, with the result that today the plant of the local systems could be duplicated for about one-third of the total capitalization and bond issues.

I do not wish to make any unfair criticism of the methods of the Bell Telephone Company, but the fact remains that the state, or any municipality, or company, desiring to establish a modern system could give service at much lower rates and earn satisfactory profits, because its capital outlay would be very much less than the amount upon which present telephone users have to pay dividends.

In 1894, before the advent of competition in telephones, the Bell Telephone Company of America had less than 238,000 subscribers' stations, with a total output of 582,506 telephones, the result of nearly 20 years' undisputed possession of the field. On December 31, 1901, seven years later, the figures, including Bell and Independent telephones, were 2,270,647. There has further been very marked improvement in the service given, since the advent of competition, due to the fact that the increased demand for telephones, has widened the field for inventors in the various branches of this art to an extent which would not have been possible during the continuance of monopoly. It is also obvious that the Independent telephone companies have provided employment for many thousands of people who would otherwise have been forced into the ranks of other trades and professions, some of which are already overcrowded.

I am satisfied that except in countries covering a small area, state ownership of local exchanges has not proved a success. France and Germany have adopted this policy and they are two of the worst telephoned countries in Europe both in regard to service and rates. On the other hand, small countries like Switzerland and Luxemburg have both a cheap and good service. This is mainly due to the fact that while centralized management may be practicable in a small area, it is not so in a large one.

The only satisfactory method of dealing with the telephone problem would, in my opinion, be the adoption of government ownership and control of the long-distance lines and government control of the local systems. I do not deny that such a proposal would be a radical departure from the present system, and that there may be difficulties to be overcome in the carrying out of a policy of this kind, but I believe that all efforts in this direction would be more than justified by the results.

I do not believe the purchase of the long-distance telephone lines is a practical proposition unless the telegraph system is acquired at the same time, as the telegraph companies would undoubtedly enter the telephone business in competition with the government. It is, therefore, necessary to take into consideration the cost of the telegraph as well as the telephone service. As to the value of these combined systems, I would estimate it to be as follows: Great Northwestern Telegraph Company, $1,000,000; Canadian Pacific railway, $600,000; Western Union, $200,000; Bell Telephone Company, $1,500,000.

Failing the acquisition of the long-distance lines by the government, legislation should be enacted compelling existing telephone and telegraph companies to give service to all local telephone systems over their lines upon the latter providing at their cost the switching apparatus and wire necessary to make such connection, and further that all telephone companies shall be compelled to give such connections as will enable their subscribers to converse with whomsoever may call them up without regard to the exchange where the call originated.

Mr. Daggar gives his ideas about the control of local systems, the conditions of license, government specifications, rural systems and concludes by saying that in his opinion the department which now controls the transmission of intelligence by mail, namely, the postal department, will be the proper authority to control the transmission of intelligence by wire. Moreover, the fact that this department has offices already in existence in every city, town and village in the Dominion would be of great advantage in the economical administration of government-owned telegraph and long-distance telephone lines, in addition to rendering assistance in working of rural telephone systems.

[*To be continued.*]

New England Telephone News.

An important addition to the telephone equipment south from Boston is about to be undertaken. The project has been under consideration for some time, but the details have only recently become known to the public. The conduit system, which has

worked so well in the centers of population, is to be applied to the service between Boston and New York by the Southern New England Telephone Company and the American Telephone and Telegraph Company, and contractors have been asked to bid on the work of construction from New Haven to Portchester, to which point the conduits from New York already extend. This is the first attempt to build a cross-country conduit system for telephone service in New England.

It is stated that the Southern New England Telephone Company contemplates installing roadside telephones along the tourist route most traveled between Boston and New York, for the accommodation of automobilists. The telephones will also be a boon to residents in the sparsely settled districts who desire to avail themselves of the privilege of having keys, which will give access to the boxes in which the telephone outfits are to be placed. The innovation is to be operated in connection with the conduit system that is projected, it is stated.

The directors of the New England Telephone and Telegraph Company recently voted to increase the capital stock of the company by an issue of 30,860 shares, for the purpose of meeting the maturing bonds of 1906, and for further extension of the equipment. The new stock will be issued to stockholders of record at the close of business August 19th, in the proportion of one new share for every eight held, and will be floated at par. Subscriptions close September 16th and are payable 50 per cent. on that date and 50 per cent. on February 16th next. B.

Telephone News from the Northwest.

The Wisconsin Telephone Company contemplates extensive improvements to the local exchange at Neenah, Wis., including a modern new switchboard and other improvements.

The Northwestern Telephone Exchange Company seeks a franchise for a local exchange at St. Charles, Minn., and offers free service for a time, but declines to have any clause regulating charges in the franchise. The Northwestern has recently discontinued connections with the People's Telephone Company, which has connected with the Tri-state Telephone Company.

The council committee of Minneapolis, which was named to consider the matter of enforcing the burying of telephone wires, has adjourned for four weeks in which time to secure additional information.

The People's Telephone Company of Superior, Wis., has awarded a contract to the Kellogg Switchboard and Supply Company of Chicago for a modern switchboard and new equipment to be used in rebuilding its system in Superior.

The Browerville (Minn.) Telephone Company has filed articles of incorporation with $10,000 capital stock. Thomas Held and others are incorporators.

The council of Winona, Minn., has voted, in the case of the Northwestern Telephone Exchange Company, which has sought permission to place its instruments in the police and fire departments free and on equal terms with the local telephone company, to grant the request, contingent upon the company accepting a franchise similar to that held by the Winona Telephone Company, which will bring the company under the regulation of the council. As the Northwestern has steadfastly refused to accept such regulation at other points, it will probably do likewise in Winona.

The Mallard Mutual Telephone Company has been incorporated at Mallard, Iowa by J. P. Mulroney and others with a capital of $12,000.

The Otter Creek and Liberty Center (Iowa) Mutual Telephone Company has been incorporated with $3,000 capital. J. H. Sandy heads the list of stockholders.

The Fox River Valley Telephone Company will begin work at once on its new exchange at Sheboygan, Wis.

A local telephone company has been organized at Crandon, Wis., and a new system will be installed at once.

The contract for the erection of a new exchange building at Sioux City for the Iowa Telephone Company has been let to F. W. Chapman of Waterloo, Iowa, at $21,500.

The Lemars (Iowa) Telephone Company has changed its name to the Plymouth County Telephone Company and increased its stock from $50,000 to $100,000. Extensive improvements and extensions are planned.

The Mississippi Valley Telephone Company contemplates putting in a new exchange at Burlington, Iowa. R.

Indiana Telephone Items.

The appraisement of the personal estate of the late Simon P. Sheerin of Indianapolis shows that Mr. Sheerin held 1,196 shares of the common stock of the Indianapolis Telephone Company, valued at $59,800; 299 shares of the preferred stock of the same company, appraised at $22,425; 421 shares of New Telephone Company stock, $33,686; 1,111 shares of stock of the New Long-distance Telephone Company, $49,995; 611 shares of Citizens' Telephone Company of Columbus, Ind., $18,330; 31 bonds of the New Telephone Company of Indianapolis, $24,800; 33 bonds of the New Long-distance Telephone Company of Indianapolis, $28,050, and 59 bonds of the Citizens' company of Columbus, $22,125.

The Lowell Telephone Company of Lake County has filed articles of incorporation with a capital stock of $9,000 to operate a complete telephone system. John H. Spindler, S. E. Pletcher and C. O. Hill are the directors.

The Converse Independent Telephone Company, which recently established a toll service between Marion and Converse, will ask for a franchise south from Marion to Fairmount. It is stated the line will be used for both telephone and telegraph purposes. O. P. Barger is manager of the company. It is the intention to use the old Wilson-McCulloch telephone line and to join with the otner Independent companies to the south of Marion. A station of the company has been established at Marion and by the use of messengers has a toll line in operation between Marion and Converse. The line is to be in competition with the Central Union Telephone Company,which recently bought the local Independent plant.

There is active competition in Hamilton County between the Central Union Telephone Company and the Independents, the former offering free telephone service to all desiring it.

Among the improvements being made by the Independent telephone companies in Indiana may be mentioned the following: The Mutual Telephone Company of Shelbyville is rebuilding its entire plant; the Crawfordsville company is laying a vast amount of cable; at Columbus additional telephones are being installed at the rate of 50 telephones per month; $15,000 additional is being expended in rebuilding the plant at North Vernon and in improving the lines; the New Long-distance Telephone Company has installed new circuits to Franklin, Greenwood and Veedersburg, and two new circuits from Indianapolis to Bedford; the Lafayette company is expending about $75,000 on improvements; at Kokomo nearly 300 new applications for telephones have been filed and the capacity of the plant will have to be enlarged to accommodate these. About $4,000,000 has been spent on improvements by the Independents of Indiana during the last year.

The Markle Telephone Company, a part of the United property recently bought by the Bell people, has raised its rates and a similar increase is expected in other towns of the United. S. S.

Bell Output for July.

The July instrument-output statement of the American Telephone and Telegraph Company is a lighter exhibit than usual, indicating the smallest output for any given month since last November. The total gains for the year to date, however, indicate a gain in instruments outstanding during the first seven months of 1905, compared with the corresponding period last year, of nearly 1,000,000 instruments. The figures for July and seven months are given as follows:

July:	1905.	1904.	1903.	1902.
Gross output	114,897	80,348	69,194	59,935
Returned	63,979	42,842	44,116	34,054
Net output	50,918	37,506	25,078	25,881
January 1 to July 31:				
Gross output	1,012,517	692,032	669,258	619,044
Returned	347,521	290,032	279,257	260,321
Net output	664,996	382,000	390,001	388,723
Outstanding July 31	5,145,560	4,161,517	3,540,321	2,914,733

New Telephone Equipment for Decatur, Ill.

The Macon County Telephone Company of Decatur, Ill., has awarded a contract to furnish a full lamp-line signal multiple switchboard and all auxiliary apparatus for its exchange. The board is to be especially arranged for magneto service, thus permitting the use of the old instruments and the present construction, which is largely composed of common-return and grounded lines. The board is so arranged, however, that it can be changed to full central energy with double-lamp supervision, without discarding any of the equipment already installed.

The apparatus is of the latest design and manufacture of the International Telephone Manufacturing Company of Chicago, and with the new equipment it is estimated that the system can be operated at a saving of fully 20 per cent.

MANUFACTURERS AND DEALERS.

The Automatic Electric Company of Chicago has issued a bulletin describing in detail the new automatic system installed by the Home Telephone and Telegraph Company of Los Angeles, Cal.

The Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., reports having closed contracts for switchboards for the following places: Minneapolis, Minn.; Louisville, Ky.; Gilbert Station, Iowa; Rocherter, N. Y.; Miami, Fla.

The International Telephone Manufacturing Company of Chicago reports a brisk demand for its transmitter, especially for toll-line switchboards. These transmitters are provided with an especially prepared grade of carbon, which is said to have a very strong, clear and natural tone.

CORRESPONDENCE.

Great Britain.

London, August 9.—At last a decision has been given in connection with the London electric power scheme, and the local authorities have had a bad setback, inasmuch as the committee which has been considering the matter has given the promoters what they have asked for. Although the decision so far is in favor of the scheme, peculiar circumstances attach to the project, and as far as this session is concerned it is rather unlikely that the bill will proceed. The final stage of the bill is the third reading in the House of Commons, but inasmuch as the committee stage was not reached until Tuesday and the session ends on Thursday (tomorrow), it is obvious that unless special facilities are given the bill cannot proceed. The hope of the promoters, therefore, lies in securing the permission of Parliament to suspend the bill until next session and then to introduce it from the point at which it left off this session. Such a proceeding is rare, and further, the obstruction by the opposition to the bill is likely to be so great that some fears are entertained that this will not be possible. If not, then the project will be "dead" for this year and would have to commence all over again in 1906. Possibly some way will be found out of the difficulty, for as a matter of common sense it would be a misfortune for the enormous expense incurred this year to have to be reincurred next session. It is just possible that an effort to rush the bill through will be successful. The committee only passed the bill by a majority and not unanimously, and there is a large number of people who think that some special enquiry should be given considering the exceptional circumstances surrounding electric supply in London.

Another matter of great importance not only to London but to the whole of the United Kingdom is the agreement with the National Telephone Company by which the postmaster-general would acquire the company's undertaking. As I have reported, a committee of the House of Commons was appointed to consider the agreement and sat for several weeks doing this. The committee in question was conceded by the government after repeated badgerings by the opposition and even some of the members of the government party. Not unexpectedly, the committee has reported somewhat against the agreement in the shape of several drastic modifications and alterations. These have to be discussed in the House and again the lateness of the session has introduced some complications. The agreement will come into force automatically if it is not rejected by Parliament before August 31st, and consequently a debate will take place. It is reported that the government will move that the recommendation of the committee be ignored and that the agreement as arrived at between the postmaster-general and the company be ratified. Here again the matter is too complicated to deal with in a short paragraph. The company is naturally strenuously opposed to any alteration in the agreement. The matter is a delicate one for political reasons and the debate tomorrow should be instructive.

It is well known that the Marconi Wireless Telegraph Company has entered into agreements with the British admiralty for the installation of wireless apparatus on board the naval vessels, but it was not so generally known that a clause in these agreements precludes the admiralty from extending the benefits of them to other British government departments. But such is the fact.

A fairly frequent service of electric trains is now being run on the District railway by Mr. Yerkes' company. Now that the staff has got into proper working order, everything is working very smoothly, although at present the actual speed is very little in excess of that of the old steam trains.

Two unfortunate accidents have occurred within the last week. The most serious was upon the electric railway of the Lancashire and Yorkshire Railway Company between Liverpool and Southport. Two electric trains collided, through no fault in the electrical arrangement but in the signalling. Several people were killed and a mild sensation has once more been created as to the dangers of electric railways. An inquiry is now being held by the railway inspecting officers of the Board of Trade, and in the meantime a number of questions that have been asked in Parliament in connection with the matter have been put off.

The other accident was on a steep hill upon the tramway service in the Isle of Thanet, where, owing to the greasy state of the rails, a car left the track and fell over the cliffs near the sea. A most miraculous escape was made by the 20 persons in the car. This accident again revives the question of brakes, but at the same time attention ought to be drawn to the extremely short curves which have been sanctioned. In many provincial towns in England also tramways have been sanctioned in such a manner that there is not room to wheel a bicycle between a car and the curb.

A new electric railway in London which is partly in tube and partly on the surface has been sanctioned, the second line of this description which has been authorized. The line in question

runs from the city to the northeast suburbs and will cost some $25,000,000, and should be a great benefit to the working people of that portion of the metropolis. Three lines have already been promoted for this district, but for various reasons have been rejected. G.

New York.

New York city, August 19.—Chief Engineer W. J. Wilgus has announced that electric service will be in operation on the suburban lines of the New York Central railroad on April 15, 1906.

James P. McDonald of 42 Broadway, has been awarded the contract for the grading of five miles of the bed of the New York, Westchester and Boston electric road. The amount of the contract is about $1,000,000. Preliminary work on this line was commenced some weeks ago, and is being rapidly pushed forward.

Dr. George A. Soper of the city health department, and his staff have been very busy during the last few days obtaining samples of the air at various points in the subway and at all hours of the day and night. Samples have also been taken of the air in other parts of the city, which will be analyzed and reported on in due time.

What appear to be the final and definite plans for a large trolley terminal at the Manhattan end of the Williamsburg Bridge have been approved by the bridge department. The terminal is to be below the street level and will consist of eight loops, widely spaced, to prevent overcrowding, and covering a space 600 feet long and 120 feet wide. This terminal is solely for the cars of the Brooklyn Rapid Transit Company, as the Metropolitan cars that cross the bridge have their terminal at the other end of the bridge. The new terminal will cost about $1,000,000. Completion is promised in the spring of 1906.

There are signs that the newly organized state gas commission will bring about a reduction in the price of New York city gas to 75 cents a thousand feet before the end of the year.

From Utica, N. Y., comes a report that William Patten, an employe of the Hudson River Power Company in that city, touched an insulated but heavily charged wire on Tuesday morning. The insulation was not sufficient to protect the wire, and Patten's act caused a stoppage of the entire street-car service for several minutes, it being necessary to turn off the power to release the man, who, however, was not very seriously injured.

Thomas F. Ryan, the head of the Metropolitan street-railway system, is now visiting British Columbia, to look after his mining interests.

Thomas N. McCarter, president of the Public Service Corporation of New Jersey, is planning to build a $100,000 mansion on his estate at Seabright.

A recent calculation shows that there are now nearly 98,000 electrical horsepower utilized for electrical motors on the island of Manhattan.

The American Ice Company some months ago replaced its old steam-power hoists with new apparatus operated by electric motors, and an official of the company states that it is found that the company is effecting a saving for power equivalent to about half the former coal bill.

Electric power will be used to operate the drawbridges at a new ferry house for the Long Island railroad service at the foot of East Thirty-fourth Street. The existing mechanism is operated by hand.

Norman Luce and others of Binghamton, N. Y., have incorporated the Luce Electric Plating Works of New York city, with a capital of $5,000.

John A. McPeak and associates have incorporated the Wyoming Gas and Electric Company at Camden, N. J., with a capital of $15,000.

D. W. W.

New England.

Boston, August 19.—The Massachusetts railroad commissioners have authorized the Worcester and Providence Street Railway Company to construct and maintain its road on private land in the towns of Millbury, Sutton, Douglas and Uxbridge. This completes the approval of public and private-way locations for the line, as far as the state of Massachusetts is concerned.

The incorporators of the Hartford and Middletown Street Railway Company in Connecticut have perfected their organization with the election of John Tregoning of New Haven as president, John B. Crawford of Hartford as secretary, and Norman McD. Crawford of Hartford as treasurer. This company has a franchise to construct a railway from Wethersfield, where it connects with the Hartford trolley system, to North Branford and North Haven, where connection with the New Haven trolley system will be secured. The authorized capital stock is $500,000.

Another new route from New Haven to Hartford has been completed by the finishing of a link between Cheshire and Plantsville. The line is part of the system of the Connecticut Railway and Lighting Company.

On August 16th another new line was opened to traffic in Connecticut, three miles in length, between Mildale and a point near Southington, which forms a link in the trolley service between Boston and New York via Worcester, Palmer and Springfield, in Massachusetts, and Hartford, New Haven, Bridgeport and Stamford in Connecticut.

The new power house now under construction in the city of Waltham, Mass., will be one of the largest outside of Boston in this vicinity. It will be of concrete and steel construction, 153 feet long, 100 feet wide and 35 feet in height, with a boiler room at the rear. It will contain three generator units, and power will be supplied for the trolley service in Waltham and vicinity, as well as electricity for lighting purposes. B.

Ohio.

Cleveland, August 19.—Stories are now current that negotiations are pending between the Widener-Elkins syndicate and Tucker, Anthony & Co. for the Columbus, Buckeye Lake and Newark and the Columbus, Newark and Zanesville properties. No confirmation of the reports have been made by any of the supposedly interested persons. These two properties are good ones and the inducements to separate with them would probably have to be somewhat flattering. With these rumors are coupled the idea that the Appleyard properties would also be taken in by the syndicate to complete the system of roads that would connect Cincinnati with Columbus, Newark, Zanesville and other important central and eastern Ohio towns. There is little doubt that the syndicate is working to get together lines enough to make a strong system in the state, but just what they will succeed in securing is a question.

The extension of the Scioto Valley Traction line to Chillicothe has been completed with the exception of a portion of the third rail. It is expected that this will be put in place within a short time. President Frank A. Davis made a trip over the line a few days ago in company with A. B. Voorhies of the Union Savings and Trust Company of Cincinnati, who is largely interested in the company. They found the work in a very satisfactory condition.

Eastern men have been looking over rights-of-way held by the Akron-Alliance Connecting Railroad Company for a few days, but with what purpose cannot be definitely ascertained. It is said that local people at Alliance are also securing options between Akron and Alliance.

A mortgage for $500,000 in favor of the Cincinnati Trust Company has been filed by the Columbus, Marion and Bucyrus Railway Company in favor of the Cincinnati Trust Company to cover a bond issue for that amount. It is signed by James G. Webb as president and H. B. Haynes as secretary. Through the Central Ohio Traction Company and one or two stretches of line yet to be built the present line from Columbus to Marion will be extended to Cleveland, although it will probably be necessary to make traffic arrangements with one of the larger roads running out of Cleveland to accomplish this end. O. M. C.

Indiana.

Indianapolis, August 19.—The People's Gas, Electric and Heating Company of Bloomington, in which W. H. Schott of Chicago has a large interest, has been sold to a Philadelphia company. The transfer will be made at once.

The citizens of Dana, Ind., are to erect an electric-light plant. Bids will be in order as soon as plans and specifications can be procured.

J. H. Roberts, an interurban railroad promoter of Grand Rapids, Mich., together with capitalists from Detroit, Mich., recently visited the city of Auburn in the interests of an electric railway which they propose to build from Jackson, Mich., to Fort Wayne.

An election in Springfield township is proposed, to give a subsidy of $17,000 toward the extension of H. E. Bucklen's St. Joseph Valley traction line east from LaGrange to Angola. It is the purpose of the Toledo and Western Traction Company to build from its present Ohio terminus to Angola. With these two roads connected at Angola and with the Indiana Railway Company's line constructed between La Porte and South Bend there would be a gap of only 10 or 15 miles in the interurban electric chain from Cleveland, Ohio, to Michigan City. The gap would be between Middlebury and Goshen and it is Mr. Bucklen's intention to fill this in next year by the extension of his St. Joseph Valley line, now running from LaGrange to Middlebury, west to Goshen or Elkhart.

The Louisville and Nashville steam road has announced that it will begin interurban train service between Evansville and Mt. Vernon, Ind., on September 1st. The Louisville and Nashville will make the round trip every two hours from six a. m. to 10 p. m. Two electric lines are proposed between Evansville and Mt. Vernon and work has begun on the Evansville and Mt. Vernon.

J. W. Alford of Anderson has been elected director of the Indianapolis and Cincinnati Traction Company, succeeding the late Ephriam Marsh of Greenfield. Mr. Marsh's successor as vice-president of the company has not yet been selected.

Work has been completed on the heavy cut near Danville on the line of the Indianapolis and Western Traction Company's road from Indianapolis to Danville. The work has been in progress since the first of last March, and it is said to be one of the largest in traction construction in the state. The grading on the line between Indianapolis and Danville is nearly complete, nearly three miles of poles are up and practically half the steel between Indianapolis and Danville is laid. Cars are expected to run between Danville and Indianapolis in November. The cost of the road from Indianapolis to Danville is $28,000 per mile.

The Highland division of the lines of the Louisville and Southern Indiana Traction Company was opened to traffic on August 10th.

The Wabash and South Eastern Traction Company has incorporated with a capital stock of $10,000. The company proposes to build an electric railway between the cities and towns of Bloomington, Nashville and Columbus. James W. Brown, O. A. Ferguson and William Holliday are the directors.

It has been announced by T. C. McReynolds, manager of the Kokomo, Marion and Western traction line, that an agreement has been consummated whereby tickets can now be purchased clear through to Wabash, via Marion, over the lines of the Kokomo, Marion and Western and over the Indiana Northern that operates between Marion and Wabash.

On August 14th freight service was begun on the electric railway between Indianapolis and Plainfield and to intervening points. The car in service is one of the freight cars formerly used by the Indianapolis and Eastern Traction Company.

The Mishawaka Common Council has granted a 35-year franchise to the Indianapolis, Logansport and South Bend Traction Company. The privilege of the franchise is not effective until its line is completed from Logansport to the southern limits of Mishawaka, which it agrees to have done, and the city lines in operation by December 30, 1907. The Fort Wayne and South Bend Traction Company is at work in Mishawaka trying to obtain similar privileges.

The Dayton and Muncie Traction Company's line between Union City and Muncie was opened for service on August 16th, with cars running hourly.

A contract has been let in New York for financing the Chicago, Lake Shore and South Bend electric railways, which the promoters claim insures the building of the road. Work is to be commenced at once and the line will be double-tracked between the terminal points.

Cars began making regular trips on August 12th on the Highland division of the Louisville and Southern Indiana Traction Company at New Albany.

Grading for the Winona-Goshen interurban railway is about completed. The company is desirous of making amicable relations with the Indiana Railway Company in regard to co-operation in passenger service.

Last Saturday night the Indianapolis and Northwestern Traction Company conducted an excursion from this city to Put-in-Bay by way of the Clover Leaf steam railroad at Frankfort and the C. and T. line steamers on Lake Erie from Toledo. S. S.

Michigan.

Detroit, August 19.—It is stated the Pennsylvania Salt Company of Wyandotte, a suburb of Detroit, will enter into competition with the Detroit Edison Company in the furnishing of commercial electricity and that the Wyandotte council will be asked to allow the company to place conduits, and for a contract to light the town. The salt company is now erecting several coke ovens and will use the gas from the coal as fuel for the boilers. It is said that this company will be able to supply electricity at 20 per cent. less than the city of Detroit in its municipal plant.

The Brooks Motor Company has reincorporated with a capital stock of $100,000. It will carry on a general automobile manufacturing business. The principal stockholders are C. H. Brooks and T. B. Van Norman.

The Adrian and Jackson Traction Company is asking the city of Jackson for a franchise for an independent street-car line along Jackson street from the limits to the center of the town. It is claimed by the company that it is unable to secure suitable arrangements with the Jackson and Suburban Traction Company, owning the city lines, for an entrance to the city. It has been found difficult to interest capital without an independent franchise in the city. W. H. Hand and James W. Helme are the promoters of the Adrian and Jackson Traction Company.

The Canadian Tunnel Company and the Michigan Tunnel Company, the two companies organized by the Michigan Central interests, have been merged into a new company called the Detroit River Tunnel Company, which is organized in Canada to construct a tunnel under the Detroit River from Detroit to Windsor. The new company is capitalized at the nominal figure of $3,000,000. The proposed tunnel will cost in the neighborhood of $10,000,000. Construction work will begin some time in October. Designing Engineer Holst of

the New York Central has arrived from New York and will design the machinery necessary for constructing the tunnel. The actual work of construction will be in charge of Benjamin Douglas, for the last 20 years bridge engineer of the Michigan Central. Michigan Railroad Commissioner T. W. Atwood, George A. Prescott, secretary of state, and C. C. Bird, attorney-general, forming the railway-crossing board, have met and formally approved the tunnel plans.

The Olds Motor Works, the oldest automobile company in the state, has removed to Lansing.

Charles H. Fisk of Detroit, of the firm of Fisk & Thomas, is now in Nashville, Tenn., in connection with winding up a deal for the erection of a large water-power plant which will supply electricity for Nashville and Chattanooga and a large part of the state. C. G. W.

Rocky Mountain States.

Salt Lake City, August 18.—The franchise recently granted by the City Council of Salt Lake City to the Utah Light and Railway Company has been approved by the mayor. It extends the company's various franchises from eight to 10 years, so that all will terminate in 50 years. The franchise was only granted after a long struggle between the Mormon and non-Mormon members of the council, the Mormons favoring the application of the company, of which President Joseph F. Smith of the Mormon Church is president. The gentile member who made it possible for the franchise to pass is being severely criticized by the local non-Mormon press.

The Lewiston and Southeastern Electric Railroad Company of Lewiston, Idaho, has completed the surveys for its proposed interurban system, and in the near future active work will be commenced on the system.

A company will be organized shortly at Reno, Nev., for the purpose of constructing an electric railway from that city to Lake Tahoe, a distance of approximately 25 miles. Power will be obtained from the Truckee River, according to the present plans of the promoters.

The establishment of an electric power plant at Ogden, Utah, is contemplated by the Oregon Short Line Railway Company, the intention being to furnish power to all the railroads of that city. The plant will be placed in operation at an early date.

The construction of an electric railway from Saratoga, Wyo., to a point on the Union Pacific near Walcott, is planned by business men of the former city, money for the enterprise to be raised by subscription. Ample power for the plant can be secured from the North Platte River.

The Fremont County Light and Power Company is the name of an organization recently formed at Sugar City, Idaho, which plans the establishment of a plant to furnish electrical power for that city, Salem and Teton City. The new company, of which James Siddoway of Teton City is president, is capitalized at $25,000. G.

Pacific Slope.

San Francisco, August 18.—The Pacific Coast Company, which owns coal mines at Black Diamond and Lawson, Wash., and controls the Pacific Coast Steamship Company, has decided to enlarge the electric-light plant which supplies the mining towns.

The Observation Tower Company will complete the incline railway at Court Street and Broadway at Los Angeles by October 1st. The cable will be operated by electric power. The machinery will be installed by the Union Iron Works.

H. H. Taylor of San Francisco, president of the Bellingham Bay Improvement Company, which has a local electric-lighting plant at Bellingham, Wash., says that the new waterpower electric transmission system now in course of construction will cost about $500,000. The distance from the plant at Nooksack Falls to Bellingham is about 60 miles. The work will be completed next year after the rainy season ends.

The Tuolumne County Water Company has given an option on its water properties to W. P. Miller, H. C. Stratton and A. Kemp Van Ee, who wish to secure an electric power plant for manufacturing and electric-railway purposes. The electric railway is to extend from Santa Cruz to Hollister and to the cement works which are to be erected in San Juan Valley.

The city trustees of Anaheim, Cal., have decided to call a bond election to vote upon a proposition to incur an indebtedness of $40,000 for the extension of the city electric-light and water plants. The estimate for the lighting system is $22,000.

The city clerk of Santa Ana, Cal., will on September 13th destroy in public the electric-light and power bonds of the city. There are 60 bonds of $1,000 each. Their destruction was ordered as it was impossible to sell the bonds.

The Klein Electric Construction Company has opened offices at 431 Montgomery Street.

The Mutual Electric Light Company has opened offices at 18 Second Street, with a sub-station in the basement and lamp rooms on the second floor. Since the new plant was opened business has increased very rapidly and the cost of operation per horsepower has been greatly reduced.

The East Shore and Suburban Railway Company, which is operating electric cars between Oakland and Point Richmond, has added some new General Electric car equipments designed for operating at 40 miles an hour. The two-motor equipments aggregate 100 horsepower and the four-motor equipments 160 horsepower per car.

The Ocean Shore Railway Company has decided to increase its capital stock from $3,000,000 to $5,000,000. A special meeting of the stockholders will be held October 19th to authorize the change and also to act upon a proposition for the issue of bonds amounting to $5,000,000. The surveys have been completed and rights-of-way have been secured. The first 14 miles of the electric road from Santa Cruz northward are being graded.

The Vallejo and Napa Valley electric railway is operating cars on its new line between Vallejo and Napa, Cal., making connection with fast steamers for San Francisco so that six round trips can be made daily. It is understood that alterations and improvements will be made by the Westinghouse Electric and Manufacturing Company on the single-phase electric system now in use. A.

PERSONAL.

W. J. Haylow, formerly superintendent of transportation of the Atlantic Coast Line in Wilmington, N. C., has become general superintendent of the railway department of the Savannah Electric Company in Savannah, Ga.

George R. Folds, who for the last three years has been connected with the Brooklyn Rapid Transit Company, will come to Chicago on September 1st, to assume active management of the South Chicago City and the Hammond, Whiting and East Chicago electric railways.

Albert S. Richey of Anderson, Ind., who has been electrical engineer for the Indiana Union Traction Company for the last five years, has resigned his position as chief engineer of that company to accept the chair at the head of the electrical engineering department at the Worcester Polytechnic Institute, Worcester, Mass.

H. R. Cage, formerly with the Manhattan Electrical Supply Company of Chicago, has removed to Houston, Texas, to accept a position with the Barden Electric and Machinery Company of that city. Mr. Cage is a young man who has been engaged in the electrical business in Chicago for a number of years, and leaves for the South with the good wishes of many friends.

Horace C. Stilwell of Anderson, Ind., has resigned as general agent of the Indiana Union Traction Company and will devote his entire attention to the Muncie and Portland Traction Company's line, which is to be constructed by the first of the year. Mr. Stilwell has been connected with the Indiana Union Traction Company since the beginning of the Indianapolis and Northern Traction Company's line and has served as director, vice-president and general agent.

Walter E. Harrington has severed his connection as vice-president and general manager of the New York-Philadelphia Corporation, to become associated with J. G. White & Co. of New York as operating manager. Mr. Harrington has had an exceptionally broad experience in the engineering field, particularly in the operation of electric-railway, lighting and gas properties. After graduating from the University of Pennsylvania in 1887 he became associated with W. G. Griffith in the electrical contracting business. Following this, he was at different times, electrical engineer for the Pennsylvania railroad in charge of the electric railway at Atlantic City, N. J., general superintendent of the Wheeling Traction Company and the Citizens' Railway Company of Wheeling, W. Va., supervising engineer in the coal regions of Northern Pennsylvania for the General Electric Company, general manager of the Cutter Company of Philadelphia, consulting engineer for a number of railway systems and general manager and vice-president of the Camden and Suburban Railway Company. In 1904 he was placed in charge of all the railway properties south of Trenton, N. J., under the Public Service Corporation, and in 1905 assumed charge of the New York-Philadelphia Corporation as vice-president and general manager. Mr. Harrington is an active member of the executive committee of the American Street Railway Association, and a member of the American Institute of Electrical Engineers. As operating manager of J. G. White & Co., he will supervise all of the railway, electric-lighting, gas and other properties operated by it, and will make his headquarters at the New York office of the company, No. 43 Exchange Place.

ELECTRIC LIGHTING.

The city clerk at Cumberland, Wis., is receiving bids for an addition to the power house of the light plant.

The McQuatters Machine and Plumbing Company of Hillsboro, Texas, has purchased the plant of the Alvarado (Texas) Light and Power Company and will enlarge and improve it.

The Gardner estate has closed the sale of the electric-light plant at Mt. Vernon, Iowa, to Mr. Emery, at $9,750.

The Westbrook Milling Company is contemplating enlarging its electric-light plant to furnish light for Westbrook, Minn.

The Austin Electric Light Plant of Chicago is a new company incorporated in Illinois, to furnish light, heat and power. The incorporators are C. R. Whitman, G. E. Dawson and J. H. Sullivan.

The Citizens' Electric Light and Power Company of East St. Louis, Ill., has let the contracts, and work will soon be commenced upon improvements in the lighting system, to cost $150,000.

The city of Burlington, Wis., will receive bids for an electric-light plant complete, also for material, up to September 5th. A. T. Maltby of Chicago is the consulting engineer. Communications may be addressed to the city clerk of Burlington, John T. Puosch.

The electric-light plant at the summit of Pike's Peak is said to have been put in operation. The plant is operated by a 20-horsepower gasoline engine. Work looking to the erection of a mammoth searchlight will at once begin, the rays from which when completed will, it is expected, reach as far as the Kansas state line, a distance of 150 miles.

The Vandalia Light and Fuel Company of Vandalia, Ill., recently sold its electric-light plant to the city of Vandalia for $18,000. A number of taxpayers have now filed suit, it is reported, to enjoin the consummation of the sale on the grounds that the city is already indebted beyond the constitutional limit, and has no right to engage in the business of selling light.

The United States Light and Heating Company, which has for its object the furnishing of electric light and heat to railway cars by the Moskowitz system of transmitting power from the axle, has passed into the control of the New York Air Brake Company. Charles A. Starbuck, president of the air-brake company, has been elected president of the light company.

In reply to Mayor Weaver's advertisement for bids for lighting the city of Philadelphia, with electricity for the year 1906 only one bid was submitted. It was made by the Philadelphia Electric Company, which has had the contract for several years. A reduction of three cents a night is made in the new bid on all varieties of lights, and it is estimated that the reduction means a saving to the city of about $118,000.

A report from Bloomington, Ill., says that a syndicate of Detroit capitalists, headed by Emanuel T. Beyer, has purchased the Union Gas Light and Electric Company for $400,000, the amount of the capital stock. This company operated the only gas plant in Bloomington and is said to be the same syndicate that is credited with overtures toward the Bloomington and Normal Street Railway Company for the purchase of the system.

The Edison Electric Illuminating Company of Topeka, Kan., has recently been purchased by B. E. Sunny, L. E. Meyers, George H. Taylor and George B. Caldwell, all of Chicago. The property has never been bonded and has paid regular six-per cent. dividends for 15 years. The capital stock is $500,000, par $100. Some $200,000 will be spent by the new owners in extension and improvements, and an issue of $1,250,000 first-mortgage sinking-fund five-per cent. bonds will be authorized, of which $700,000 will be offered to the public in the near future.

Five large courtrooms in the new Federal Building, Chicago, are now being decorated with electric-light brackets, some of which cost $300 apiece and weigh 40 pounds. The work of putting up 16 700-pound brackets in the dome is to be started within a short time. Each will carry 32 light bulbs enclosed in a large dome of glass four feet in diameter. Eight of these fixtures will be suspended from the eighth floor of the dome, seven feet out from the wall, while the remaining eight will be suspended at the first floor. The cost of all the electric-light fixtures in the new building will be almost $60,000.

ELECTRIC RAILWAYS

The Calumet Electric Street Railway Company of Chicago has contracted for extra power service at the White City end of its line on account of the increased passenger traffic. The Commonwealth Electric Company has installed a 300-kilowatt rotary converter in its White City sub-station to take care of this additional load.

A survey will be made this fall for a trolley line from Red Lion to York Furnace, Brougueville and Airville, Pa., a distance of more than 15 miles. The line is the project of an independent company and contemplates furnishing the connecting link for through trolley service to Baltimore. There is at present a line being completed from

Baltimore to Belair, and a survey is under way for another line from Belair to Delta, work on which will be begun before very long.

G. Martin Brill of Philadelphia, chosen as president of the street-car building merger formed recently, has demanded that the financial managers change the original plans so as to provide $2,000,000 more cash. Mr. Brill's acceptance of the presidency makes this change a condition, and there is little doubt that his demand will be granted.

The Fort William and Port Arthur (Ontario) town councils have been conferring together regarding the running of Sunday cars. The Port Arthur electric-railway commissioners have no serious objection to the proposition, and it is likely the matter will be satisfactorily arranged. Fort William has stood off for about a year, but is now willing to agree.

Announcement is made of the purchase of the property known as Big Island, in Lake Minnetonka, 20 miles from Minneapolis, by the Twin City Rapid Transit Company. The property will probably be rechristened Coney Island, and the company will construct, on a smaller scale, an amusement center on the plan of the big New York resort. Steamers will be operated on the lake in connection with the new suburban electric railway of the company, now nearing completion.

PUBLICATIONS.

Bulletins Nos. 3105 and 3952 have been issued by the Emerson Electric Manufacturing Company of St. Louis. The first relates to single-phase induction motors of one-eighth and one-sixth horsepower and the latter to miscellaneous pulleys for flat and round belts, replacing Bulletin No. 3057. The data given, in each case, include list prices.

"The Paiste line is the standard line wherein is found all that is latest and best in handsome labor-saving specialties; so write 'Paiste' on your orders." So says the H. T. Paiste Company of Philadelphia in its Bulletin No. 25, devoted to Paiste panel boxes, panel cut-outs, entrance switches and other specialties of like character. The bulletin is well illustrated by half-tones and diagrams and is provided with useful data, including list prices.

Circular No. 1108 from the Westinghouse Electric and Manufacturing Company of Pittsburg illustrates and describes Westinghouse regulating and reversing controllers. These controlling devices for the operation of electric motors represent the highest development of the company's electrical design and the most advanced methods of manufacture. They include equipments for the control of both alternating-current and direct-current motors under nearly all practical conditions.

One of the important specialties of the Crocker-Wheeler Company of Ampere, N. J., has always been the motor for small power service. Its latest bulletin is devoted to this type of machine—one-quarter to three horsepower. The motors are fitted with end shields, which permit of their being made dustproof. A few examples of the many forms which this type of motor assumes are shown in the pages of the bulletin, which also include a technical description.

The Kellogg Switchboard and Supply Company of Chicago has published its new bulletin No. 11, which is a handsome book of over 100 pages, entitled "Common Battery Non-multiple Switchboard." Besides a fine colored picture showing a model private-branch exchange, the book is full of half-tones showing in detail circuit apparatus, switchboard cabinets, power equipment, protectors, etc., with a number of switchboards in actual use. Common-battery non-multiple exchanges are fully described showing diagrams of connections, both with central office connections and private branches and without central office connections. Two-party selective systems are described, and there are some pointers on switchboard installing.

MISCELLANEOUS.

The Canadian Pacific Telegraph Company is stringing an additional copper wire between Winnipeg and Vancouver, B. C.

The Daily Consular and Trade Reports recently contained a statement from Consul-general Holloway of Halifax to the effect that the St. Lawrence River was not to have the benefit of submarine-bell signals, for which a contract has been made by the Dominion government. Consul-general Holloway now reports that the Submarine Signal Company denies the accuracy of that statement and declares that the bells will be installed in due time, large shipments of material having already been made and the work being well under way. The company is required to equip with its apparatus 30 steamers. These need not necessarily be Canadian vessels.

The cable steamer Colonia, which arrived at Canso, N. S., to lay the Commercial Cable Company's additional line to Ireland, is grounded on the rocks near Fox Island at the entrance to Canso harbor. At the time of this report steamers were endeavoring to float the steamer, but it was thought it would be a total wreck. The Colonia laid the shore end of the cable on August 18th, and was just starting to lay the ocean section of the big cable, when a strong current running off the harbor carried it swiftly into the ledge near Fox Island. The steamer had on board 2,400 miles of heavy ocean cable, and this was moved into the cable ship Mackay Bennet as quickly as possible. All steamers in the vicinity of the wreck offered assistance. The Colonia also brought out from London a cable for the Newfoundland government, to be laid between Canso and Port aux Basques, and one in which the Canadian Pacific Telegraph Company is very much interested. The Colonia is one of the largest and most completely equipped cable ships afloat. It was built to lay the all-British cable across the Pacific, and is owned by the Telegraph and Construction Maintenance Company of London, England.

TRADE NEWS

Guy & Goodell have purchased the entire business of the Winfield Electric Company of Winfield, Kan.

The May Company department store, Sixth Street and Washington Avenue, St. Louis, is preparing to make extensive enlargements and improvements, occupying the remainder of the block through to Lucas Avenue. The new apparatus includes, among other things, 10 modern electric elevators, proposals for which will be received in the immediate future by the consulting engineer, William H. Bryan, Lincoln Trust Building, St. Louis.

The bureau of supplies and accounts, Navy Department, will receive sealed proposals until September 5th for furnishing eastern navy yards with the following: Schedule 82—arc lamps, lamp cord, wire; schedule 83—motor, miscellaneous electrical supplies, electric smoothing irons; schedule 84—starting rheostats; schedule 86—Okonite tape. The bureau will also open bids on August 29th for furnishing certain eastern navy yards with the following: Schedule 71—telephone cable; schedule 73—battery cells, cable; schedule 75—electric glue heaters. On September 19th the bureau will open bids for furnishing western navy yards with electrical material as follows: Schedule 77—motors; schedule 78—circuit-breakers, electric wire, ammeters; schedule 79—motors. Specifications and blank proposals will be furnished on application to the bureau at Washington.

BUSINESS.

Mathias Klein & Sons, 81 West Van Buren Street, Chicago, anticipate a large fall trade, as orders and inquiries for their product have been exceptionally heavy during the last few months. The Klein product is known far and wide. The firm was established in 1857, and its tools have an excellent reputation among linemen.

Arc-burst clusters, as manufactured by the Benjamin Electric Manufacturing Company of Chicago, consist of a practical grouping of highest efficiency meridian type lamps with Benjamin wireless clusters made doubly effective by reflectors, scientifically arranged to radiate and distribute perfectly all available light. They make a light particularly adapted for art galleries, restaurants, stores of all kinds and all public buildings.

The Chicago House Wrecking Company, which, as is well known, purchased the material from the St. Louis World's Fair, is finding a ready sale for its electrical material. The company is in a position to supply almost everything in the way of electrical supplies, and asserts that this material has seen but limited service and is practically as good as new. The company will be pleased to hear from those in the market for material of this kind.

The Northern Electrical Manufacturing Company of Madison, Wis., declares that Northern vertical motors represent the most recent developments in electrical equipment for vertical-shaft drive. The Northern designers have eliminated the trouble due to lubrication of the vertical shaft. The equipments supplied by the company are so arranged that there will be no trouble due to oil spilled from the bearings falling on the commutator and the driven machine. Bulletin No. 50 illustrates some novel arrangements of Northern vertical motors.

The Crocker-Wheeler Company is in receipt of an order for a 200-kilowatt three-phase 60-cycle engine-type alternating-current generator for the Ivorydale (Ohio) lighting and power plant of the Proctor & Gamble Company. This machine is a duplicate of the first Crocker-Wheeler alternator ever built, which was installed 10 months ago in the Atlanta plant of the Proctor & Gamble Company. The high efficiency and excellent performance of the earlier machine led the purchaser to cancel an order for another type of generator and to order a duplicate of the first machine.

As a lubricant for wire rope Dixon's Ticonderoga flake graphite, manufactured by the Joseph Dixon Crucible Company of Jersey City, N. J., has the indorsement of the leading manufacturers as well as the approval of those experienced in its use, because of the well-recognized fact that flake graphite prevents the abrasion and wear of all parts coated with it. For this purpose graphite must be combined with suitable greases to make it adhere, but there has always been considerable danger and difficulty in applying grease to moving cables. Dixon's Handy graphite rope dressing is also a product which meets with success as a lubricant for wire rope.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) August 15, 1905.

797,015. Induction Arrester. Edward C. Paramore, Philadelphia, Pa. Application filed December 1, 1904.

In an induction-neutralizer two primary coils of equal resistance are combined with a secondary coil of equal resistance to the line in which the neutralizer is in circuit, the secondary coil being connected at its terminals to one of the primary coils. (See cut on next page.)

797,048. Circuit-breaker. Harry P. Davis, Pittsburg, and Arthur B. Reynders, Wilkinsburg, Pa., assignors to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed February 27, 1904.

An electric circuit-breaker comprises a sheet-metal hinged arm provided with main and shunt contact terminals, sheet-metal closing and locking toggle levels, a tripping coil, a flexible strap connecting one end of the coil to the main contact terminal on the hinged arm, a loosely mounted armature, a base plate, and stationary contact terminals mounted thereon.

797,049. Electrical Terminal Connection. Isaac De Kaiser, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed November 21, 1903.

Combined with the frame of an electrical machine are insulated terminal conductors having rings of cord wound thereon, a two-part block having openings to receive the conductors and rings and means for fastening the block parts together and to the machine frame.

797,050. Insulator. William W. Dunsmore, Falconer, N. Y. Application filed August 24, 1904.

A cross-arm having a threaded opening is provided with a slot communicating with the opening and an externally threaded insulator plug consisting of two longitudinal sections, the contiguous faces of which are provided with mating offset portions.

797,054. Fuse Terminal. Howard W. Gibbs, Newburyport, Mass., assignor to the Chase-Shawmut Company, Newburyport, Mass. Application filed December 9, 1904.

In an electric fuse or cut-out are a shell or case comprising a tubular body and end caps having slots for the terminal plates. Terminal plates project through the slots, and means are held between the end caps and body, which engages and holds the terminal plates against longitudinal movement.

797,060. Controller for Alternating-current Apparatus. Ray P. Jackson, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed January 23, 1905.

Connected with a source of alternating-current energy are a transformer winding, a suitable translating device having a terminal connected to the winding, an ohmic resistance and an inductive resistance connected in parallel with each other and having their middle points connected together and to the other terminal of the translating device. Means connect the terminals of the ohmic and inductive resistances to different points in the transformer winding.

797,061. Controller for Electric Motors. Ray P. Jackson, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed June 6, 1904. Renewed January 21, 1905.

A suitable translating device is connected with a transformer having primary and secondary windings, the former of which has an intermediate point connected to one terminal of the source and the latter an intermediate point connected to the translating device. Means connect the respective terminals of the primary winding to the source alternately, and means make variable-voltage connections between the terminals of the secondary winding and the source.

797,065. Electric Switch. Benjamin S. Luther, Boston, Mass., assignor to the Chase-Shawmut Company, Newburyport, Mass. Application filed April 4, 1904.

In an electric switch are a supporting plate having a hole through it, stationary contact plates on one side of the supporting plate, a movable contact member and a rod to which the member is secured which passes through the hole. A supporting frame at the opposite side of the supporting plate, a toggle connected at one end to the rod, and at the other end to the supporting frame, a

slotted link connected to the toggle and a lever pivoted to the supporting frame which is connected to the link complete the apparatus.

797,090. Lamp Socket. William Uschmann, Schenectady, N. Y. Application filed June 1, 1904.

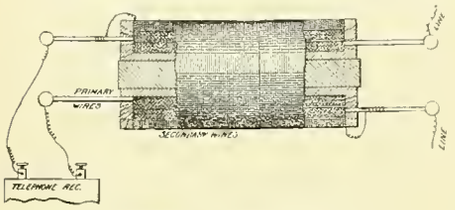
A core, disks carried by the core, a contact carried by the core, a head revolubly mounted upon the disks, and a contact carried by the head are the essential parts of the lamp socket.

797,103. Electric Clock. Martin Fischer, Zürich, Switzereland, assignor to the firm of Actiengesellschaft "Magneta," Zürich, Switzerland. Application filed November 20, 1903.

An electrically operated stopping device is periodically moved into engagement with the revoluble element to stop the clock movement.

797,110. Storage Battery. Gustave K. Hartung, New York, N. Y. Application filed April 30, 1904.

In a secondary battery are an electrode, comprising an expansible tube, and a conducting rod of non-metallic material having a metallic core embedded in the material.



NO. 797,015.—INDUCTION ARRESTER.

797,141. Block-signal System for Electric Railways. Frank R. McBerty, Evanston, and Malcolm E. Launbranch, Chicago, Ill., assignors to the Western Electric Company, Chicago, Ill. Application filed September 9, 1904.

In a block-signaling system for electric railways are semaphore signals, one at each end of the block, and controlling magnets for the signals. A circuit for each magnet includes a source of current, and a controlling switch is provided for each circuit at the other end of the block. Switch contacts, associated with each of the magnets are adapted to be operated thereby to render inoperative the circuit of the other magnet, whereby the operation of both signals simultaneously is prevented.

797,169. Space Telegraphy. Ferdinand Braun, Strassburg, Germany. Application filed February 6, 1899.

In a transmitter for space telegraphy are an oscillation circuit containing a condenser and a spark gap, and a transmitting wire connected conductively with the circuit.

797,180. Electrical Safety Apparatus for Signaling on Railways. Henri Cousin, Paris, France, assignor to Société Cousin & Co., Paris, France. Application filed April 3, 1905.

Electrical contact bars are fixed on the line and controlled in conjunction with the ordinary signaling mechanism. Two sets of brushes are flexibly connected with a transverse shaft on the locomotive and provided with contacts which are normally apart and only come together when the brush passes in a certain direction over the line contacts. An electromagnet is arranged in circuit with one set of brushes and adapted to operate a signaling device.

797,187. Car Signal. Frederic H. Ensign, Los Angeles, Cal. Application filed September 20, 1904.

A signal on a car comprises a lamp and a target, an electric circuit through the lamp, means included by the circuit for operating the lamp, fluid-pressure means for operating the target and for controlling the circuit, brakes for the car and means for controlling the brakes and the fluid-pressure means.

797,198. Automatic Electric Cut-off. Roy M. Griffith, Elwood, Ind. Application filed January 16, 1905.

The essential features of the device are an electric switch, the clock mechanism for operating the switch and means for retaining the switch clock mechanism at rest. Other parts are a throw-out rod, a cam disk having a series of peripheral cams, a revoluble time-setting dial connected to the time-clock mechanism and means situated between the time-setting dial for intermittently operating the cam disk.

797,215. Plug Box for Electric Circuits. Henry G. Osborne and Edward Richter, New York, N. Y. Application filed May 23, 1904.

The face-plate of the plug box is provided with a central opening, and double-acting spring-operated doors are hinged at the opposite sides of the opening so as to swing both inwardly and outwardly, the doors being provided in their free edges with recesses which form a central opening when the doors are closed.

797,217. Operating Mechanism for Controllers. William D. Pomeroy, Norwood, Ohio, assignor to the Bullock Electric Company, Cincinnati, Ohio. Application filed December 8, 1903.

Combined with a controlling switch are a shaft for turning it, a member fixed to the shaft, an operating arm loosely mounted on the shaft and a spring-pressed plunger carried by the arm and engaging the member to actuate the shaft when the arm is turned.

797,250. Guard for Incandescent Electric Lamps. Charles P. Anderson, St. Louis, Mo. Application filed March 17, 1905.

The guard consists of a number of longitudinal wires fastened by a clamp band to the lamp socket.

797,252. Electric Switch. Milan V. Ayres, Newton, and Daniel E. Hennessy, Everett, Mass. Application filed February 9, 1905.

An electric switch for trolley wires comprises a fluid receptacle having two branches, a fluid therein and a pair of contacts, one moved by one branch of the receptacle, the other by the fluid in that branch, to make and break as the receptacle is tilted. Connections are made between the trolley wire and the switch.

797,253. Switch Gate for Conduits. Arthur W. Banister, Boston, Mass. Application filed March 13, 1905.

A conduit is provided with branches and a switch gate is pivotally mounted at the crotch of the branches, the latter being operated by a worm-gear rigid with the gate and exterior to the conduit.

797,254. Means for Transmitting Electricity to Vehicles on Electric Railways. Attilio Beer, Venice, Italy. Application filed August 18, 1902.

A third-rail device for electric railways is described.

797,271. Electric Switch. Gano S. Dunn, East Orange, N. J., assignor to the Crocker-Wheeler Company, Ampere, N. J. Application filed August 25, 1903.

In a switch for dynamo-electric machinery are combined a contact finger, a contact-carrying movable part and contacts carried thereby, means for operating the movable part to move the contacts in front of the finger, means for lifting the finger from the path of the contacts and means operating independently of the movement of the movable part for returning the finger into the path of the contacts.

797,325. Safety Fuse. Joseph Sachs, Hartford, Conn., assignor to the Johns-Pratt Company, Hartford, Conn. Application filed December 18, 1903.

The safety-fuse comprises a casing, end caps therefor, a fuse strip, fuse-strip terminals passing through the end caps and to which the fuse strips are electrically connected, and means passing through the end caps and casing and into the edges of the fuse-strip terminals for securely connecting the parts together.

797,342. Trolley Wheel. Frank E. Bryan, Niles, Ohio. Application filed December 24, 1904.

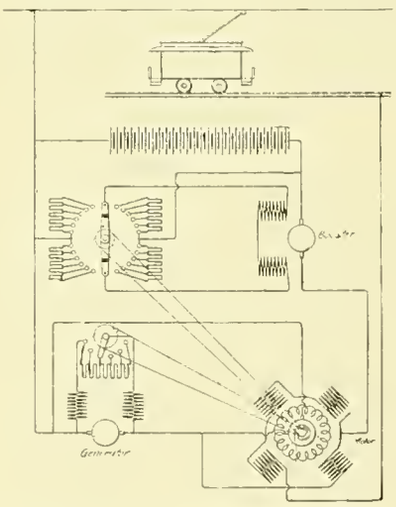
The trolley-wire groove is continuous around the circumference of the wheel. Auxiliary grooves of lesser depth, outside the main groove, serve to direct the wire into the latter.

797,355. Trolley Mounting. George E. Henry, Vincennes, Ind. Application filed November 9, 1904.

Details are described.

797,369. Water Rheostat. William D. Pomeroy, Norwood, Ohio, assignor to the Bullock Electric Company, Cincinnati, Ohio. Application filed December 1, 1903.

In a water rheostat are combined a receptacle for the water, a hinged cover therefor, two or more plates carried by the cover and means for short circuiting the plates when the cover is closed.



NO. 797,518.—SYSTEM OF ELECTRIC DISTRIBUTION.

797,394. Third-rail Guard. Melchior Zugermayer, East Rutherford, N. J. Application filed April 19, 1905.

One claim reads as follows: In an electric-railway system a third-rail guard, consisting of a longitudinally extending hood, covering one side and the tread of the rail, and open along the other side of the rail, and a movable side plate adapted to be depressed by the passage of a car extending along the other side of the rail forming the other side of the guard hood and with the hood normally inclosing the rail, the hood extending over the inside face of the movable plate.

797,396. Electric Motor. Ralph E. Barker, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 26, 1903.

In a dynamo-electric machine are a pole piece, a coil thereon, a shaft, a rod back of the pole piece and parallel to the shaft, coil-holding members loosely mounted on the ends of the rod, extending partially around the coil and bearing on the back of the pole piece and adjusting nuts on the rod.

797,398. Electrofluid-pressure Switching Mechanism. Walter J. Bell, Los Angeles, Cal., assignor of one-half to Leon F. Moss, Los Angeles, Cal. Application filed August 25, 1904.

Switching mechanism consists of fluid-pressure means for moving the switching element, an electric actuator for the means, an operating circuit for the actuator and an excitable electric element for making and breaking the operating circuit.

797,424. Electric Fire-alarm Apparatus. Eugene Fuller, Archie Center, R. I. Application filed January 28, 1905.

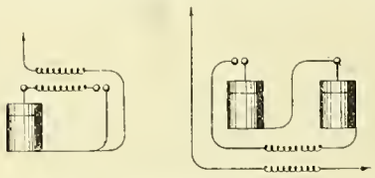
A normally closed electric circuit has means for opening and closing it. A normally open electric circuit contains an annunciator and means for closing the second-mentioned circuit when the first-mentioned circuit is opened. A normally open auxiliary electric circuit has means for closing it and means, operated by the closing of the auxiliary circuit, return the means for closing the second-mentioned circuit when the first-mentioned circuit is opened to its normal position.

797,433. Electric Switch. Edward M. Hewlett, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 4, 1904.

Combined with a movable switch blade are a curved rachet, a pawl and a detent, pivoted on the blade and cooperating with the rachet and means for operating the pawl and detent simultaneously.

797,454. Attachment Plug. Henry T. Paiste, Philadelphia, Pa. Application filed January 20, 1904.

Non-conducting material forms the body of the plug, which is covered by a metallic shell. The shell has an irregular surface, the body being provided with a recess extending adjacent to the shell. Metallic terminals, means for electrically connecting the shell to one of the terminals and a body of cement within the recess engaging the shell complete the device.



NO. 797,544.—SPACE-TELEGRAPH TRANSMITTER.

797,472. Attachment Plug. George B. Thomas, Bridgeport, Conn., assignor to the Perkins Electric Switch Manufacturing Company, Bridgeport, Conn. Application filed February 3, 1905.

Details are described.

797,498. Block-signal System. Fred B. Corey, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed January 21, 1905.

In a block-signal system are combined a counterweighted signal, an electric motor for driving the signal from "danger" position, a relay having its armature in the motor circuit and a switch operated by the signal mechanism and a track-relay armature both included in the circuit of the first-mentioned relay.

797,518. System of Electrical Distribution. Sigvald Krohn, Berlin, Germany. Application filed November 2, 1899.

A system of electrical distribution comprises a generator, a distribution circuit, a storage battery in parallel with the generator, a booster in the battery branch, an electromagnetic regulating device in the distribution circuit and a current varying and reversing switch for the booster field magnet controlled by the regulating device. (See cut.)

797,526. Switch. Frank R. McBerty, Evanston, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed December 21, 1903.

A movable guard for the spring jack has means for locking it in position to prevent access to the spring jack. A plug has a key portion adapted to unlock the guard to permit the insertion of the plug.

797,544. Space Telegraphy. Ferdinand Braun, Strassburg, Germany. Original application filed February 6, 1899. Divided and this application filed May 18, 1903.

A transmitter for space telegraphy contains an oscillation circuit containing a condenser and the primary of a transformer and a transmitting wire connected with the secondary of the transformer, the other end of the secondary being connected to a capacity area other than earth and having no direct connection with earth. (See cut.)

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on August 21, 1905:

388,008. Electric Signaling. Clement Ader, Paris, France.
388,052. Multiple Switchboard. Milo G. Kellogg, Chicago, Ill.
388,053. Arc Lamp. Virgil C. Killin, Chicago, Ill.
388,078. Machine for Tempering Metal Wires and Strips. Frederick Sedgwick, Chicago, Ill.
388,091. Harmonic Telegraphy. Francois Van Rysselberghe, Brussels, Belgium.
388,092. Telegraph Receiver. Francois Van Rysselberghe, Brussels, Belgium.
388,093. Dynamo-electric Machine. Montgomery Waddell, New York, N. Y.
388,141. Electric Typewriter. James F. McLaughlin, Philadelphia, Pa.
388,142. Electric Typewriter. James F. McLaughlin, Philadelphia, Pa.
388,143. Electric Typewriter. James F. McLaughlin, Philadelphia, Pa.
388,181. Galvanic Battery. Howard Cassard, Baltimore, Md.
388,242. Pneumatic Intermittent Circuit-closer. William C. Barney, New York, N. Y.
388,244. Printing Telegraph. Jean M. E. Baudot, Paris, France.
388,245. Method of Working Metals by Electricity. Nicholas Benardos, St. Petersburg, Russia.
388,246. Apparatus for Working Metals by Electricity. Nicholas Benardos, St. Petersburg, Russia.
388,247. Current Collector for Electric Railways. Josiah L. Blackwell, New York, N. Y.
388,283. Multiple Switchboard. Milo G. Kellogg, Chicago, Ill.
388,300. Electric Steering Apparatus for Torpedo Boats. James O'Kelly, London, and Bernard C. Collins, Nunhead, England.
388,312. Battery Zinc. Benjamin Searles, Clinton, Mass.
388,333. Telegraph Receiver. William T. Barnard, Baltimore Md.
388,335. Secondary Battery. John Beattie Jr., Westport, Mass.
388,357. Fire Telegraph. John H. Guest, Brooklyn, N. Y.
388,358. Automatic Fire Telegraph. John H. Guest, Brooklyn, N. Y.

WESTERN ELECTRICIAN

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LIBRARY OF ELECTRICAL ENG'G.

Modern Electrically Operated Ore-handling Plant.

By Frank C. Perkins.

Handling ore direct from the steamer to the car, or to storage, by modern methods furnishes still another application of electric power of considerable proportions. Such a plant is operated by a large dock company at Conneaut, Ohio, and its construction and operation are shown in the accompanying pictures. The equipment consists of four fast plants, as they are termed, and a bridge spanway. The latter is shown in Fig. 1 and is for conveying the ore to the storage areas. The four fast plants are shown at the right in Fig. 1, and three of them more clearly in Fig. 2.

Referring to Fig. 2, it will be seen that each of the fast plants is equipped with a movable chute underneath. They are also each supplied with a movable trolley and with a two-rope ore-grab bucket. At the front or water end of each outfit is a raiseable cantilever extension, by means of which the bucket may be run out over the boat. This is shown in the lowered position in the outfit in the foreground. The two in the rear have their cantilevers raised to clear the masts and funnels of the steamers. At the opposite end of the fast plants a rigid cantilever extension projects out toward the storage space. By means of this apparatus the ore is hoisted from the boats by the grab buckets and deposited either in the cars or in storage.

A five-ton two-rope grab bucket is utilized with each plant, the hoisting speed being 300 feet a minute with full load, while the runway travel is from 800 to 1,000 feet per minute. It is stated that the travel of the fast plant on the track is from 50 to 75 feet a minute. A portal pier, spanning four railway tracks, as shown in Fig. 2, is used for forming each direct unloader, the distance from center to center of the pier legs being about 63 feet. The raisable cantilever is nearly 60 feet in length, the fixed cantilever being nearly 68 feet in length.

The bridge spanway (Fig. 1) is used for storing the ore, as well as for taking it from the storage, the bridge shown has a total length a trifle over 558 feet, the span being somewhat over 250 feet and the cantilever extensions 154 feet each. This spanway is of sufficient capacity to handle a grab bucket of seven net tons with a hoisting speed of 225 feet a minute. The speed of travel along the runway is from 900 to 1,000 feet a minute, and the travel of the bridge on the track is at the rate of from 50 to 75 feet a minute.

The man trolleys, which are self-propelling, have suitable cages for the operators, and are employed not only on the bridge spanway but on each of the fast plants. It is stated that only one man is required to operate the two-rope grab bucket, the traveling of the trolley along the runway and the turning of the bucket by means of a turntable, which is in the trolley just in front of his cage. By means of this turntable arrangement the operator is enabled to turn the bucket when it is in the hatch of a vessel, thus giving a greater digging area.

Two electric motors, each having a capacity of 150 horsepower, are employed for hoisting and one electric motor of 100-horsepower capacity is utilized for racking. These motors were constructed by the Elwell-Parker Electric Company, and a motor of the same type of 75-horsepower capacity is mounted on each direct unloader for moving it, and for lowering as well as raising the cantilever.

Each of the fast plants, as stated, is provided with a movable chute which may be operated by the man trolley, or by hand, as desired, and this chute is used when the ore is loaded from the vessels into cars. The ore may be put into railway trucks on any of the four tracks under the pier of the crane, in unloading the ore from the vessels, or it may be placed into cars on the track under the fixed cantilever arm, or into the trench, as found desirable. A movable hopper is utilized for guiding the ore into the railway truck, and when the ore is deposited in the trench it may be taken by the electrically operated bridge tramway and placed in storage. The railway cars may be moved under the portal pier of the crane, and the tramway is capable of taking the ore from

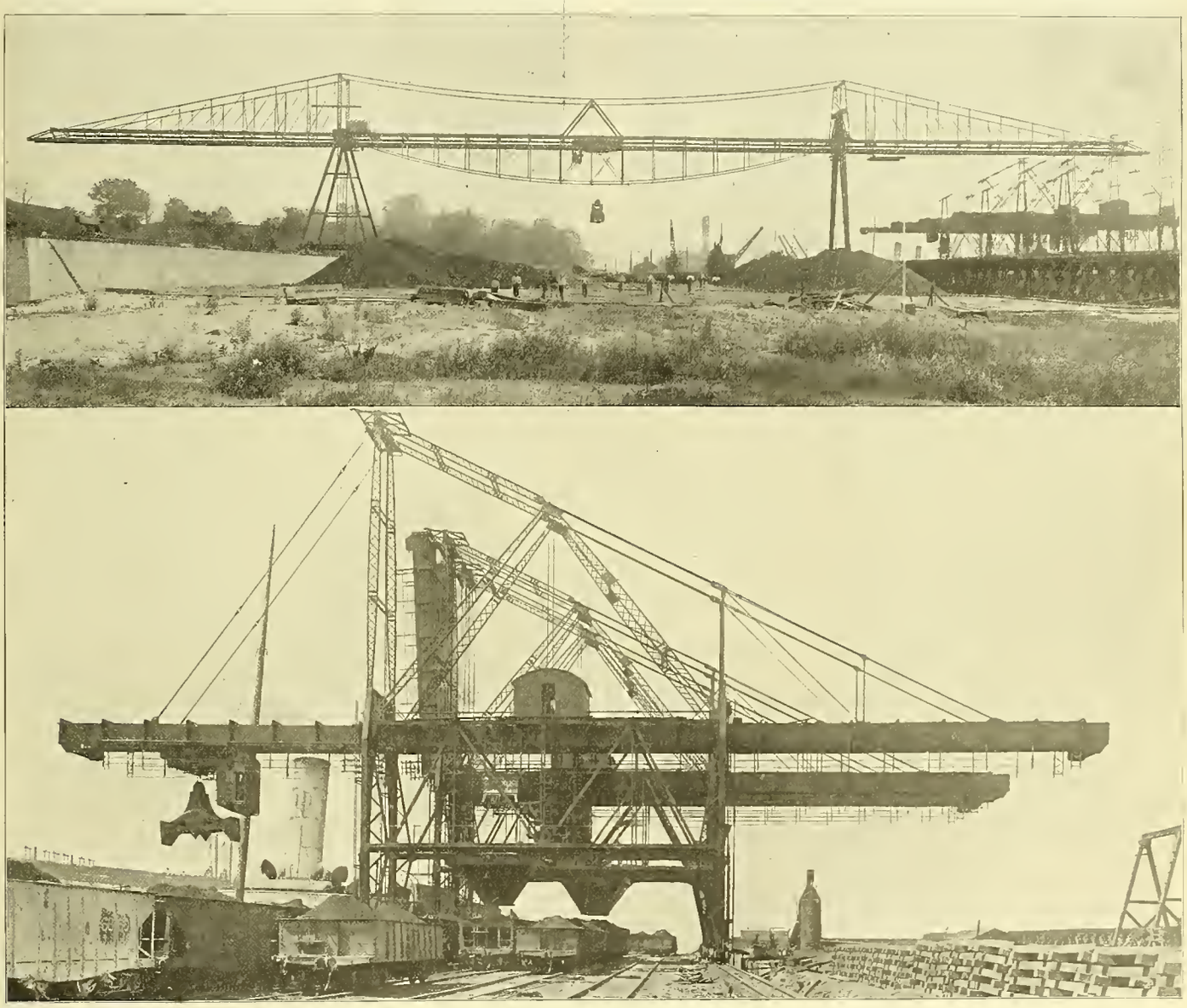


Fig. 1. Bridge Spanway for Conveying Ore to Storage.
Fig. 2. Fast Plants for Unloading Steamers to Cars or Storage.

MODERN ELECTRICALLY OPERATED ORE-HANDLING PLANT AT CONNEAUT, OHIO.

the storage and placing it in the cars. The total weight of the crane on the fast plant is 337,000 pounds, while the total weight of the trolley and bucket is 59,400 pounds. The capacity of the hook of the fast plant is 20,000 pounds, and of the bucket 10,000 pounds.

The electrically driven spanway is moved along its track by a 150-horsepower motor. The capacity of its hook is 28,000 pounds and of its bucket 14,000 pounds. The total weight of the trolley and the bucket and of the bridge is 69,000 pounds, while the total weight of the crane of the tramway is over 1,000,000 pounds.

It may be of interest to note what a wonderful saving in time and labor results from the use of these labor-saving devices. The total number of trips of the four fast plants was 121,901 during 2,997 hours, the total tonnage being 538,402. This is an average of 179.64 tons an hour, the average number of trips an hour being 40.675, with an average of 4.416 tons to the bucket. During another test the total number of trips was 40,119, with a total tonnage of 164,326, the time being 978 hours 35 minutes. The percentage of cargo was 75.8, the average number of trips being 40.997 an hour at 4.09 tons to the bucket, and an average of 169.92 tons an hour.

The steamer Cornell was unloaded on one occasion, having a total of 6,095 tons. The total number of buckets was 1,353, with an average of 7.7 net tons to the bucket for the first car, and 5.74 net tons for 11 cars, the average being 4.5 tons to the bucket for the 77.7 per cent. of the cargo.

The steamer James H. Reed was also unloaded by these four electric fast plants. There were 25 working hatches, 12 feet center to center, the cargo being 8,326.5 net tons of ore. The scrapers were not used, and the percentage of cargo unloaded was 100 per cent. The total time required was 39 hours and 39 minutes for the four machines, no delays of any kind being deducted, resulting in the delivery of 210 tons an hour for each machine.

It is said that these fast plants are capable of unloading fully 75 per cent. of the cargo of any modern steamer with hatches 24 feet center to center, without the aid of hand labor in the hold of the vessel, and that at a continual rate of 150 tons an hour. These results are certainly interesting and show to what perfection this class of modern labor-saving apparatus has been developed.

The equipment above described was installed by the Brown Hoisting Machinery Company of Cleveland.

A Systematic Extension of Foreign Trade.

The Department of Commerce and Labor, Washington, D. C., is desirous of securing the co-operation of manufacturers and other persons interested in the efforts being made by the department, through the Bureau of Manufactures, to extend the foreign trade of the United States. In furtherance of this work it is proposed to establish a comprehensive card index which will enable the department, upon application, to furnish information desired by manufacturers, or by intending purchasers, and it is contemplated to extend the system, if the necessary authority shall be granted by Congress, to the principal consulates abroad. To enable the bureau to prepare such an index, manufacturers and exporters are requested to fill out blanks, supplied by the Bureau of Manufactures, and furnish briefly information which may be recorded in connection with their business. John M. Carson is chief of the Bureau of Manufactures.

Peculiar Street-car Accident In Milwaukee.

An unusual accident occurred recently in Milwaukee at the East Water Street Bridge, in which one of the large interurban cars of the Milwaukee Electric Railway and Light Company was partially wrecked, and with its 12 passengers nearly hurled into the river. The cause of the accident was a collision between the steamer Kearsarge, belonging to the Canada-Atlantic Steamship Company, and the north end of the bridge, just at the moment the car was leaving the south end of the bridge. The south end of the bridge was partially demolished and a wide gap opened, the car remaining suspended across the gap in the precarious position shown in the two accompanying pictures. When the collision took place the rear end of the car slid rapidly down until it caught on the end of the bridge, threatening at any moment to fall into the river, and causing a panic among the passengers.

The steamer William H. Gratwick had just passed through the north draw, the bridge had closed, and the southbound interurban car was crossing when the Kearsarge came in sight. The bridge signals ordering the boat to wait for the next opening, had been hoisted, and Captain John McNeill of the Kearsarge signaled his engine room for steam astern. It is said that the engineer misunderstood the signal, and the boat moved forward. By the time he understood the order the boat was so near the bridge that its momentum caused the collision.

When the steamer struck the bridge it tore it open, crushed the strong iron railing, tore a triangular hole in the planks nearly 10 feet across, and forced the bridge open westward for a distance of 35 feet, the south end of the bridge being carried eastward a corresponding distance.

The car, which had gone ahead at full speed in an effort to clear the bridge, was about two-thirds across, but the rear trucks still remained on the bridge when the shock came. As the bridge swung east the car struck the south approach of the bridge, loosening it and almost knocking it from its supports. Two of the huge bridge spans were wrenched from their fastenings and fell on the car, one breaking in the roof and the other smashing the windows and woodwork on the west side of the car. At the same time the south arm of the bridge, weakened by the falling of the approach arch and supports, began to sag. Nearly 20 feet of timbers, supports and iron braces were dropped and hung down into the water. Meanwhile the car, spanning the chasm between street and bridge, swayed dangerously, and its occupants scrambled to the street, all escaping unhurt, except for scratches from flying glass, and a few bruises.

The task of clearing the car from its dangerous position was a difficult one, and required no little engineering skill. E. W. Olds, superintendent of rolling stock of the railway company, had charge of the work. Eight hours were required for the wreckers to remove the debris sufficiently to allow the bridge to be swung into the middle of the river. After the iron superstructure had been cleared away a scow, piled high with railroad ties was backed under the bridge to support the car. A crib work of ties was then built up under the car, which was slowly jacked up, seven hours being required before the rear truck was raised sufficiently to be moved to the approach of the bridge. When the time for the final haul came two cars were backed up and attached to the wrecked car with ropes, and after several trials the car was pulled safely to the track on the approach.

PECULIAR STREET-CAR ACCIDENT IN MILWAUKEE.

Street Railways in Manila.

In the Western Electrician of April 22d a description was given of the opening of the Manila street railway which is operated by the Manila Electric Railway and Light Company, which not only furnishes transportation to the city but lighting and power as well.

During the last 2½ years about 1,500 to 2,000 of the "little brown men" have been occupied in erecting the power house and car barns and installing a complete electric system. Their wages ranged from 50 to 70 cents a day, varying according to their occupation. The Filipinos were well satisfied with this small sum, because it was almost twice as much as they were accustomed to receive under Spanish rule. The main trouble was to keep them at work steadily. With their increased wages they felt that two to three days of consecutive labor was quite sufficient. By allowing them to observe innumerable feast-days, and letting them take a rest in the middle of the day when the heat was intense, the foreman found that they were more willing to work.

A hard problem was to find a wood for ties and poles, and also for the car bodies, which would withstand the assault of the white ant and be practically weatherproof. As an experiment, three kinds of wood were used for ties; the native wood called molave, California redwood, and an Australian wood.

The only wood which seemed to be ant-proof was teak, and the cars were built of this material, combined with steel of a heavy design, which was carefully protected with rust-proof paint. Teak is a dense, hard wood, which needs no chemical treatment. It is difficult to work with tools and to steam bend, but has a beautiful appearance.

The Manila climate is intensely hot, and hurricanes are a common occurrence. The majority of the equipment consists of open cars, but several convertible and semi-convertible cars are being used for experimental purposes. Absolute simplicity was the keynote of the designs for the cars, so that there would be no difficulty in keeping the cars clean. The heavy, driving storms occur so frequently that extra precautions were taken to secure the comfort of the passengers. All cars are vestibuled and equipped with curtains of Pantosote, mounted on extra heavy slats, which will resist the strongest wind. The gutters, water ducts and cables for curtains are made of non-rusting metals, and the dashboards of extra heavy steel. There is a considerable overhang to the monitor roofs, and the ventilators are so arranged as to readily dispose of any water which may collect.

The Manila electric-railway repair shops are thoroughly equipped to design and build their own cars, and are conducting experiments with a view to using native woods. The present equipment consists of 95 passenger cars furnished with Westinghouse two-motor equipments throughout. On account of the lower price of teak wood in Europe, most of the car bodies were purchased there, but the trucks were purchased in America. The power house contains four Westinghouse turbo-generators which produce approximately 4,000 horsepower for general power purposes. The power house, car barns and other buildings are built entirely of steel and concrete, all metal being painted to guard against deterioration.

Viewed as a whole, or in detail, the plant of the Manila company, which was built and is being operated by J. G. White & Co. of New York, is fully up to the most advanced standard of American practice.

Electrically Lighted Circular Swing.

One of the numerous attractions at Electric Park in Newark, N. J., is the circular swing, an unusual picture of which is shown herewith. The swing is a thing of beauty at night, for it is illuminated by nearly 1,000 electric incandescent lamps, which are connected to the system of the Public Service Corporation of New Jersey.

There are six cars to the swing, suspended by wire cables. When at rest the swing gives the apearance of six great ropes of light suspended

ELECTRICALLY LIGHTED CIRCULAR SWING.

from a brilliantly lighted hoop. Once in motion, however, each light describes a circle many feet in diameter, and the peculiar effect produced upon the photographic plate is well shown in the picture. The revolving lights at any particular level describe concentric circles, which, with the tower of the swing as an axis, form a cone-shaped body of light. The picture, of course, is a "freak" one, and the swing in motion does not present the same appearance to the eye as does the photograph.

Electrostatic Separation of Metallic Ores.

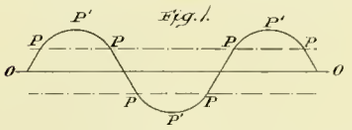
Greenleaf W. Pickard of Boston has invented an improved method of applying electrical energy to the electrodes by which the electrostatic separation of metallic ores is effected. The invention has for its object the regulation, both as to potential and duration of charge, of the electric energy applied to a pair of electrodes, so that the charge of the electrode may be adjusted to varying requirements.

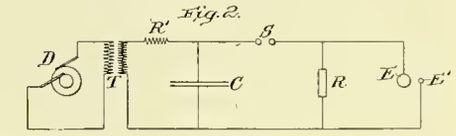
It has been discovered by Philip Henry Wynne that electrostatic separation or concentration (the terms may be used interchangeably) is more effectively carried on by employing a potential at the electrodes or in the working electrostatic field which varies rapidly and emphatically as contrasted with steady potential or one which is maintained as uniform as is practicable under working conditions. For some purposes and classes of material economical separation can be obtained by employing as the immediate source of electrical energy a high-frequency alternating-current dynamo with a suitable transformer to step the potential up to an effective intensity; but the gradual rise and fall of potential which is characteristic of such a cycle is not suited to a great majority of materials and conditions if maximum separative efficiency is to be secured. During such potential cycles or such portions of them as actually accomplish electrostatic separation there is a protraction of the static charge which brings about or is liable to bring about undesirable effects, the exact nature of which is not wholly clear, but the consequences of which, practically considered, are felt in imperfect separation of differentiated particles of matter. Whatever may be the immediate causes of this imperfect performance, it is at least certain that they proceed from protraction of the static charge, which has time to communicate itself or its influence to particles in the mass under treatment which it is not desired to have responsively subjected to the charge.

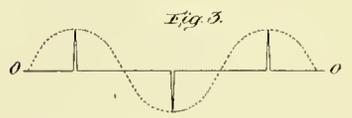
In the drawings herewith, which are reproduced from Mr. Pickard's patent, Fig. 1 represents a curve denoting a potential phase cycle. Fig. 2 illustrates diagrammatically an apparatus for producing sharp potential variations. Fig. 3 shows a phase-cycle curve characteristic of the results produced by an apparatus like that of Fig. 2, and Fig. 4 shows in cross-section the elementary parts of an electrostatic separator.

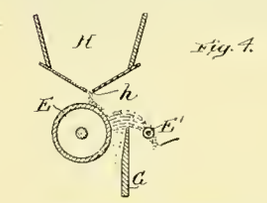
The conditions referred to will be understood by reference to Fig. 1, where (O O) represent the zero line of potential and the curve represents the potential-phase cycle. At some point—say (P)—either on the positive or negative side, the potential acquires sufficient intensity to repel or separate a selected portion of the material under treatment. During that part of the cycle represented by (P P' P) the electrodes possess a separating charge which may persist during a large fraction of the time occupied by the entire cycle, and under some conditions and with some materials this charge will have time to be felt by other particles than those desired to be influenced. Whatever changes may be imposed upon the potential-phase cycle at the electrodes, it is of course essential that at least a working-minimum potential be available, and Mr. Pickard's object is to regulate and reduce the time element in the potential-phase cycle as it is effectuated at the electrodes, while retaining all the values of high potential for separating purposes.

Speaking with reference to the curve which graphically represents the phase cycle produced by a source of electrical energy—such as, for instance, a high-frequency alternating-current dynamo—the invention is characterized by the cutting out more or less of the potential ordinates at will, leaving only such portions of the crest of the cycle wave as may be found desirable for separation purposes to be communicated to the electrodes. In Fig. 2 is illustrated diagrammatically an apparatus for producing this result. (D) represents an alternating-current high-frequency dynamo, and (T) a transformer connected therewith. (E E') are the electrodes of the separator, connected electrically with the transformer terminals, except for the spark-gap (S), which is in one branch or the other of the connections. Between the transformer and the spark-gap there is placed in parallel with the electrodes a condenser (C), and between the spark-gap and the electrodes there is connected a non-inductive resistance (R), also in parallel with the electrodes. With this arrangement the condenser (C) becomes to all practical intents the source of potential for the electrodes, and the transformer (T) is excluded from all immediate influence over the electrodes. A resistance (R') may be interposed between the transformer (T) and the condenser (C) to damp and prevent the occurrence of oscillatory disturbances in the circuit. As the potential phase created by the transformer rises toward the potential at which the









ELECTROSTATIC SEPARATION OF METALLIC ORES.

spark-gap is set to break the condenser is charged, the electrodes remain unaffected. When this potential is reached the spark-gap breaks, the electrodes are excited and the function of the resistance (R) follows in the series of occurrences, cutting out the electrodes; but the condenser being susceptible of almost instantaneous discharge the potential at the electrodes drops to zero without any appreciable detention or graduation. The phase curve produced at the electrodes, as contrasted with that produced by the transformer, is graphically represented by Fig. 3, wherein the dotted curve represents the normal characteristic phase curve of the potential created by the source of energy, and the unbroken line represents the potential changes at the electrodes.

An apparatus to which these electrical devices may be applied is shown in Fig. 4, wherein (H) represents in cross-section a hopper slotted at (h) to deliver material to the electrode (E), between which and the electrode (E') the static field is produced. A separator (G) is placed between the electrodes the better to segregate the particles selectively affected by the static charge. The electrode (E) is a cylinder having a metallic surface, and (E') is a copper wire enclosed in a glass tube. The separator (G) is a partition, preferably of dielectric material, which serves to divide the separated portions of the comminuted material acted on by the electrode field.

It should be borne in mind that the phase diagrams used for illustration do not pretend to represent with perfect fidelity any actually produced wave form, but that they are employed to show a simple form of wave which will be approached more or less closely in actual practice.

In the practice of electrostatic separation the invention is intended to place at the service of the operator electrode impulses or excitations which may be reduced to infinitesimal time intervals. If, for instance, the potential be derived from an alternating-current dynamo having a frequency of 50 per second, the electrode excitations can be reduced by this method to two or three millionths of a second, so that during all of the time except this minute fraction the electrodes are unexcited and inert. The disturbances of the separative process which result from prolongations of electrode excitation and require time to develop are eliminated and nearly perfect separation of materials is said to be obtained.

Electric Power Supply in London.

[From the London correspondent of the Western Electrician.]

Since the era of electric-power companies was inaugurated in 1900 London has been left singularly alone in this matter. In 1898 a joint committee of the houses of Lords and Commons, presided over by Lord Cross, was formed for the purpose of reporting upon the general question of electric power supply throughout Great Britain, consequent upon the introduction of a number of bills before Parliament by companies asking to be allowed to "peg out" certain defined areas, extending in many cases to thousands of square miles, in which to supply electricity for motive power purposes on a large scale. The report of that committee made certain recommendations which freed such companies from obligations placed upon an ordinary electric-supply company working under a provisional order granted by the Board of Trade under the electric-lighting acts of 1882 and 1888. A notable exception in favor of the "power" companies was that they should not be liable to compulsory purchase at the end of 42 years, as are the ordinary electric-supply companies above referred to. No serious objection has ever been taken to these recommendations because the amount of competition between electric-power companies and local authorities and companies supplying under the electric-lighting acts of 1882 and 1888 is of an infinitesimal character.

There are now 24 electric-power companies authorized, and most of the areas relate to scattered rural districts in which the towns and villages have for the most part comparatively small populations and are well away from each other so that independent electric-supply plants would be unremunerative in the majority of cases. Hence the power company is more or less alone in its area, for in those cases where large towns owning electricity works were in the area it may be said generally that the rule has been to exclude them from the operations of the power company.

For four years after the passing of the original power act London was left severely alone; principally by reason of the fact that as a district London stands in an unprecedented position. Unlike any other large town in Great Britain, it is split up into a number of comparatively small districts, each controlled by a local authority, there being at the same time a supreme authority over them in the shape of the London County Council, which, however, does not administer the local wants of the various localities. In practically all these separate areas there is an electric-supply works, frequently owned by the local authority; in some cases by companies, and in a few instances there is competition between the local authority and a company. In all cases the electric-supply authority works under a provisional order of the Board of Trade, granted under the electric-lighting acts of 1882 and 1888. The local authorities, however, are the predominant partners, for all the companies will be purchasable by the local authorities in 1931. Thus up to the present the future of electric supply in London may be said to be in the hands of the local authorities.

For the first time, in 1904, an electric-power bill was introduced into Parliament dealing with a portion of the east of London—what might be termed the industrial portion, inasmuch as here are to be found the majority of the factories, docks, etc., of London. After a lengthy inquiry the proposal was rejected on the ground that the financial evidence of the promoters was not sufficiently strong to convince the committee that the scheme would ever materialize.

But the year 1905 will be remembered as an epoch-making year in the history of electric supply in London, for, metaphorically speaking, the local authorities and the electric-supply companies were staggered by a proposal on the part of a company to supply electrical energy to them in bulk at prices at which the present authorities could not themselves generate current. This company also proposed, under certain conditions, to supply direct to the individual manufacturer, the object being to

encourage the manufactures of London, which, it was claimed, were stagnant, owing to the want of development of cheap electric power. The company which it was proposed to form came with a backing almost unexampled in parliamentary history. The names of the promoters were sufficient guaranty—and even the opponents did not deny that—that the $25,000,000 capital would be subscribed many times over, while the estimates of the engineers as to capital expenditure were supported by actual tenders from the manufacturers of the plant, who were willing to supply the necessary machinery at prices which at first astonished—to put it mildly—all the opponents.

The details of the proposals of the company were as follows: The area selected extended far beyond the boundaries of the County of London to the north, south, east and west, an area which in one portion is literally crowded with factories, docks, etc. Three sites for generating stations were then decided upon, one at Greenwich, another at West Ham, and a third at Fulham, each having a capacity of 90,000 kilowatts normal rating. All the sites faced upon the River Thames, with obvious advantages from the central-station engineer's point of view.

The company proposed to supply in bulk to authorized distributors, i. e., those electric-supply authorities working under provisional orders, at a price below the average works costs of such authorities, direct to factories, for motive-power purposes, and also direct to canals, railways, tramways, docks and government departments. So far as the individual manufacturer was concerned, it was only intended to supply him with the consent of the authorized distributor, if one existed, but should that consent be withheld, then the Board of Trade would be asked to determine whether the action of the authorized distributor was reasonable or otherwise. In this way the promoters argued that the authority under the electric-lighting acts would be still left in undisputed possession of its present business.

Estimates were produced to show that only four per cent. of the total horsepower installed in London factories was driven electrically, and that therefore none of the present business would be competed for. As showing the almost colossal nature of the possibilities which the promoters see in London for the supply of electrical energy the following figures will be interesting. By 1911 it is estimated that the demand will be:

For power purposes, 340,000,000 units.
For lighting purposes, 234,000,000 units.
For traction purposes, 567,700,000 units.
Total, 1,141,700,000 units.

The whole object of the scheme, obviously, is size, and the promoters admitted that only by the sale of an enormous quantity of energy could low prices be maintained. It was put forward, and not contradicted, that out of 456,415 horsepower in London today only 16,176 horsepower is driven electrically. Another fact quoted against the existing authorities as tending to retard the universal use of electric power was the fact that there are 31 different systems of generation and 19 different voltages scattered about in 51 generating stations in the area throughout which the new power company proposed to supply from three interconnected generating stations. The average size of the existing generating sets is 331 kilowatts and the average size of the existing generating stations 2,720 kilowatts.

On the question of prices, upon which it was admitted the whole matter turned, it was accepted by the opposition that the present average price per unit is 1.94d., whereas under the proposed scheme this would be brought down to something between three farthings and one-half penny according to the load factor, such price being for energy supplied in bulk, including the cost of transformation to any required voltage or style of current. Moreover, the maximum price which the promoters could charge under their bill was 1½d. per unit, the lowest charges ever inserted as the maximum in any electric-power bill.

With regard to the capital charges, the average expenditure per kilowatt installed in the existing works today was put at £50 or thereabouts, but the promoters on the strength of tenders received from Messrs. Parsons and other firms stated that their capital cost per kilowatt would be £8.4, a comparable figure in every way with the existing £50. The generating costs were put at the phenomenally low figure of only 0.154d. per unit.

In face of the fact that tenders were produced showing that well-known manufacturers would supply all the necessary plant at the prices upon which the estimates were based, the only loophole left for the opposition was to prove that the scheme was unsound in its inception, but it must be stated that the promoters have made out a very strong case indeed. They urged that they were going into this business with more "push" than had been the case hitherto, and this was evidenced by the inclusion of the sum of $125,000 in the estimates for the purpose of a canvassing department and also for use in assisting manufacturers to change from steam to electric driving without having to bear the heavy initial cost of the change.

On these figures the bill passed the House of Lords and secured the rejection of four competing bills which would have dealt with the same area in four different sections. The great difficulty to be got over was the hardship likely to be done to the existing supply companies, which are liable to purchase, but the committee thought it had safeguarded these companies by the insertion of a clause dealing with the matter. Everyone realized that the greatest opposition would come to the bill in the House of Commons, and so it proved. An unsuccessful effort having been made to prevent the measure coming before a committee of that House, a committee was accordingly appointed and the bill committed to it in due course.

Hitherto the companies and the local authorities had been acting in concert in opposing the bill, but during the passage from one House to the other the companies were approached one by one in order to seek a means to avoid any further opposition, and within a week or so of the bill coming before the House of Commons committee practically all the companies had withdrawn. The basis of all the agreements come to was that when the companies' existing generating works were fully loaded all excess supply should be taken from the big power companies at very low rates and that no competition should take place. This volte face on the part of the companies left the local authorities the sole opponents, and they made full use of the opportunity. They realized that with the end of the session at hand obstruction was the policy, provided it was not carried on too openly. The result was that a large amount of evidence and speech was repeated almost ad nauseum, and the bill, although finally passed by the committee, was only sent up to the House for final reading two days before the end of the session. By the standing orders of Parliament three days must elapse between the passing of a bill by a committee and its third reading. This was obviously impossible, and a motion that the bill be suspended until the next session and continued from the point at which it was stopped this year was prevented from being heard owing to further obstruction in the House itself by some of the opposition.

Hence the whole proposal will have to be brought up afresh next session and all the ground gone over again. It is stated to be the intention of the promoters to do this despite the bill having cost some $250,000 in promotion expenses this year.

It may be interesting to note that Mr. Samuel Insull of the Chicago Edison Company was among the list of promoters handed to me.

Copper Market.

Electrolytic wire bars were quoted the latter part of August at 16 cents a pound, the highest price since 1901. The exports for the first seven months of 1905 amount to 332,144,960 pounds against 299,116,160 pounds for the first seven months of 1904. If the domestic production for the current calendar year is estimated at 875,000,000 pounds, the above rate of exports, if maintained throughout the entire year, would represent 65 per cent. of the United States' production. Imports into this country for the first half of this year were 98,784,000 pounds, and at this same rate the quantity of imported copper for 1905 would amount to 197,568,000 pounds. Adding imports to production the new domestic supplies for 1905 aggregate 1,072,568,000 pounds. If the same ratio of exports continues as for the first seven months the total quantity of copper exported this year will reach the unprecedented amount of 569,391,360 pounds, or 53 per cent. of the United States production and imports for the year.

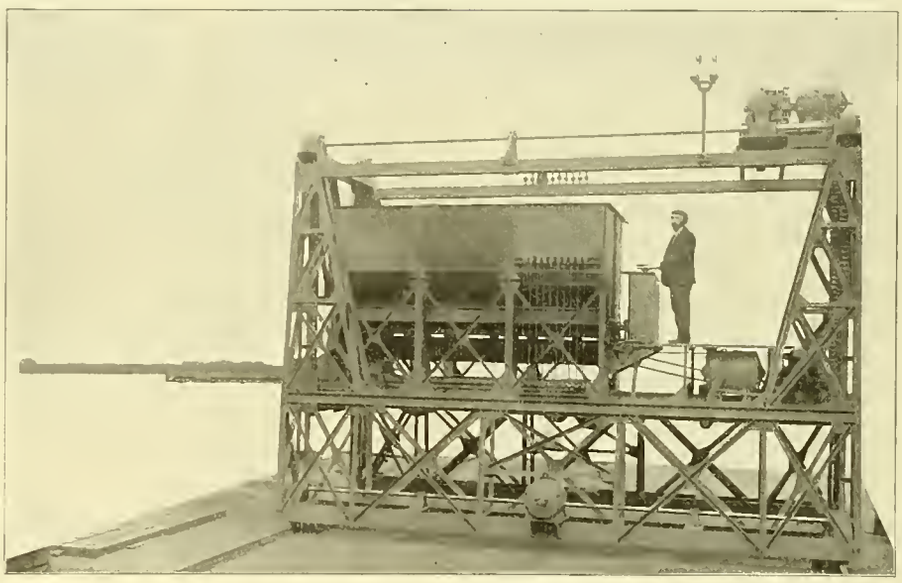
Electrical Retort-charging Machines.

The economy obtained by the use of electrical retort charging machines is a well-established fact and they are now extensively utilized in both Europe and America for charging and discharging gas retorts. Great improvement has been effected in these machines, but one difficulty has remained, namely, two machines are required to do the work, one for charging the retort, the other for discharging it. The latest development in this line comes from Switzerland, and obviates this difficulty, one machine doing all the work. Mr. Bertrand, a Swiss engineer, is the inventor of this apparatus, the Maschinenfabrik Oerlikon of Switzerland being the manufacturer.

In this new type of retort charging machine the ladle which is used, consists of two separate parts movable with respect to one another. On entering the retort it discharges the coke and leaves a fresh charge of coal as it is withdrawn, the coke being pushed out of the rear end of the retort. It can thus be seen that this form of apparatus is only suitable for use where the retorts are open at both ends, and although in some cases this would be a serious drawback, in other cases there are certain advantages for this form of construction.

A motor controls the ladle, driving by worm gear and pinions a cable fastened to the bottom of the ladle, or else a drum which winds up a chain connected with the frame. After the ladle has entered the retort sufficiently, this frame locks, the bottom part of the ladle is withdrawn and the charge of coal is let drop.

The ladle weighs from 160 to 190 kilograms and is provided on the end with a hinged shield, so that it can be drawn out without interfering with the charge. The bottom, as it reaches the end of its travel, unlocks the frame, which in turn is drawn back ready for the next retort, all the movements taking place automatically. After the apparatus has once been started nothing more is necessary, as the ladle and frame continue in operation until the work is completed, when they automatically stop. Only one minute is required for the complete operation.



ELECTRICAL RETORT-CHARGING MACHINES.

Two coal hoppers, with a capacity of 3,000 kilograms each, are placed on the framework and fill the ladle through valves in the bottom. The entire platform, with bunkers and charging mechanism, are suspended by four cables. The vertical movement is obtained through these chains, which are driven through sprocket wheels by a motor. This motor, on lowering the gear, acts as a generator, an electric brake being provided, connected with the electrical circuits in such a manner that a very accurate adjustment of the charging apparatus can be readily obtained.

The position of the operator can be seen from the accompanying illustration, as well as the levers, all the various movements being controlled from the same box.

The picture is a view of one of the machines installed at the work of the Cie. du Gaz de Wazemmes in Lille. They are used to feed a battery of five furnaces, each furnace having 11 retorts.

The vote to establish an electric-light plant in Westfield, Wis., was carried.

International Association of Municipal Electricians.

The tenth annual convention of the International Association of Municipal Electricians was held in the convention hall of the Reed House, Erie, Pa., August 23d to 25th, the first day's session being called to order by President Walter M. Petty of Rutherford, N. J., at 10 o'clock a. m. The Rev. A. C. Ellis was introduced and invoked the divine blessing.

President Petty then introduced Hon. R. J. Saltsman, mayor of Erie, who tendered to the delegates and guests the freedom of the city, saying that the doors were "wide open," and called attention to the many historical points of interest in the city and immediate vicinity. In closing the mayor said: "Conventions are a grand thing; they bring men together for an interchange of thoughts and ideas and are the best means of bettering the municipalities, which get the benefit of your enlarged experience and knowledge. I hope this will be one of your best conventions and that it will be the pleasantest gathering you have ever had."

On behalf of the association Mr. J. B. Yeakle responded to the mayor's welcome in a few well-chosen words, assuring the citizens of Erie that none could forget the hospitality so freely extended.

The address of President Petty was in the form of suggestions "as to means of increasing our membership and adding to its value."

The report of the executive committee showed an increase of membership for the year of 13. It also recommended Mr. W. Y. Ellett of Elmira, N. Y., for life membership, which recommendation was adopted by the convention. The president then appointed W. H. Thomson, William Crane, J. B. Yeakle, M. J. Donohue and T. F. Almon as nominating committee.

At the afternoon session the paper of William Brophy, "Suggested Improvements in Fire-alarm Telegraph systems," was presented and discussed very generally by those present, after which the paper by C. E. Diehl of Harrisburg, Pa., "The Advisability or Inadvisability of Fusing Fire and Police Telegraph Boxes," was read by the author and discussed. The closing hours of the afternoon were given to the paper prepared by Louis Gascoigne of Detroit, Mich., on "Underground Construction." After dinner the delegates and friends were given a trolley ride around the city and to the parks, where entertainment was prepared for them.

At the morning session of the 24th the paper of C. L. Williams on "Erection and Maintenance of Electric Light Plants" was read by the secretary, Mr. Williams not being able to attend. Mr. Hatch of Detroit, Mich., then read "Electric Light Engineering," and the two papers were discussed together. T. C. O'Hearn presented a paper, "The Need of a Rigid Inspection by the Municipality," which, owing to the lateness of the hour, was made a special order for discussion at the afternoon session.

After lunch the discussion of Mr. O'Hearn's paper was taken up, during which the National Electric Code was also considered, the two being so closely related.

"Electrostatic Induction on Telephone and Telegraph Circuits" was the title of a paper prepared by H. R. Allensworth of Columbus, Ohio, which next received consideration at the hands of the delegates, and the debate at times was very warm, and numerous illustrations were drawn on the blackboard to better convey the ideas of those participating.

After adjournment the delegates were taken in special cars to Waldemere Park, where entertainment was provided, and all returned to the city well satisfied that the citizens of Erie knew how to entertain and interest delegates attending conventions.

The "Question Box" was the order for Friday morning, and this feature was of unusual interest, and spirited debates was the order until the president had to close it in order to finish up the business that demanded attention.

The report of the treasurer showed a balance of $317.94 in the treasury, being an increase of $84.72 over last year.

The nominating committee presented its report and recommended the following for the officers for the ensuing year: President, Jerry Murphy, Cleveland, Ohio; first vice-president, William Crane, Erie, Pa.; second vice-president, H. R. Allensworth, Columbus, Ohio; third vice-president, B. A. Blakey, Montgomery, Ala.; fourth vice-president, F. A. Cambridge, Winnipeg, Man.; secretary, Frank P. Foster, Corning, N. Y.; treasurer, C. E. Diehl, Harrisburg, Pa.; executive committee, T. C. O'Hearn, Cambridge, Mass.; A. S. Hatch, Detroit, Mich.; J. B. Yeakle, Baltimore, Md.; Louis Gascoigne, Detroit, Mich.; Walter M. Petty, Rutherford, N. J.; James Grant, New Haven, Conn.; T. F. Almon, St. Louis, Mo.; W. H. Thomson, Richmond, Va.; W. Y. Ellett, Elmira, N. Y.; finance committee, W. D. Claiborne, Savannah, Ga.; G. F. Macdonald, Ottawa, Can.; H. C. Bundy, Watertown, N. Y. The report was received and the recommendations adopted by the convention.

Invitations from Buffalo, N. Y., Chicago, Ill., Put-in-Bay, Ohio, and New Haven, Conn., were presented for the convention of 1906, and the representatives from New Haven presented their claim in such a convincing manner that that city was finally selected as the meeting place for the eleventh convention.

Those present and registered are as follows:

C. D. Rolph, Rochester, N. Y.; Louis Gascoigne, A. S. Hatch and wife, Detroit, Mich.; B. A. Blakey, Montgomery, Ala.; J. H. Warren, New Brunswick, N. J.; Walter M. Petty and wife, L. A. Petty, Rutherford, N. J.; Miss E. L. Petty, Brooklyn, N. Y.; W. D. Claiborne, Savannah, Ga.; James Grant, E. L. W. Kittredge, New Haven, Conn.; T. H. Bibber, Chelsea, Mass.; W. H. Thomson, Richmond, Va.; G. F. Macdonald, Ottawa, Can.; J. F. Burns, Schenectady, N. Y.; H. C. Bundy, Watertown, N. Y.; Frank P. Foster and wife, Bertha M. Ryan, Corning, N. Y.; J. B. Yeakle and wife, Baltimore, Md.; Jerry Murphy, Cleveland, Ohio; John Berry, Indianapolis, Ind.; John S. Craig and wife, Toronto, Can.; M. J. Donohue, J. E. Donohue, Miss Josephine Connors, Niagara Falls, N. Y.; Miss Laura Kennedy, Buffalo, N. Y.; A. C. Farrand, Atlantic City, N. J.; C. R. Newman, Passaic, N. J.; Adam Bosch, Newark, N. J.; T. F. Almon, St. Louis, Mo.; W. Y. Ellett, Elmira, N. Y.; H. R. Allensworth, Columbus, Ohio; C. E. Diehl and wife, Harrisburg, Pa.; F. A. Cambridge and wife, Winnipeg, Man.; F. T. Andrae, Milwaukee, Wis.; Frank E. Pierson, Morristown, N. J.; T. C. O'Hearn, Cambridge, Mass.; Clarence R. George, Houston, Texas; John H. Dorrington, W. P. McCartney, A. A. Anderson, Pittsburg, Pa.; T. Torrey and wife, F. Peace, A. P. Eckert, W. P. Ambos, New York; William Crane and wife, D. N. McBrier, Charles Andrews, Mrs. E. Allen,

ELECTRIC TOWER AT WHITE CITY IN CHICAGO.

J. W. Leech, J. Z. Miller, W. H. Wilson, H. T. Lasure, Erie, Pa.

After the convention had adjourned a fish fry was tendered the delegates at Four Mile Creek, which was enjoyed by all who attended.

Waterpower Development on the Clinton River in Michigan.

Development of the waterpower of the Clinton River near Pontiac, Mich., is now rapidly taking form, and in about two months the first of three plants to be located within five miles from the city will be ready for operation. The Clinton River Power Company, which owns the power facilities, was incorporated in July, this year, with a capital stock of $75,000. Fred J. Seeley is the president and Carl H. Pelton, secretary and treasurer.

The flow of the Clinton River, though not remarkably large, is very constant the year around, an ideal condition for the development of the waterpower. In all there will be three dams and power plants erected, having a combined capacity of about 1,600 horsepower. The first of these plants, which is now under construction, is located at Amy, about three miles from Pontiac, upon the site of an old mill which has operated for 75 years. The head at this point by raising the old milldam is 29 feet, and 426 horsepower will be here developed. The power house is to be of the most approved concrete construction.

The other two plants upon which work will be pushed as rapidly as possible will be located one and five miles from Pontiac, and will be of 426 and 750 horsepower, respectively. Current will be used in Pontiac for lighting and various purposes. Already the amount to be developed by the first plant has been contracted for, and there is no doubt but that the total amount will find a ready market. A transmission line, constructed upon up-to-date principles, will carry the current to Pontiac at 6,600 volts.

MacKean, Ball & Co., contractors and engineers of Chicago, have charge of the installation of the plant.

Electric Tower at the White City in Chicago.

Since the electrical features at White City, the large amusement park at the corner of Sixty-third Street and South Park Avenue, Chicago, were described in the Western Electrician the electrical tower in the center of the grounds has been completed. The accompanying picture shows the tower as it appears at night. Not to mention the amusement features, the park has become popular on account of its exceptional illumination, and with the addition of the tower the brilliance of the place at night is surpassed probably by no other similar resort in the country.

The tower rises to a height of 283 feet. Including the colonnade the actual connected load of the tower is 15,700 eight-candlepower incandescent electric lamps. Of these, 11,700 are above the colonnade. A handsome urn 12 feet high and five feet across crowns the structure. The urn is outlined with 600 incandescent bulbs.

To wire the structure 5,900 feet of No. 0000 feeders were used, and 5,000 feet of No. 14 single-conductor wire. The switch gallery is located 107 feet up the tower, where four cut-out boxes, each 12 feet high, are located. Into each box 174 circuits of about 24 lights each are led. Two main centers of distribution are located at opposite corners at the base of the tower, and are fed by two sets of 1,000,000-circular-mil cable, leading direct from the main switchboard in the Commonwealth company's sub-station on the grounds. From each of these centers four three-wire sets of feeders feed the cut-out boxes. Four sets stop at the switch balcony and the other four go further up to four smaller boxes at the top.

As the tower is a steel structure covered over with metal sheeting, a method of fastening the sockets had to be devised. This was accomplished by attaching the sockets to light strips of iron 24 feet long and bolting the strips to the sheeting. The electrical work on the tower was done under the supervision of Mr. J. P. McGilvray of the McFell Electric Company of Chicago.

Chicago Street-railway Situation.

Mayor Dunne's "contract plan" for building a 264-mile municipal street railway in Chicago and the report of the mayor's traction expert giving route, cost, probable earning power and cost of operation for the system were taken up for consideration by the local transportation committee of the council this week. For the majority of this committee the legal point was raised that it is beyond the power of the council to make such a contract with a private company as the mayor proposes. This was referred to the law department for an opinion.

Many perplexing questions concerning the proposed municipal line were put to the mayor and his advisers. The committee wants to know from what source the money for building this road is to be obtained and who the men are who will control it when built. State laws governing the incorporating of companies were called to the mayor's attention and one of the aldermen suggested that in case the road was run in such a manner that there is no profit with which to pay interest on bonds or provide a sinking fund, or there is a foreclosure, or if it happens that the stock gets into different hands and the stockholders elect a different set of directors, the result would be that the franchise rights given the company under the "contract plan" would go to the new owners and the city would be as far from municipal ownership as ever. Answers to such questions are expected at future directors the result would be that the franchise meetings of the committee, which will probably be lively ones. All indications at present are that the committee stands eight to five against the mayor's proposition.

The Queen City Electric Light and Power Company of Sioux Falls, S. D., has been incorporated with a capital stock of $300,000 by H. J. Hanford of Chicago, Pitt Curtis of Norwalk, Ohio, and A. Huntington and U. S. G. Cherry of Sioux Falls.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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DATES AHEAD.

Railway Signal Association, Great Northern Hotel, Chicago, September 12th.

Colorado Electric Light, Power and Railway Association (annual convention), Glenwood Springs, Colo., September 18th, 19th and 20th.

American Electrochemical Society (general meeting), Bethlehem, Pa., September 18th, 19th and 20th.

American Electrotherapeutic Association (annual meeting), Academy of Medicine, New York city, September 19th, 20th and 21st.

American Street Railway Association (annual convention), Bellevue-Stratford Hotel, Philadelphia, September 25th to 29th.

Illinois State Electric Association (annual meeting), Peoria, Ill., October 5th and 6th.

INSULATING MATERIALS for dynamo-electric machinery, transformers, etc., are valuable in so far as they are able to perform their function under varying degrees of temperature. The English Engineering Standards Committee recently issued a report on the effect of temperature on insulating materials which contains some interesting results obtained from actual tests made upon various classes of insulating substances. Samples were exposed from nine to 12 hours to varying temperatures, and it was found, according to the report, that none of them was suitable to withstand 125° C. for this length of time and still retain their insulating properties. Asbestos and micanite, even, suffered by this exposure, the latter in consequence of the charring of the material by which the scales of mica were cemented together. Temperatures higher than 100° C. are liable to occur in inaccessible parts of a machine, bringing the insulation near to the ultimate value which it can safey stand, is shown by the tests. Even when apparently suitable materials are used in a machine, a few years must elapse before their suitability can be proved beyond a doubt. It required several years to prove that the insulating materials formerly used in street-railway motors ultimately pulverized.

THE big electric power scheme for London has met the fate that many persons predicted for it. It was passed by the second House, but owing to the obstructionist methods adopted by the opposition both in committee and in the House of Commons itself there was no time for it to pass the concluding stages. Further, a motion asking that the bill could be held over until next session was prevented from being heard, although notice had been given. The bill, which is dealt with elsewhere in this issue, if it is introduced next session, will have to start anew. Thus, it is calculated, some $250,000 has been wasted by the promoters alone, and that the total expenditure incurred by the opposition has amounted to a further sum of $750,000. If the mild panic caused by this bill in municipal circles in London has no other effect, it has had the beneficial influence of setting everybody to put his house in order. Probably not since the introduction of electricity has such enterprise been shown in forwarding the cause of electrical energy for power purposes, and prices are being quoted which under the existing conditions must inevitably entail a call on the rates indirectly. Thus there is little inducement for the manufacturers to take energy at cheap rates, knowing that their rates will be increased in consequence. It is not to be supposed that a small local authority can compete with a company generating on the huge scale proposed by the promoters of the power bill. And on the figures for cheap cost of generation, many leading engineers did not disagree.

CONSIDERED in the light of present-day perfection of electrical apparatus and the remarkable advances which have been made in the transmission of electric power over long distances, it seems a pity that 60,000 electrical horsepower should be continuously going to waste in the heart of the richest agricultural district in the United States. Yet such is the case. The Des Moines Rapids of the Mississippi River at Keokuk, Iowa, represent an available head of 30 to 35 feet the year around, which, if developed by a dam of suitable proportions, would mean a waterpower rivaled only by power developments at Niagara Falls. The project has been in the minds of local people for many years and has been mentioned before in this journal, but, strange to say, has never been widely commented upon despite the manifest possibilities which it presents. A company was formed some time ago, known as the Keokuk and Hamilton Water Power Company, to acquire the necessary rights. Government permission to construct the dam has been secured and considerable data has been collected. Further than this the work has not gone, though in the minds of many who know the conditions it will be but a matter of time before active steps will be taken to utilize the power now going to waste.

Commercially, the proposition is simply this: To develop 60,000 electrical horsepower within the great corn belt having a population in 1900 of 242,161 within a radius of 40 miles of the rapids, 1,468,496 within 100 miles and 3,917,046 within 150 miles. The opportunity thus presented for the wide application of electrical power to agricultural purposes is a favorable one, and there is no competition except steam power within the radius of the activity of the proposed dam. If manufacturing be the object in view several railroads, north and south and east and west, together with the Mississippi itself, offer abundant shipping facilities for both raw material and manufactured articles.

As an accomplishment in engineering the development of this waterpower would be one of the greatest of its kind. The dam would, with the exception of that of the British system on the Nile, be the greatest in the world, and would be over 30 feet high by over 5,000 feet long. From an electrical point of view nothing unusual would be encountered in the building of the plant and the distributing system. How soon a practical attitude will be assumed toward this important work is hard to tell, but it seems improbable that a great work of this nature, presenting such possibilities, will be left for a great length of time before it is undertaken.

ONE of the most noteworthy features of New England power-plant practice today is found in the wide use of exceedingly moderate transmission voltages. In many quarters there seems to be a feeling that 13,200 volts should not be exceeded, and many plants have been designed with this supposed limit in view. The use of 13,200-volt generators without transformers is so common in New England that the practice deserves inquiry. New England is naturally conservative and standard machinery finds a ready sale there. The distances over which power must be sent are, moreover, not great, as a rule, compared with the long transmissions of the far West, which factors account, in part, for the low voltages used. Another cause lies in the fact that in some municipalities the danger of high potentials has been greatly exaggerated. It sometimes is next to impossible to convince a board of selectmen that a well-designed high-voltage line is actually less formidable than a network of so-called insulated wires carrying current at lower potentials in all sorts of localities and under unfavorable conditions.

Consolidations of local street-railway systems and concentration of the generating equipment in a single plant with dismantling in the case of obsolete stations are largely responsible for the present state of affairs. It is not always as easy to break away from such conditions as might seem on paper. Special transformers built for 13,200 volts primary and say 30,000 volts secondary would cost the company a neat sum; the installation of the equipment and the strengthening of the transmission line by the employment of new and higher voltage insulators throughout would be an expense of moment, and the station losses in transformation and purchase of new step-down transformers at the substation would all have to be carefully considered. Nevertheless, the saving in copper and annual power lost might very likely justify these changes after an expert examination of the problem in detail. The point is that unusual conditions like this deserve close study on the part of the management, and in the light of western experience there would seem to be no reason why a 30,000 or even a 40,000-volt transmission should not be attempted in New England under the proper commercial conditions. The 60,000-volt insulator is available in trying climates for lower potentials, and if one studies the variations in central-station practice in the single state of Massachusetts it is difficult to escape the conclusion that the time is ripe for the wider gathering of such plants together as centers of a distributing system rather than as isolated points of inefficient current generation. Each case must of course be finally calculated on its own merits, but it is certainly odd that New England practice should have of late become so cut-and-dried in the matter of voltages. In the interests of operating economy it is to be hoped that investigations of this question will form a prominent part of future developments in New England engineering activities.

Notes on the Power Factor of the Alternating-current Arc.[1]

By George D. Shepardson.

The alternating-current arc presents a wide field for research because of the many variable elements. During the last year the effect of the wave-form of electromotive force applied to the terminals of a standard enclosed arc lamp, and the elements affecting the power factor, were studied in connection with the graduating thesis work of Messrs. L. S. Billau, C. B. Gibson, E. H. LeTourneau and R. Morris at the University of Minnesota. Some of the results obtained seem of sufficient interest for presentation before the Institute.

Electromotive forces having sine, flat-topped, and peaked wave-forms were obtained from a 7.5-kilowatt, 60-cycle, General Electric double-current machine provided with three interchangeable sets of pole-pieces. Another wave-form was obtained

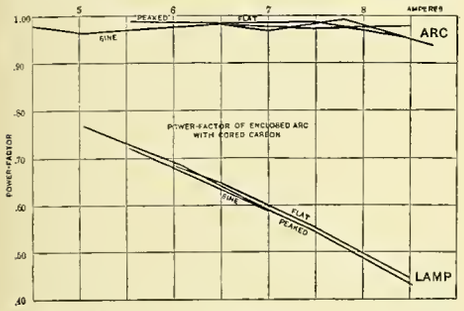


FIG. 1. POWER FACTOR OF ENCLOSED ARC WITH CORED CARBONS.

from the circuit of the local lighting company. Current from these sources was sent through an facture, or through a hand-feed lamp having in series the reactance and feeding coils of the stand- enclosed constant-pressure lamp of standard manu- ard lamp. With the latter, all the conditions of a standard lamp are reproduced, except that the length of the arc is controllable.

For part of the experiments, wave-forms were recorded by a modified Duddell oscillograph; unfortunately, this broke several times during the progress of the work, and many of the tests had to be made without oscillographic records.

Much difficulty was experienced from lack of uniformity in the carbons, although these came from a well-known maker of high-grade carbons, and were supposed to be of the best quality. In fact, the irregularities in the carbons entirely masked some of the variables which were being studied, and led to results so erratic that only a small part of the investigation gave results worthy of confidence. Variations in the performance of the carbons affected the candlepower of the light more than did changes in wave form.

Study of the power factor of the arc under varying conditions shows that it is practically independent of the form of the electromotive force

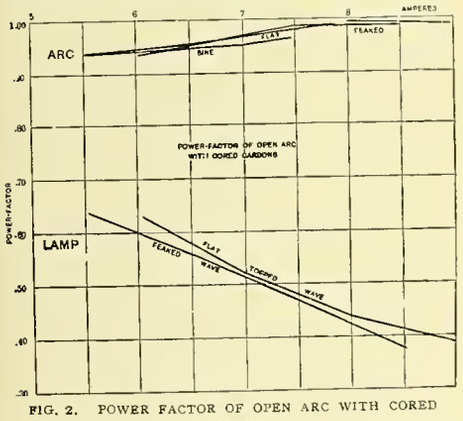


FIG. 2. POWER FACTOR OF OPEN ARC WITH CORED CARBONS.

applied to the lamp terminals. The power factor of the enclosed arc with soft-cored carbons is found to be practically constant for current strengths between 4.5 and 8.5 amperes with seven-sixteenths-inch carbons, varying between 95 and 99 per cent. (See Fig. 1.) The power factor of the whole lamp circuit, including reactive coil and feeding coil, is practically independent of the wave-form of impressed electromotive force, being higher for small currents and lower for large currents. The change in the power factor of the lamp circuit, from 76 to 43 per cent. in this case, is evidently due to the smaller resistance of the arc with larger current, the reactance of the circuit being sensibly constant within the range considered. With the same grade of soft-cored carbons and with open arc, the power factor of the arc increases from 94 per cent. with 5.5 amperes to 99 per cent. with 8.5 amperes (Fig. 2), being independent of wave-form of impressed electromotive force, at least within the limits of accuracy available. With open and with copper-plated hard carbons, such as commonly used with open arcs, the power factor of the arc varies from 80 to 90 per cent. (See Fig. 3.)

The power factor of the arc is found to remain constant when the arc pressure is constant, whatever the range of current and whatever the wave-form of impressed electromotive force. Likewise, when the length of the arc (measured by the image thrown by a lens) is maintained constant, the power factor of the arc is independent of changes in current and in wave-form of electromotive force applied to the lamp terminals. The quality of the carbons and the exposure of the arc to the air affect the power factor of the arc considerably. The distortion of the current wave-form doubtless affects the wave form of electromotive force developed by the transformer or by a small generator. The effect of the lamp coils doubtless tends to make all impressed electromotive-force waves alike when they reach the arc. Future investigations are expected to determine the wave-form of electromotive force actually applied to the arc under varying circumstances, the effect of changing it, and the reactions of the arc upon the source of electromotive force.

By means of a modification of the Duddell oscillograph, curves were obtained showing the variations in the instantaneous values of line pressure, arc pressure and current. The departure of the arc power factor from unity is evidently due to distortion of the current and electromotive-force curves, there being little, if any, difference. In some of the records there is a slight unsymmetrical displacement of zero value. Duddell and Marchant show similar displacement of zeroes in their paper before the British Institution of Electrical Engineers. (Jour. Inst. Elec. Eng., Vol. 28, pp. 60 to 86, 1899.) This phenomenon seems not to have

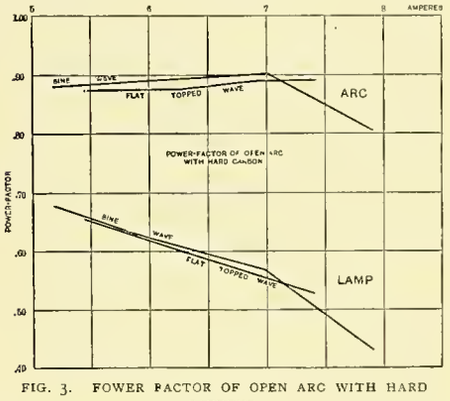


FIG. 3. POWER FACTOR OF OPEN ARC WITH HARD CARBONS.

been explained satisfactorily, and suggests a field for fruitful investigation.

The hard carbons show a much more sudden rise in the difference of potential around the arc than do the soft-cored carbons or soft solid ones. Characteristic of the soft-cored carbons is the secondary peak on the arc-potential curve, occurring nearly simultaneously with the maximum current value and thereby raising the power factor. Differences between the positive and negative loops are probably due to slight differences in the composition of the carbons. The more gradual growth of the current wave with the long arc will be noted, probably being due to the more rapid cooling of the arc gas during the extinction. With long arcs there is a tendency toward a double peak on the front of the potential wave. This portion of the wave changes greatly with the condition of burning and with irregularities in the carbons. With the short arc the potential wave rises to a marked peak at the rear. The current waves are concave to the axis when rising and convex when falling, due to the resistance being less in the hot vapor of the decreasing arc than in the cooler vapors of the increasing arc. With the hard carbons and open arc, the arc potential waves vary considerably with the length; with short arc the potential rises almost vertically to a high peak, is nearly horizontal on top, and rises to a peak at the rear; with the long arc, the peaks are not so prominent and the potential wave does not rise so rapidly.

1. Abstract of a paper presented at the convention of the American Institute of Electrical Engineers at Asheville, N. C., June 22, 1905. Mr. Shepardson is professor of electrical engineering at the University of Minnesota.

Canadian Contractor's Association.

The electrical contractors of Vancouver, B. C., have recently formed an association for the purpose of mutual benefit and protection. The association, while not proposing to make prices exorbitant, aims to maintain a schedule rate at figures that will enable the contractors to do good work. Dating from the first of July a license fee of $50 a year will be imposed on all electrical contracting firms now doing business in the city and on all new firms that may start. The president is F. C. Cope; vice-president, A. F. Barber; secretary-treasurer, A. Cherrell.

Operation of Alternating-current Motors in Electric-light Plant of 1,000 Kilowatts or Less Capacity.[1]

By E. H. Beil.

Within the last few years the use of alternating-current motors has increased largely, and the alternating-current motor is now encroaching on what has been considered by many the legitimate field for direct-current motors only, i. e., variable speed, as in crane and elevator work.

Up to within a few months the cost of alternating-current motors has been quite a serious consideration to the power consumer, but, now that prices compare favorably with those on direct current, it is very likely that the consumer will demand and obtain, if possible, alternating-current in preference to direct-current power, and the effect this will have on the lighting system is of considerable importance.

The writer will endeavor to cite the experience of our company along these lines.

We now furnish two classes of power service, viz., 500-volt direct current, and alternating current, single or two phase. Originally the power service was 500-volt direct current only, but about six years ago the first alternating-current-motor installation was connected, since which time we have been pushing the alternating-current business almost exclusively, except in elevator work, and at the present time have about equal power loads on each service. Nothing has as yet been done with alternating-current elevator motors, all elevators being operated by 500-volt direct current.

On our alternating-current service, motors ranging from one-eighth to 100 horsepower are connected, and very little disturbance to the lighting results from their operation. As a rule, individual transformers are installed, the exceptions being in the smaller-sized motors, say up to three horsepower, which are often connected directly with lighting installations. The service required of the motor, however, determines as to whether it should have its own transformer or not. If, for example, the service is intermittent, the motor being started and stopped frequently, it is bound to effect the lighting unless the transformer capacity is greatly in excess of the load. In many cases this does not matter, as the power is a day load and the lighting a night load, the two rarely overlapping.

We have one 100-horsepower two-phase motor on our alternating-current power circuits, wound for 2,000 volts. This motor is started daily at 7 a. m., run until the noon hour, after which it is again started, and runs the remainder of the day. Starting is always done under no-load condition, and upon inspection of lights on this circuit at times of starting, no change of candlepower was noticeable. In fact, the only installation from which we ever had any trouble in this respect was one in which a one-horsepower single-phase motor was connected to a somewhat lengthy secondary service, which was already carrying its full lighting load, the customer having stated that the motor would never be used later than 4 p. m. His business, however, exceeded his expectations, necessitating the using of the motor at night, and as the motor was started and stopped frequently, the lighting was badly affected. After putting on a new connection direct from the transformer, no more trouble was experienced.

In many instances motors are started up under comparatively light loads, as in machine shops, laundries, etc., when the motor is connected to a line of shafting, from which machines are driven by countershafts. In others, the full load is on from the start; a case in mind being that in which a 20-horsepower motor runs a roller coaster at one of the parks.

The applications of the alternating-current power are quite varied, power in small units being used to drive dental engines, lathes, small air compressors, presses, shoe-repair machines, cash-carrier systems, foundry blowers, newspaper presses, etc. We have displaced steam power in a laundry, with an installation consisting of one 20-horsepower and one 10-horsepower two-phase and five two-horsepower single-phase motors, which have been giving very satisfactory operating results.

The repair item is naturally one of considerable interest, and our experience leads us to believe that very few repairs are needed. The total cost of repairs on all alternating-current motors from the time of the first installation up to date being less than $1000; the total horsepower now installed is approximately 700.

As hereinbefore stated, all elevator work is operated by direct current. Polyphase equipment has been on the market several years, and we now understand that a successful single-phase elevator motor has been recently brought out. Should this outfit be all that is claimed, it will undoubtedly open quite a field for more business, particularly in such systems as ours, when the distribution for the most part is single-phase.

1. A paper read before the Ohio Electric Light Association at Put-in-Bay, Ohio, August 16, 1905. Mr. Beil is an electrical man of Youngstown, Ohio.

Electrical Apparatus for Chicago Drainage Canal Power Plant.

As announced in the Western Electrician of August 19th, the Sanitary District of Chicago is advertising for proposals for furnishing and installing materials for the Drainage Canal power plant at Lockport, Ill., and also for a transmission line extending to Chicago. The bids will be received until noon October 11th, and will cover an extensive line of apparatus such as switchboards, switches, transformers, lightning arresters, towers or poles, wire, etc. The following outline of the requirements is taken from the specifications issued by the chief engineer of the District, whose offices are at 1010 Security Building, Chicago:

A marble board is to be furnished, consisting of 14 panels, seven to be 19 inches wide and 88 inches high; two to be 32 inches wide and 58 inches long; three to be 32 inches wide and 38⅞ inches long and two to be 32 inches wide and 40 inches long.

The indicating instruments required are to be practically dead beat and guaranteed to be accurate within one-half of one per cent. throughout their entire range. The finish required is a dead black with polished brass trimmings lacquered to prevent tarnishing. The direct-current instruments must be of the shunt type and conform in size and appearance with the alternating-current instruments. The alternating-current instruments will be used on 6,600-volt three-phase 60-cycle current. All necessary series and potential transformers, with fuse blocks, must be furnished. Particular care must be used in the insulation of all transformers used in connection with indicating instruments.

All wires leaving the board must be terminated at a point six inches above the floor line and underneath the operating panel, at which point they must be properly connected to circuits from apparatus or devices such as series and potential transformers, remote-control switches and all other instruments which are to be located at other points.

Four transfer boards will be required, the marble panels to be two inches thick, 90 inches high and 63 inches wide, provided with barriers. Each panel must be provided with the following:

Three single-pole single-throw hook-type switches of 450-ampere capacity, 6,600 volts; three single-pole double-throw hook-type switches of 450-ampere capacity, 6,600 volts; three connecting bars between jaws of single and double-throw switches; three series transformers are to be mounted on the top of each panel.

The switches are to be used on 6,600 volts and must be provided with the necessary insulating bases, in addition to the marble panels.

The barriers required are between each switch, and between connections of wires of different phase on the back of the panels, eighteen electrically operated remote-controlled switches for the following purposes are also required: Eight three-pole switches for 4,000 kilowatts capacity at 44,000 volts, three-phase 60-cycle; three three-pole switches for 8,000 kilowatts capacity, at 44,000 volts three-phase 60-cycle; two double-pole switches for 350 kilowatts capacity at 250 volts direct current; four double-pole switches for 50 kilowatts capacity, at 250 volts direct current; one single-pole switch for 175 kilowatts capacity, at 250 volts direct current.

The rheostats required are to be used for the following purposes: Four for fields of 4,000-kilowatt alternating-current generators; two for fields of 350-kilowatt direct-current generators.

The total resistance required for each of the alternating-current generator field rheostats is 1.6 ohms in 50 divisions; maximum current in fields with all resistances cut out, 150 amperes; minimum current in fields with all resistances cut in, 78 amperes.

The resistance contained in the rheostats must be proportioned to regulate the current strength between 78 and 150 amperes in 50 equal steps; the total resistance required for each of the direct-current generator field rheostats being 25 ohms in 100 divisions.

The resistance used in these rheostats must be stable in character and capable of carrying the required current continuously without injurious heating. The change in temperature of the coils must not cause abnormal change in voltage after sections have been cut in or out. The segments or contact blocks, and all the other current-carrying or contact-making parts must be of ample size, and under the most severe operating conditions there must not be any injurious heating or sparking. The contact arm must be operated by a suitable reversible direct-current 250-volt motor controlled from the main switchboard operating panel.

The 44,000-volt bus-bar compartments are to be placed on the second gallery. They are to consist of two four-inch enameled brick walls three feet high and 142 feet long, intersected at frequent intervals with eight-inch cross walls 18 inches high, on which the necessary 44,000-volt insulators are to be mounted. The space between these two side walls is to be divided into three compartments by the placing of two barriers of soapstone 1½inches thick and 20 inches high, running lengthwise. The barriers are to be set in the brick cross walls 2¼ inches, and where the ends abut they are to be mortised one-half inch.

The bus-bars are to be a round section of copper with a carrying capacity of 450 amperes, provided with suitable lugs where connections are indicated. The bus-bars are divided into two equal sections, and at the points indicated must be connected into knife blades disconnecting switches.

The circuit compartments are to be placed parallel with the bus-bar compartment. The side walls are to be of white enameled brick four inches thick and 18 inches high. They will extend from the bus-bar compartment to the end of the building and up the end wall to the roof trusses. The vertical section may be made entirely of 1½-inch soapstone, which must be set 2¼ inches in the building wall.

The three 6,600-volt bus-bars are to be 119 feet long, composed of flat copper sections, with a carrying capacity of 1,200 amperes. They must be mounted on suitable insulators set in the brick wall provided therefor under another contract. The exciter bus-bars are to be 11 feet long and must be composed of flat copper sections with a carrying capacity of 1,200 amperes.

A system of conduits is required for running the various cables and wires within the power house. All conduit and fittings must comply with the specifications of the National Board of Underwriters, as published in its rules for 1904.

A complete system of wiring must be installed to light the building. Current for this purpose will be taken from the exciter bus-bars, the voltage being 250 volts. An approved form of compensator of 30-kilowatt capacity is to be furnished for dividing the current into two equal voltages of 125 volts, and the wiring is to be three-wire from the compensator.

Eleven ornamental enclosed arc lamps will be installed, these lamps to be provided with suitable resistance for use on 125-volt circuits.

Each alternating-current generator armature must be connected to a transfer board by two three-phase cables of 300,000 circular mils each. These cables must be of stranded copper insulated with an eight-thirty-seconds-inch wall of high-grade rubber compound, and each conductor tapped one-thirty-second inch. The fields of each alternating-current generator are required to be connected through a rheostat and remote-control switch to the exciter bus-bar with flexible cables of No. 000 B. & S. gauge.

Each direct-current generator must be connected through the circuit-breaker and main switch to bus-bars with two cables of 750,000 circular mils for each pole. The fields of these generators are to be connected through the rheostat to bus-bars with No. 6 B. & S. gauge stranded copper cables.

The primary side of each bank of transformers is to be connected through the series transformers to the top switches on the transfer boards with stranded copper cables of 600,000 circular mils, insulated with an eight-thirty-seconds-inch wall of high-grade rubber compound covered with one-sixteenth-inch braid. The secondary sides of the transformers will be connected through the two oil circuit-breaker switches in series, to the 44,000-volt bus-bars on the second gallery, with stranded copper cables of No. 0000 B. & S. gauge.

Twelve step-up transformers, oil and water-cooled type, set in banks of three, are required. Each bank of three transformers must have a capacity of 4,000 kilowatts and operate safely under an overload of 25 per cent. The primary coils are to be wound for 6,600 volts, the secondary coils for 44,000 volts, frequency 60 cycles. The windings of primary and secondary coils must be divided in suitable sections, carefully insulated from each other to minimize danger of breaking down in the coils. The arrangement of coils is to be such that damaged sections may be readily replaced.

As two transformations are to be made under a power factor of about 85 at full load, particular attention must be given to regulation in these transformers, and the proposal must state the regulation, efficiency and heating limits guaranteed under 50 per cent., 75 per cent. and full load, assuming power factors of 85, 90 and 100.

Twelve step-down transformers of the same type and capacity form a part of the installation, and must comply with all the details required for step-up transformers. These are required for installation at the sub-station located at the city limits. The primary coils of these transformers will be wound for 40,000 volts and taps brought out for secondary voltages of 6,600, 9,000 and 11,000 volts, and if construction will permit additional taps, for a five per cent. variation from these voltages.

Lightning arresters will be needed for each end of two three-phase 60-cycle 44,000-volt circuits, each circuit normally transmitting 8,000 kilowatts over a distance of 30 miles. Each arrester must be provided with a hook-type knife switch for the purpose of disconnecting arrester from the circuits for examination and repairs.

The transmission lines will consist of two three-phase circuits of No. 000 B. & S. gauge stranded copper conductors or their equivalent in aluminum conductors, and will extend from the power house along the canal to the city limits, a distance of about 30 miles. Proposals will be received on both steel towers and steel poles. If towers are used, each tower must be 55 feet high and not more than 12 feet in width at the base. They must be constructed of substantial steel angle bars bolted together and latticed, braced with angle bars of requisite strength. The taper at the top must be designed for two cross-arms, one carrying four wires and one two wires. These wires will be placed in two equilateral triangles with a spacing of 72 inches between wires. The cross-arms are to be so placed that the lower wires will be at least 47 feet from the ground, each tower being provided with a suitable ladder. The construction of these towers must be such that they will withstand the strains caused by the breaking of any two wires on one side of a cross-arm. The strain thus caused will approximate 2,000 pounds for each wire, in addition to the ordinary wind strains on structure and remaining wires.

In case steel poles are used each must be 60 feet high and not more than 48 inches in diameter at the base. They may be constructed of tubular steel in sections or built up of structural or special steel members properly proportioned and braced. Approximately 180 miles of No. 000 B. & S. gauge bare stranded medium hard-drawn copper or stranded aluminum cable of equal conductivity will be required for the construction of the line. To carry these nearly 4,000 wire insulators will be required. These must be made of a high grade of porcelain, free from seams, flaws, or cracks, and carefully glazed, each insulator to be constructed of at least three separate pieces cemented together in an approved manner. The separate parts of the insulator are to be subjected to a test of 50,000 volts, and after the insulators have been assembled they must be subjected to the following test:

The top of the insulator must be immersed in water forming one pole and the pin space of the insulator filled with water forming the other pole. A potential of 100,000 volts must then be applied for a period of five minutes. The capacity of the testing set must be at least 200 kilowatts, and the voltage of the generator maintained within 10 per cent. of its rated voltage. The submitted design of insulator must withstand a precipitation test of one inch in five minutes at an angle of 45 degrees, with an impressed voltage of 90,000 volts. The insulators must be suitable for use on 50,000-volt circuits and must be capable of withstanding this pressure under ordinary climatic conditions and changes of temperature in Chicago and vicinity.

The traveling crane for which bids will be received is for the power house, and is to have a capacity of 40 tons, the motors to be of the enclosed slow-speed multipolar type, wound for 250 volts.

Grounding the Neutral.

[From Question Box of National Electric Light Association.]

QUESTION.

What objections are there to grounding the neutral of a four-wire, three-phase system outside the station and relying upon these ground wires on neutral instead of lightning arresters? This refers to systems operating with neutral grounded in station.

ANSWERS.

E. W. Gough, Great Barrington, Mass.: Grounding the neutral of the three-phase system permanently increases the danger in handling the high-tension lines, and, acting in place of the lightning arresters that would be normally placed on the phases, increases the risk of a discharge through some of the apparatus connected to the neutral; assuming, of course, that the three-phase wires are insulated from the ground.

R. G. Radley, Milwaukee Electric Railway and Light Company: If the grounds are made to a railway track direct current will flow over the alternating-current neutral and phase wires, and this may cause fictitious indications in series ammeters at the station—those not used with current transformers. Should C. R. type of feeder regulators be in use on these feeders, this direct current may hold the arc from one clip to the next, short-circuiting a coil and burning the contacts.

W. H. C.: When outer wires receive static charges they are relieved only by discharging through transformers or generators, endangering apparatus. The proper way is to install a series of gaps from each outer to common wire and ground common wire at each place where this is done.

Paul F. Williams, Chicago Edison Company: After a system has been operated with neutral grounded in the station it will be found to be grounded outside also, due to no attempt being made to keep it clear of grounds. Hence conditions will not be changed by intentionally grounding it outside. The advantages gained by grounding a neutral at each lightning-arrester installation are as follows:

Renders placing of arresters on a neutral unnecessary, thereby reducing arrester investment and maintenance cost.

Partial protection against gradual accumulation of high charge on phase wires, by allowing a path for discharge from phase wire through primary of transformer to grounded neutral. The ground on neutral should not be depended upon entirely

as protection, but arrester should be placed on phase wires.

E. J. Bechtel, Toledo Railways and Light Company, Toledo, Ohio: We see no objection to grounding the neutral of a four-wire three-phase system at the station only, but if grounded at different points in a street-railway district, the return currents of a street railway are apt to be annoying. Lightning arresters should be used with this method.

The Edison Electric Illuminating Company of Brockton, Mass.: Grounds should not be relied upon as lightning arresters, because they would require that the discharge, in order to reach the ground, pass through some of the translating devices on the lines. There is no objection, however, to using some of the neutral grounds for the purpose of grounding lightning arresters on the outside wires.

Resuscitation from Electric Shock.[1]

By E. E. Noble.

Many interesting and instructive papers have been written and presented to conventions from time to time by physicians and surgeons on the subject of "First Aid to the Injured." Their instructions as to what to do in casualty cases have for the most part been complete, but they have in a general way only touched on the subject of "Resuscitation from Electric Shock." They have probably gone as far into this branch of the subject as their knowledge of the effect of electrical injuries and the working conditions of men engaged in electrical lines would permit. As a matter of fact, however, slight attention has been paid to this particular subject, and comparatively few of the medical profession have made its treatment the subject of as close study as other forms of injuries. This may be due, however, to the difficulty in obtaining actual data. Casualties are a very serious drain upon the treasuries of light and power companies employing a large number of men, and are a source of deep regret to those in charge of the electrical work. Any means which can be found to prevent fatalities in case of accident will not only be welcomed from a humane standpoint but will be a great benefit to the companies and men engaged in work necessitating the handling of high-tension wires. Injuries to men engaged in this class of work are, in the majority of cases in my experience, the result of a more or less severe electric shock. In many cases this is the direct result of the carelessness or neglect of the employe himself or of a fellow employe, and because of a lack of familiarity with the proper restorative measures on the part of those who are present or who are called upon to render first aid, the electric shock probably causes directly or indirectly more fatal cases than any other form of injury sustained by men in this line of work.

It was my good fortune last year to witness a series of experiments, the results of which should be of material benefit to men engaged in electrical work, and which should be of interest to members of this association. The experiments were conducted by Dr. George W. Crile, a prominent surgeon of Cleveland, who has interested himself very deeply in this subject for some time past, and Dr. J. J. R. McLeod of Western Reserve University of Cleveland. These experiments were conducted with a view to further strengthening the theory of the probable cause of death from electric shock and to determine if possible the practicability of resuscitating persons injured in this manner. There has been until a comparatively recent date some diversity of opinion even among the surgeons as to the cause of death from electric shock. It would seem, however, from the experiments referred to and from other experiments that death from electric shock occurs from the effect of the electric current upon the heart, the circulatory system and the respiratory system. There seems to be a marked difference in the susceptibility of different persons to electric shock and the physical condition of the person receiving the shock has apparently a great deal to do with its fatal effect. For instance, a case is recalled of a lineman who received a shock through both hands at a pressure of about 1,000 volts which was so severe as to permanently injure both hands, necessitating amputation of several fingers. This shock was not fatal, as the man was apparently in excellent physical condition at the time he received it.

As an illustration of the other extreme, cases are recalled of men who have received what are considered very light shocks at pressures varying from normal lighting pressure up to 500 volts, and which have proved fatal.

Drs. Crile and McLeod conclude that death from the passage of a heavy current through the body is due to either temporary stoppage of the heart or "inhibition" as it is termed by medical men, or to immediate action on the heart, causing what is called fibrillary contraction of the ventricles, or, in other words, contraction of the muscular fibers of the heart, whose function it is to force the blood to the general circulating system and the lungs. There is also a fall of the arterial blood pressure. The blood pressure is the tension exerted by the blood upon the walls of the vessels under the influence of the heart's action, and may be likened to water pressure in a pipe line. Dr. Crile has made very extensive researches into the question of blood pressure in surgery and has found that blood pressure may be raised by the use of a saline solution containing a certain proportion of adrenalin, which is a drug obtained from what is known as the supra-renal gland, generally of the sheep.

In the course of the experiments previously referred to, several points were brought out which are interesting when considered in connection with practical work on high-tension lines. It was shown that an important factor in a fatal electric shock is the action of the current upon the heart itself, and that unless a relatively large part of the current passing through the body traverses the heart the shock will not necessarily prove fatal. It was further shown by the results of the experiments that it is the amount of the current passing through the body rather than the voltage to which death is due. It was also demonstrated that by the prompt application of artificial respiration, respiration could in some cases be re-established. Especial examination of the blood showed that electric currents up to 2,300 volts caused no chemical or other changes in the blood itself, and animals whose blood was subjected to this test and which were allowed to live showed no later effects. Neither does the current cause any change in the tissue of the brain, spinal cord or other nerve structures, as the animals subjected to this voltage and allowed to live showed no depreciation in function. For example, current at a pressure of 2,300 volts was passed through the brain of a dog, laterally and vertically, over a period of one minute. The dog was then resuscitated from the immediate inhibition or temporary suspension of animation and allowed to live. No after effects were noticed.

The conclusions which may be drawn from these experiments are interesting. It will be noted that there is no destruction of tissue as has been generally supposed, except where burns occur at the points of contact. From the fact that to cause death it is necessary for a certain amount of current to pass through the heart it will be seen that the position of the points of contact constitutes a very important factor in a fatal electric shock. For instance, in receiving a shock the current may pass through the body from the left arm to the left foot, in which case a large proportion of the current would go through the heart, and the shock would be very apt to prove fatal, depending largely upon the resistance of the contact. On the other hand, a shock in which the current passes from the hand to the head or from the knee to the foot, is not apt to prove fatal for the reason that the current does not pass through the heart.

Owing to the fact that it is the amount of current rather than the voltage that causes death, it will be seen that the resistance of the points of contact will also play a very important part in the fatal effect of the shock. For instance, a man may receive a shock from the tips of the fingers of one hand and through the body to the ground, or through his coat sleeve or some portion of his clothing if it is at all damp, allowing only a small amount of current to pass through the body.

A shock of this kind will not often prove fatal, even if the heart does lie in the path of the current, if the patient is properly cared for after it has occurred. On the other hand, a man may firmly grasp a live wire while standing upon the ground, or he may lose his balance while working upon a pole and receive a shock, perhaps in itself only a slight one, and may become unconscious and fall against the wires, which will, owing to the fact that he is unable to extricate himself, burn into the flesh, allowing a large amount of current to pass through the body. A shock of this character will in many cases prove fatal, depending of course on the position of the points of contact and the relative amount of current which passes through the heart.

The result of these experiments cannot help but be of benefit to men who are obliged to handle wires carrying high voltages. In order that full benefit may be derived from them, it would seem a good idea to map out a systematic plan of action to be followed in all cases of electrical injury. The workmen should be educated and trained in "first aid to those injured through contact with live wires." Many of the men employed in electrical lines are already familiar with the artificial respiration method of resuscitation from electric shock. This is not carrying the education far enough. Every man in this class of work should be plainly told just what he is expected to do in case of accident. Each man should be familiar with the general plan to be followed in these cases and should be familiar with the locations of the different hospitals, and which, if any, are best equipped to take care of such cases. The men should be trained in detail as to what method to pursue in taking care of an injured person until the arrival of an ambulance or medical aid.

The following method of resuscitation is suggested by Dr. Crile: "Place the patient at once upon his back with the head turned on one side; place one hand upon each side of the chest over the heart; then exert rhythmic or regular pressure at the rate of approximately 40 to 60 times per minute, so as to press air out from the lungs and cause the heart to empty itself; with each pressure upon the movable ribs air is forced out of the lungs and blood is forced out of the heart. With the recoil of the chest walls air is taken into the lungs and blood into the heart. In this manner both artificial respiration and artificial circulation may be obtained, sometimes leading to immediate restoration of the normal functions of the heart and the respiration. This treatment should be begun at the earliest possible moment after the accident, and should be continued not less than 30 minutes. If it is a case of inhibition, that is to say, if the heart has been temporarily stopped by nerve influence, and the amount of current which has passed through the heart has not been sufficient to cause fibrillary contractions, the chances for recovery in most cases should be very good." While this is being done an ambulance should be summoned and the proper officials of the company notified, but this should not interfere in the least with the work on the patient. On the arrival of the ambulance one man should be detailed to go with it and continue treatment up to the minute the patient is given into the hands of the hospital authorities.

One thing supremely important must be borne in mind, and that is promptness in applying restorative measures. As an illustration of the value of promptness in these cases, a case is recalled of a man who received a comparatively light shock, resulting in unconsciousness. After a period of about 20 minutes had elapsed after the shock the patient opened his eyes for a moment and moved slightly, and closed his eyes again, after which it was impossible to revive him. There is good reason to believe that if restorative measures had been promptly applied in this case death would not have resulted. It has been previously stated that death is due in these cases to either inhibition of the heart due to nerve influence, in which resuscitation is possible, or to fibrillary contraction, in which case resuscitation is not possible.

As it can only be determined by direct examination of the heart whether or not fibrillary contraction has taken place, and as it will be readily seen that this is impossible in casualty cases and can only be done by a surgeon, it must be strongly emphasized that there can be absolutely no distinction in the treatment of these cases, and every case must be treated as though it were merely a temporary suspension of animation.

In these cases another point of extreme importance should be borne in mind. That is, do not cease work upon a patient unconscious from electric shock until every known means for his resuscitation have been made use of. Surgeons who have made this a study tell us that men have been revived after several hours' labor, and in view of this fact it is little short of criminal not to use every means to bring the patient back to consciousness, or perhaps properly speaking, back to life. There is one other point in connection with the experiments previously mentioned that may ultimately prove of deep interest to the men engaged in electrical work. The fact was brought out as stated, that death does not necessarily follow an electric shock unless a certain amount of current passes through the heart. From this it will be readily seen that if some method can be devised for diverting the greater portion of the current around the heart the number of deaths from electric shock will be greatly lessened, perhaps almost eliminated.

It is possible that this may be accomplished by means of a light metallic gauze jacket to be worn next the skin, or by a system of metallic bracelets worn around the upper arms and connected by means of flexible conductors to a belt of some similar material worn around the waist or some part of the body below the heart.

From observations made in the course of the experiments it is estimated that in the neighborhood of 85 per cent. of the total amount of current passing through the body can be shunted around the heart by means of a device of this nature. It would probably not be an easy matter to bring such a piece of apparatus into general use among electrical workers, and especially linemen. The chances are that they would be more or less skeptical as to its efficiency. At the same time it is probably worth a trial as an experiment, and Dr. Crile and others are at present giving this matter a great deal of attention. The safety of the men who have to handle wires carrying high voltages should, in the interests of humanity, receive careful consideration, and if by following some such plan as that outlined in this paper the number of casualties can be reduced, or if a life can be saved that might otherwise have been lost, we may feel that we have at least tried to do our duty.

1. A paper read before the Ohio Electric Light Association at Put-in-Bay, Ohio, August 18, 1905.

A number of New York men are interesting themselves in a large power plant, estimated to cost $10,000,000, which is to be built on the Susquehanna River, near York, Pa. William Barclay Parsons is chairman of the engineering board, and Carey T. Hutchison is in charge of the construction work. It is planned to transmit the electrical power generated at the new station, not only to nearby towns, but also to Philadelphia and Baltimore.

Westinghouse Exhibit at the Lewis and Clark Exposition.

The development of apparatus for the generation, distribution, control and application of electrical power has been so rapid that engineers, station managers, power users and the engineering public in general have been compelled to keep constantly in touch with the electrical field in order to remain abreast of the times. The latest and most improved products in every line of industry may always be seen at expositions and fairs, which are great educational factors. At the Lewis and Clark Exposition, Portland, Ore., in the building devoted to machinery, electricity and transportation, the Westinghouse Electric and Manufacturing Company occupies 1,500 square feet of floor space. This section is devoted to the display of many kinds of generators, motors, controllers and instruments of every description. The accompanying illustrations give a good idea of the appearance of the exhibit.

Starting in at the main entrance to the exhibit, attention is attracted by the most prominent and most interesting feature of the display, a 400-kilowatt Westinghouse-Parsons turbo-generator unit. To the left is a showcase containing all the standard types of portable instruments, and just behind this is an electrically operated distant-control automatic oil circuit-breaker, designed to open a 200-ampere 33,000-volt circuit.

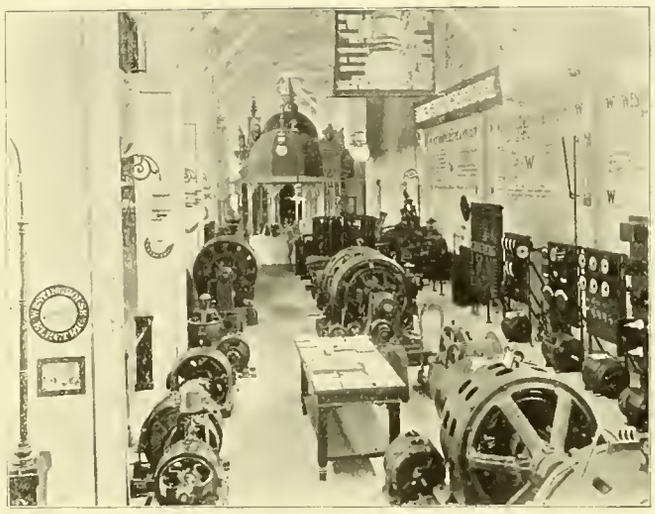
Passing on down the aisle a No. 92 50-horsepower direct-current and a No. 107 75-horsepower alternating-current series railway motor are seen, and a switch group of the multiple-control system. To the right is a group of type S motors, including a vertical type machine, a 25-kilowatt rotary converter and a two-kilowatt type S generator direct-connected to an Ohmen high-speed engine manufactured by the Ohmen Engine Works of San Francisco, Cal. Across the aisle is a motor-generator set consisting of a 150-horsepower induction motor and a 100-kilowatt direct-current engine-type generator, and in immediate succession are a group of type R direct-current motors, one-sixth to one horsepower, a 120-kilowatt revolving-field self-contained alternating-current generator and a 100-horsepower type HF induction motor. At the extreme rear the Sanitary Devices Manufacturing Company displays, in conjunction with this exhibit, an automatic dust-removing plant driven by a type-S motor.

In the rear section are some distinctive types of Westinghouse transformers, including a 110-kilowatt air-blast transformer, a number of type OD, type N, manhole type, etc. Five OD transformers, ranging from 7½ to 25 kilowatts, are mounted on the wall.

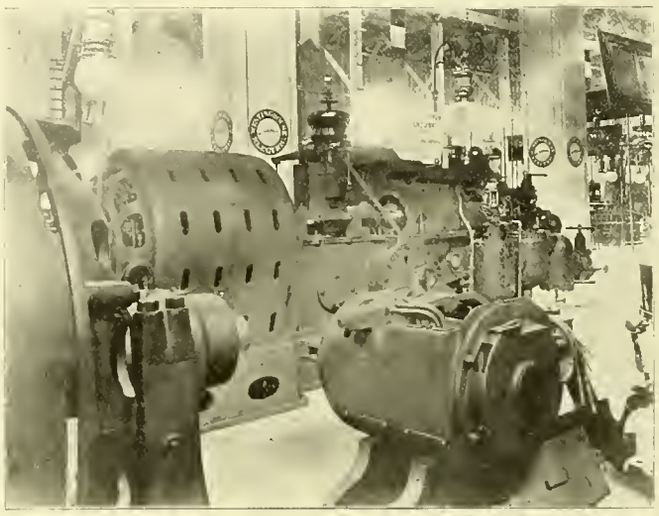
On turning to the left and walking toward the main entrance may be seen a group of induction motors, types H and CCL, for constant-speed work, and types F and C, for variable-speed service. A line of special motors, both alternating-current and direct-current, for crane service, is also shown. Standard switchboard instruments, comprising voltmeters, wattmeters, ammeters, power-factor meters, etc., are arranged on display boards against the wall.

In the controller section are found an oil-immersed auto-starter for use with the CCL motors, a rheostatic controller for the type HF motor, an elevator controller used with type F motors, an automatic pump controller and finally a three-wire double-voltage controller for use with direct-current motors in machine-tool drive. Near the center of the exhibit is a rope hoist manufactured by the Denver Electric Company, to which is connected a No. 103A type F induction motor. Various classes of fuses artistically arranged on a board, a double-throw oil switch, a static interrupter, choke coil and lightning arresters complete the display.

The exhibit is illuminated by two large "Westinghouse" display signs, and by series-multiple arc lamps suspended from artistic gooseneck posts. It might be mentioned in this connection that the entire building is lighted by lamps of similar pattern.



General View of Exhibit.



Turbo-generator Unit.

WESTINGHOUSE EXHIBIT AT LEWIS AND CLARK EXPOSITION.

Line Construction.[1]

By B. L. Chase.

One of the most important factors of an electric-light or power system is the line construction, for upon it depends the continuity of service, without which even the most perfectly equipped stations would be commercially useless.

In most cases the customer who uses electric power for small motors (which constitute a large part of the business of electric-light and power companies) does not know the efficiency of his motor nor care. But should the service occasionally fail, while repairs are being effected on outside lines, the electric motor, as far as he is concerned, is a failure, and representations of cheap power would do little toward satisfying him, as a single stoppage might mean more loss to him than his entire power bill for a month.

Modern generating plants are, as a rule, efficient and reliable, the lines being the weakest link in the system, particularly those of great length.

The first consideration in building a pole line is the question of location, as a rule a difficult proposition in itself, for in most cities so many corporations maintain overhead lines as to make it a nice question, from an operative and commercial viewpoint, which route could best serve the territory in view.

The probable opposition of property owners also must be considered and overcome, as this sometimes causes much delay and financial loss. Direct lines are of course the best, but are not always practicable, for in city construction many obstacles must be surmounted, such as the lines of competing companies, telegraph, telephone and fire-alarm lines, trees, and instances where high-voltage lines might come too close to buildings and endanger life. All of these conditions must be considered in the location and constructional features.

In laying out a line the poles should be located on lot lines where possible, for you will find some property owners who always have a kick coming, and in most cases of this kind if the pole is set on the lot line you can with very little expense move it a few inches and satisfy them.

The future should also be taken into account; poles should be located on the corners of intersecting streets, as such placing will simplify and cheapen the construction of lines on these cross streets when such are necessary. The writer has encountered much trouble in the rebuilding of old lines through the failure to observe this detail in the original installation.

In order to secure freedom from interruption, high-tension lines should be constructed above all telephone, telegraph and other wires for service of a similar character, for these conductors being small and easily broken down by wind or sleet will cause unending trouble to both companies and be a constant menace to life and property.

An accident of this nature came under the observation of the writer some few months ago. A broken telephone wire which had fallen across a 4,500-volt line at a point five or six miles from the power station was lying across a fence. An Italian in attempting to remove the wire from his path was instantly killed, and his companion also killed while trying to render assistance. In this case the telephone company settled with the families for $1,250 each.

High-voltage lines constructed underneath telephone, telegraph and other wires also endanger the lives of employes of these companies, whose work necessitates their constant exposure to danger, by climbing between high-tension wires. Telephone linemen do not as a rule realize the importance of keeping entirely clear of the high-voltage circuits, as their work is such that all wires may be handled without personal discomfort.

As an illustration of this condition a few weeks ago a gang of linemen employed by a long-distance telephone company was stringing a pair of wires over a high-tension lead. They had pulled in but a few spans when they let the wires slack down across the high-tension line, burning it off and also the telephone line in several places, but fortunately causing no deaths.

Considering the enormous number of telephone and telegraph wires and the constant work of maintaining them, it can be seen that it is imperative that the high-tension lines be placed above and entirely clear of all other wires. High-tension wires are several times larger, and being stronger are less liable to accident from natural causes, and the pole fixtures being much heavier and of more substantial construction are practically immune from accident.

A good road along a pole line is very desirable, and the route selected should be as free from obstruction as possible, and trees carefully trimmed, as even the small limbs will be the cause of much trouble.

Wood poles are the most desirable for high-voltage transmission, iron poles affording more chance for troublesome and dangerous grounds, and subjecting workmen to extreme danger from the same cause. Iron poles, however, have demonstrated their utility for low-voltage and railway work and are more sightly in such cases where it becomes necessary to place them at close intervals.

Michigan and Idaho cedar poles are most commonly used in this state, Idaho largely taking the place of Michigan cedar in long poles, owing to the difficulty of obtaining Michigan poles which come within specifications. The Idaho cedars are generally straight and smooth, and often of nearly the same size from end to end, and less opposition is met from property owners when such are used. Michigan poles generally have large butts and crooks, a feature most objectionable to some property owners, but who would be perfectly satisfied if a nice straight pole had been set.

For power transmission the poles should be both long and strong, in order to carry the circuit above all others and to stand the stress of heavy winds and sleet storms. All poles should be shaved, painted and gained before being erected, as the cost of labor in doing this work will be double after the pole is set on end.

For ordinary work, poles should be set 120 feet apart, or 44 to the mile, but local conditions will govern, especially in cities. The setting should be carefully done, and the poles kept as nearly in line as possible. Too much care cannot be taken in tamping, as a poorly tamped pole will be out of line after the first windstorm, and to straighten up means unnecessary expense, and if left in that condition speaks but ill of the man who had charge of the work.

Hard yellow pine serves best for cross-arms, and for ordinary construction will give good results,

1. A paper read before the Ohio Electric Light Association at Put-in-Bay, Ohio, August 18, 1905. The author is superintendent of line construction for the Columbus (Ohio) Railway and Light Company.

but for heavy corners and junction poles, where the strain is great, oak arms should be used. Machine bolts, five-eighths or three-fourths inch in diameter, passing through both arm and pole, with a large washer under both head and nut, will be found the best for holding the arm securely in the gain. This method makes a cleaner and safer job than fastening the arm with lag screws, and permits repairs and changes to be made much easier. Lag screws are cheaper, however, and are sometimes used in ordinary construction, but should be avoided in heavy work.

For high-tension lines, the cross-arms should all be double, and a block securely bolted between the arms about eight inches from the end, will materially add to their strength. The initial cost of this mode of construction will be somewhat higher, but will be cheaper in the long run. It practically prevents a wire from coming in contact with the arm through breakage of a pin or insulator, and the resultant effects (probably burning off of the cross-arm and allowing the wire to fall to the street or upon other wires strung below).

Poles at angles should always be guyed at a point as near in line with the strain as possible. A very light pole properly guyed will withstand heavy strains, without distress, which would otherwise require the erection of a heavier pole.

In all cases great care should be exercised to keep guys clear of all other wires and strain insulators should be cut in about six feet from the pole, which will assure a greater degree of safety to employes who work among the high-tension wires and the guy wires with which they might come in contact accidentally. Guying to trees is a very bad practice, for you do not know what minute they will blow down and cause you trouble that would cost more than 10 times the cost of a guy stub in the first place.

The most dangerous strains on overhead lines come from sleet storms, ice sometimes covering the wires to a depth of an inch. Under these conditions the insulators and pins become the weakest points, and precautions should be taken in your construction to guard against such strains. A three-eighths-inch carriage bolt through the pin lengthwise will insure against a failure under almost any conditions, and will be found to be a cheap method of reinforcement. Other means for the prevention of accidents should be installed, such as iron guard wires at angles to keep wires from slipping off the arm, should a pin or insulator break.

Several head guys at corners or at the end of the line, will relieve the strain and will, in case of accident to these poles, save several poles from being broken.

It is the belief of the writer that only in a case of emergency work should be done on circuits of this nature, while current is on the line, for it is extremely hazardous at best, and the method to be preferred is to complete all arrangements and cut the current off only long enough to make actual connections.

The different circuits should be so arranged that sections can be cut out by means of oil switches on poles, so that in no case would it be necessary to deprive a large number of customers of current. This system has proven very satisfactory, as it is comparatively seldom that the current is cut off, and an explanation of the danger incurred by the linemen is generally satisfactory to any user of current who makes complaint. It is customary to do such work at a time when it will least interfere with the larger number of users of current, and only after notifying them, and considering their suggestions as to time.

The alternative, i. e., to carry current at all times, may result in serious and generally in fatal accidents, a number of which have occurred in the city where the writer is employed, through lack of observance of above suggestion. And the liability in such instances would more than offset the objection to an occasional deprivation of current.

A word might be said in regard to lightning arresters. These are generally placed at intervals of about a mile, and seem to afford protection to transformers, as it is but seldom that one is damaged. It is different with the arresters themselves, however, as several of these are lost in every storm; many different types are in use, with but slight variation in results.

The line proposition resolves itself down to a careful study of all contingencies, the installation of good material, thorough workmanship, rigid inspection and proper maintenance of every detail, as it is only by constant attention to these that the required service may be obtained.

League of American Municipalities.

The League of American Municipalities closed its annual convention in Toledo, Ohio, on August 25th, after a three-day session. Engineering and financial problems affecting municipalities were discussed. It was declared that it is better to control private ownership than for the city to either own or occupy its public utilities. The next convention will be held in Chicago. The officers elected are: President, R. G. Rhett, mayor of Charleston, S. C.; secretary, John MacVicar, Des Moines; treasurer, William D. Morgan, Georgetown, S. C.

Inquiry Into Telephone Systems by Select Committee of Canada.

[*Continued from last week.*]

F. A. Pickernell of Newton, Mass., assistant to the president of the American Telephone and Telegraph Company, was an interesting witness before the committee. Mr. Pickernell stated that he had been in the telephone business all his life. From the Institute of Technology in Boston, where he graduated in 1885, he went to the American Bell Telephone Company, and in 1887 went to the American Telephone and Telegraph Company as electrician, and has since been with the company. Mr. Pickernell was before the committee twice and many questions were put to him. He stated that the company he represented was the largest telephone company in the world, and in answer to a question, stated that throughout the world rates for telephone service are always much higher in large cities than in small cities. Being asked to explain this Mr. Pickernell said:

If it is to be taken up in detail it would occupy days of the time of this committee, and I suppose the committee is aware that that question has been discussed before very many tribunals. But some of the important points may be of interest and can be referred to without taking too much time. Let us consider a telephone exchange in a small place, a town may be of 1,500 or 2,500 inhabitants. The central-office equipment is small. The number of people to be served with telephones being small, the switchboard requires a little space. Being made up of simple units it does not cost a great deal of money. In manning the exchange few employes are required at the central office, each operator being able herself to perform all the labor of establishing any particular connection. There being relatively few people for any particular subscriber to talk to, he will not make as many calls in 24 hours as he would if he was connected with a large system. It easily happens in the small exchanges that we are now considering that one operator may handle as many as 150 or 200 subscribers. I said that the central-office equipment was simple. It is simple because it is very easy to associate the different units so that one operator may easily controll all. Moreover, in the small town the area is limited; the lines are short in length. We find in a small town of the kind we are now discussing very frequently that the amount of wire required for serving each subscriber may not average more than say half a mile. That is if you take the total amount of wire in any particular town of this kind and divide it by the number of subscribers you may find that perhaps not more than half a mile of wire is required for each subscriber. The methods of construction are simple. The engineering problem is simple, and the necessity for underground systems of distribution does not exist. In that small town the number of wires on any particular route and in any particular network is relatively few. When a telephone gets out of order it is simple for a man to locate the trouble and correct it. In this way we find the cost of giving the service is relatively small. The plant investment is similarly very small. Now, if you step into one of the larger places, a place covering a considerable area, containing several offices, the density of the population being so great and the area so great that it becomes impossible and too costly to serve more than a small proportion of the total number of people from one office, you find every element not only of cost of installation, but also in the cost of operation and maintenance enormously increased. Our switchboards have become much more complicated. Instead of so organizing the apparatus that a few hundred units only have to be put under the control of a single employe, we have in each office to organize thousands of units, hundreds of thousands in the aggregate, so organized that each operator may have access to all. The effect of that is to increase the cost enormously of the central-office equipment. Now, inasmuch as we have established, and necessarily established, several offices in place of one, one operator can no longer herself unaided complete the connection for any particular subscriber. A subscriber calls the central office and wants to talk to another subscriber located in one of the other offices. In this case you now have to use the operator in the first office and a second operator in the other office.

A few of the questions put to Mr. Pickernell and his answers are as follows:

Q. What would be the difference in the cost of the switchboard in Montreal and the cost of the switchboard in a town of 5,000 inhabitants? A. The switchboard in the town of 5,000 inhabitants can be set up and installed, complete and ready for service, for between $9 and $10 a line. That is giving a modern common-battery service. In a city like Montreal, giving the same, which is the highest grade of service—it is the kind of service Montreal is getting ready at this time to put in and the kind of service they have had in Ottawa for some years—the switchboard and central-office equipment alone will cost between $18 and $20 a line. The figures I am giving you, gentlemen, are the figures that apply in the United States. I am not familiar with the details of the cost in Canada.

Q. In the smaller exchanges, with 100 telephones, we will say, what would be the percentage of the cost of the switchboard per subscriber? A. In little towns of the kind you speak of with a magneto service, a switchboard for 100 wires usually costs about $450 to $500, $4 to $5 a line. In the smaller towns I have seen many first-class exchanges built for $50 a subscriber. In a town like Montreal the cost will probably be at least $150 a station. That is the plant cost.

Q. Has the company which you represent anything to do with country service? A. Yes, sir, a great deal. We have hundreds of thousands of telephones in the country, service for farmers.

Q. What is your average cost per subscriber to the farmers? A. With the bulk of the farmers, you must understand, in the States, the lines are owned by the farmers themselves. They build the lines from the farm to the exchange, and there they make arrangements with the telephone company for switching them. The telephone company in the vast preponderance of the cases does not own the farmers' lines at all. It is only in some very densely settled sections that the telephone company builds farmers' lines and owns, maintains and operates them.

Q. Have you a switchboard in connection with the farmers? A. We have facilities at our switchboard for handling the traffic from the farmers' lines in all instances.

Q. Have you any automatic switchboards? A. Yes, sir; there are quite a number of them in different places through the States installed in an experimental way. I saw one a few weeks ago not far from St. Louis, in some small town, and there is another experimental one in Massachusetts, two in fact, I think.

Q. Is it just in the experimental stage? A. It is really in the experimental stage. If you went to the World's Fair at St. Louis you might have seen one on exhibition there. We have a number in use, working only fairly well. We cannot as yet state definitely that they are going to be a permanent part of our telephone system.

Q. Have you had any experience, and if so, what experience, have you had in connecting different telephone companies together? A. While engineer of the American Telephone and Telegraph Company I was also consulting engineer for several local telephone companies, large properties, but what we call local companies, that is, companies operating over certain restricted areas. The American Telephone and Telegraph Company has constructed long toll lines connecting various local telephone companies together. The toll line, for example, between Boston and New York, between New York and Chicago, between Chicago and New Orleans, between Omaha and Boston, and between Boston and Jacksonville, Fla. These long lines are owned and operated by the American Telephone and Telegraph Company. By means of these toll lines we make physical connections with local friendly companies; they are mostly controlled by our company at all the different terminals. For example, the connection between New York and Chicago; the through line is owned by the American Telephone and Telegraph Company, which makes physical connection at New York with the terminals and the toll lines of the New York Telephone Company, and at Chicago it makes physical connection with the terminals and the toll lines of the Chicago Telephone Company. In other words, the operating department of the American Telephone and Telegraph Company has been engaged continuously now for 20 years in working out methods of connecting physically the various telephone properties.

Q. Do they not connect with Independent companies at all? A. With none whatever.

Q. But there is no difficulty in the way of connecting with Independent companies, is there; no physical difficulties? A. I think we would find enormous physical difficulties.

Q. Describe some of the difficulties which you have encountered in your experience in giving this physical connection. A. Of course, the most troublesome part of the telephone business, from an operating standpoint, for 20 years has been in working out methods for handling these physical connections. In the first place, primarily, before you can do anything, you have to work out the business end of it. You have to have the interests of the people to be connected together, mutually satisfactory. These arrangements have to be of such a character that both companies can make money out of them; then for the purpose of having the staff to operate it efficiently it is of very great importance that the two plants that are to be physically connected shall be of substantially the same character. That does not mean that their detail must be alike, but alike on broad lines. So far as general principles go, they must be substantially of the same nature. We must have our terminals and apparatus of substantially the same character. Take the telephones and transmitters. From a purely local standpoint they might at one terminal use instruments that would be reasonably satisfactory for local service, but if you are making connections to them with a man 200 miles away they might not be satisfactory. The local man who has this instrument does not lose anything, but we who haul the business over 200 miles of

wire not only lose the revenue which we should obtain because of the inability to talk through to other instruments, but we incur the expense of trying to establish the connection and get blamed for the inadequate service.

Q. That is merely a matter of standardizing the system, is it not? A. It is largely a matter of standardizing, largely so. But even with standard instruments at each end, we require to have co-operation to work together. In working out this physical connection we have to work out the operating feature.

Q. Is not another condition that the plant will be well maintained, and if so, what do you mean by that? A. On this question of maintenance of plant, I take the position that the maintenance of the plants should be somewhere near a parity. It is one of the most difficult things we have had to encounter in working out physical connection between a variety of companies. You take, for example, a company that is operating may be, a small exchange located in a rural section. Perhaps one-half of the subscribers of that exchange may be farmers, and the farmers may own the lines themselves, and it may be a part of the arrangement that they keep the lines in repair. As a rule these lines are not maintained as well as it is necessary to insure good service. Supposing we make a connection to a station of that kind with one of our toll lines, we have on the one side a plant improperly maintained with the wires out of order, and they may remain out of order for one or two days. The transmission at best may not be as good as it should be. We haul into that station a message from a point 200 miles away and we find that the line is out of order; that thing happens perhaps a dozen times a day, and our long and expensive line has been used and no revenue derived from it because the connecting line is out of order. This is a matter about which it is very difficult to get reasonable uniformity. We cannot expect complete uniformity, but we must get reasonable uniformity or one of the parties will suffer.

Q. Can you account for the large increase in telephone business in such states as Ohio and Indiana, or how do you account for the increase in the telephone business in those states? A. In those states and all through the West there has been a tremendous increase in the telephone business. The great stimulating factor has been the introduction of the so-called farmers' lines or rural service. The introduction of large groups of farmers' lines has made the exchange service in smaller towns more popular also. Now, the telephone companies have not furnished the capital for building those farmers' lines. The farmers, as I have said, build their own lines. There are exceptions to this, however. There are many ways of trading which I could tell you of if you were interested. But the farmer, as I say, built their own lines, furnished their own telephones and kept them in order. They built a line up to the exchange in a small town. They made their own arrangements with the telephone company for switching; that is, for connecting their line with the local exchange or the toll system. Now it has been the enormous number of farmers' stations constructed with their own money that has created this tremendous expansion in the business. This has occurred especially in the thickly settled sections. You will remember that Indiana and Ohio are thickly settled.

Q. From what you say there is no independent telephone company could take care of this business, a company like the National in England or the Bell company in Canada? A. Well, I do not think the Canadian government, with all its resources, could furnish the money that is necessary. I do not believe the United States government either could furnish the money to put in the telephone development that is necessary. I have seen the estimate; I did not make it myself, but I give it to you because it came to me from a reliable source, that to put in the telephone plant which the farmers themselves have created and to which other companies have contributed in the states of Ohio, Indiana and Illinois would require an expenditure in excess of $50,000,000.

Q. Now, in all this development in the states of which you have just spoken, how was the connection made with the companies on trunk lines? Was it made by agreement or was it compulsory? A. The first thing that happens under these conditions is that a farmer representing his neighbors and himself goes to a telephone company and makes a connecting-line contract with a company for the service. The company assures itself that the man is really a representative of the people, as he claims to be, that they are a proper kind of people, that they have got a proper kind of equipment, and in return the company agrees to furnish a service for a certain consideration very much in the same way as the Canadian Bell Telephone Company has done in some instances.

Q. What would be the gross returns of a long-distance telephone system as a paying concern? It was said here by a witness that 12 per cent. is sufficient? A. I heard those figures given. Twelve per cent. of the gross returns on a telephone plant is absolutely insufficient to bring in any return on the capital invested or even to operate and maintain the plant itself. The amount of gross return to capital invested will vary, of course, with the character of the plant, but in most instances one has to obtain a gross return of about 25 per cent. or else you are not sure of earning six per cent.

Q. What percentage of spare plant should a well-organized telephone company keep on hand? A. A well-organized telephone plant, one that has been properly engineered, will have on an average from 30 to 35 per cent. of its plant spare all the time. That condition is brought about in this way: When a cable has to be put in to supply one section of the city, we have to look ahead for 12 or 15 months, and when we put that cable in today perhaps not over 25 per cent. of the wires are in use—probably 80 per cent. of them are not used. Then we immediately make provision for further extensions, and, by the time the further extensions are provided for, the cable is filled up. The same way with a pole line, which represents another type of telephone property. If we are going to build a line between Ottawa and Montreal we would put in poles that are capable of carrying perhaps 20 circuits. It would be foolish to put in all these circuits today because they are not needed. We would start off with one or two circuits. Now, that pole line has a capacity for 20 circuits. We only install, say four. Therefore, 80 per cent. is idle. Now, that is constantly the condition of things in a telephone plant. You never can have your plant filled. Some of it will be completely filled and some of it will be used to but a very slight extent, and in making up statistics of that kind, which we make up every year, showing the comparison of plant in use and not in use, I think the figures will indicate that there is between 30 and 35 per cent. of the plant idle all the time, and necessarily so.

Work of the National-Interstate Telephone Association.

All arrangements have been made for collecting and keeping on file at the general headquarters of the National-Interstate Association, 708 Electric Building, Cleveland, Ohio, complete data in regard to the Independent situation in the various states. Associations and individual companies are asked to respond promptly to requests from the office for information or data, and to refer all inquiries of any kind in regard to telephone matters to the general office. All information received by the association, when so requested, will be considered strictly confidential, and will be given out to no one without the consent of the persons furnishing it.

Hon. O. S. Berry of Carthage, Ill., has been appointed as the fifth member of the committee on litigation and legislation, a vacancy being left by the officers when making up this committee in order to give Illinois representation when the state became organized.

Arrangements have been completed for handling standard toll signs and transparencies, as well as directory covers, stationery, business cards, etc., bearing the official shield, and also various sizes of electrotypes of this emblem. A preliminary price-list has been prepared and will be sent to anyone interested. A complete catalogue will be ready for distribution within the next 10 days. Any profits made will be used to help carry on the association work.

Independent telephone men in all parts of the country are requested to forward all information regarding the local situation in their respective localities which they think would be of interest in making up the bulletins which the association issues from time to time.

Telephone News from the Northwest.

The Maple Lake Telephone Company of Maple Lake, Minn., has been granted a local franchise.

The Tri-State Telephone Company has acquired a controlling interest in the Stevens County Telephone Company at Morris, Minn., with exchanges at Chokio and Hancock also.

The Iron Range Telephone Company has sold its local exchange at Ada, Minn., and the lines in that vicinity to the Norman County Telephone Company.

The Northwestern Telephone Exchange Company will install an interior exchange in the courthouse in Minneapolis.

The Farmers' Consolidated Telephone Company of Sacred Heart, Minn., has been incorporated with a capital of $50,000.

E. A. Hess of Lyons, Iowa, has been awarded the contract for the construction of a telephone line from Billings, Mont., to Buford, N. D., for use in connection with the irrigation project. His bid was $15,932.

Telephone connections have been completed between Winona and Waseca, Minn., by the Chicago and Northwestern railway.

A. C. Cooledge and I. S. Mahan have incorporated as the LeMars (Iowa) Telephone Company with $100,000 capital.

The Lafayette Telephone Company has been incorporated at Gratiot, Wis., by H. W. Burmeister and others. The capital is $25,000.

The general offices of the New State Telephone Company were moved on September 1st from Odebolt, Iowa, to Sioux City. R.

Indiana Telephone Items.

It has been announced that the Converse Telephone Company, owned by O. L. Barger, has been merged with larger interests. The new company has opened a business office in Marion and will file articles of incorporation within a few days with a large capital stock, and the new organization will take possession of the Converse exchange. The Converse company already has the construction of a line well under way from Converse to Sims, and at the last-named place the line will join an Independent line to Indianapolis. It is learned that the new company is already making plans to erect its own building in Marion, and will place a number of toll stations there, whether or not it operates a local exchange. It is probable that there will be interesting competition between the new company and the Central Union Telephone Company.

David J. Smith, a switchman employed by the Pennsylvania Railroad Company, while using the telephone received a shock that caused his death. The company has a private telephone system and it was revealed that one of its wires had come in contact with an electric-light wire. Mr. Smith took hold of the metal hook instead of the receiver and received the shock.

The New Long-distance Telephone Company has been granted a franchise by the City Council of Frankfort giving it the right to construct, maintain and operate a toll telephone system out of the city of Frankfort for a period of 25 years. The franchise does not include a local telephone system, however, it being especially stipulated in the franchise that a local service should not be given by the company.

Improvements amounting to nearly $12,000 will be made on the Central Union Telephone Company's plant at Greensburg, Ind.

The Lost River Telephone Company of Paoli has filed articles of incorporation with a capital stock of $325. The company is to operate in Orange County.

Farmers who have hauled their hay to town and "stood around" waiting for buyers, now sell it in advance by telephone. The farmer knows what products to load by having ascertained the demand and the price by telephone. S. S.

Ohio Telephone Notes.

The Cincinnati and Suburban Bell Telephone Company has notified the owners of the Union Trust Building that its contract, which expires on January 1st, will not be renewed. The building has had a private exchange, with telephones in most of the offices, and was operated from the general exchange with one number. This private exchange will be moved to the main office, and tenants will be compelled to make arrangements with the company for service. In all 167 telephones and 81 extension telephones were in use in the building.

The liquidation of the Federal Telephone Company, announced to take place this fall, may be put off two or three years. The members of the controlling syndicate, after more mature consideration, have come to the conclusion that the company is a good pooling property, and that they do not care to lose control of the subsidiary companies through the extensive sale of their securities. When the sales can be made to the interest of the controlling owners, and the Federal liquidated in a proper manner, this step will be taken, it is said.

Col. Frederick S. Dickson, president of the Cuyahoga Telephone Company and other Everett-Moore properties, has returned from a vacation spent in the northern part of Maine.

An information bureau connected with the other departments and offices by a telephone system with an exchange will be established at the Grand Central depot in Cincinnati.

W. W. Libhart, manager of the exchange at Chicago Junction, has been promoted to the Norwalk office, and Frank Canady of the Sandusky Telephone Company will take his place. Mr. Libhart will still have general supervision over the Chicago Junction office.

James T. Carbin has sold, to the Farmers' Telephone Company of Fireside, the Bloomville exchange and 65 miles of toll lines extending to Tiffin, Shelby, Republic and other points, the consideration being about $15,000. Some time ago he sold the exchange at Republic to the same company for $6,000. Many miles of toll line which he built has been sold to other persons also. Mr. Carbin was the pioneer Independent telephone promoter of Crawford County. Ten years ago he built a small toll line at Likens, where he had a general store. Then he began to extend operations and built miles of line in Crawford, Richland, Seneca and Huron counties, besides two exchanges. These properties he sold for about $25,000, and all of the lines are operated in connection with other Independent lines. C.

Automatic Telephone Exchange Proposed for Oakland, Cal.

The Home Telephone Company of Alameda County, Cal., has made application at Oakland for a franchise. It is proposed to establish an automatic telephone service similar to that installed in Los Angeles. The company's representative before the City Council stated that a bond of $100,000 would be filed, work would begin within three months, and at least $850,000 would be expended within three years to complete the installation. William Thomas and his associates in the Home Telephone Company of San Francisco are directors in the branch companies recently incorporated for carrying on the telephone business in Oakland, Stockton, San Jose and Fresno. The Oakland company is capitalized at $3,000,00, San Jose and Fresno at $2,000,000 and Stockton at $1,500,000.

GENERAL TELEPHONE NEWS.

P. W. Siebert of Lexington, N. C., has secured the right to install an interurban telephone system between a number of towns in the state.

Ed. Hendry has resigned as superintendent of the People's Telephone Company at St. Charles, Minn., and will take a position with the Northwestern Telephone Exchange Company. He is succeeded by Chris Amundson.

An extensive system of Independent long-distance telephone lines centering at Chiguahuapan, state of Puebla, Mexico, and extending to the capitals of all of the districts of the state of Puebla, was formally inaugurated a few days ago.

The Lewistown Telephone Company of Lewistown, Mont., will, according to a recent announcement of the management, rebuild its entire system as far as Great Falls. About $25,000 will be expended in the improvements contemplated.

P. T. Spencer, C. G. Miller and their associates will construct a telephone system at Alhambra, Cal. They have incorporated as the Alhambra Home Telephone and Telegraph Company, with a capital stock of $50,000, of which $5,000 has been subscribed.

Governor Terrel of Georgia has had arguments made before him by attorneys urging him to veto the bill passed by the State Legislature giving to telephone companies the right of eminent domain, including the right to condemn land for erecting telephone poles thereon.

The Iowa Telephone Association held a meeting last month and decided to adopt the National-Interstate district plan of organization. District meetings will be announced by the officers, and the organizations in the various districts will be perfected in the near future.

Among recently incorporated telephone companies are the following: Caddo Telephone Company, Teddy, Okla.; Clinton County Telephone Company, Delmar, Iowa; Cost Telephone Company, El Campo, Texas; Green Valley and Atkinson Telephone Company, Atkinson, Neb.

The Independent telephone company of Shelbyville, Ind., prints in the columns of the Shelbyville papers each week a list of new subscribers and a list of those who have dropped out. Patrons have grown accustomed to clip these lists and correct their directories. With a little care the telephone directories are thus kept up to date. The company believes the money so invested in advertising space is well applied.

Judge Hosmer has decided in the suit of the Co-operative Telephone Company of Detroit versus the Public Lighting Commission that the lighting commission has the power to charge the telephone company whatever rate it may decide on for the use of its conduits, notwithstanding the city ordinance provides for the use of the conduits on a cost basis for maintenance. This places the Co-operative company, the only Independent company in Detroit, practically on the same basis as the Michigan State Telephone Company.

MANUFACTURERS AND DEALERS.

The Baldwin Telephone Supply Company of Kansas City, Mo., has been incorporated.

Anderson & Nachman, 356 Dearborn Street Chicago, agents for the Metaphone interior telephone, which it is asserted is giving entire satisfaction to those who have installed the system, are doing a satisfactory business. Through their efforts this system has been installed by many large firms in the West. It is said that the Metaphone is a distinct advance in interior telephone work. It consists of a transmitter and receiver mounted on opposite ends of a short metal handle. The transmitter is not fastened to the wall as in other interior telephones, and is therefore equally accessible to a tall man or a child. It is not affected by the vibration of walls in factories nor by the throbbing of the engines on shipboard. Anderson & Nachman will be pleased to hear from contractors or other firms who contemplate the installation of an interior telephone system.

CORRESPONDENCE.

Great Britain.

London, August 16.—The report of the Pacific cable conference has now been published. The conference was held as the result of the generally unsatisfactory nature of the working of the Pacific cable. The opening of the report states that the commissioners representing the various governments have endeavored to bear in mind that the Pacific cable was initiated not merely as a commercial undertaking but also and largely for the purpose of promoting imperial unity. They do not feel that the cable has failed to secure its anticipated share of traffic, except in the case of New South Wales and Victoria. This latter result is attributed to the special facilities granted to the Eastern Extension Cable Company in Sydney, an agreement with which by the New South Wales government was one of the points under consideration. In this connection the Pacific Cable Board is recommended to take all legitimate steps to secure an increased business, and that the board should use its discretion as to entering into an amicable agreement with the Eastern Extension company. It is further urged in order to secure a continuity of cordial relationship between the various governments that no agreements should be entered into or any facilities granted to any company without tthe proposal being submitted to the board or the various governments before a final decision is come to. The commissioners record the hope that the fullest possible effect will be given to their recommendations in view of the far-reaching political consequences attendant upon the success or failure of the Pacific cable.

The prediction as to the action of the government with regard to the agreement with the National Telephone Company came true. The recommendations of the committee with regard to further facilities being granted for municipal telephone licenses and as to the taking over of the staff were overridden by a vote in the House of Commons, but the postmaster-general gave a pledge that the whole of the company's staff should be taken over, except those officers in receipt of a salary of $3,500 per annum and over. Thus the terms of the agreement remain the same, with this one addition, as given in the Western Electrician.

Some dissatisfaction is felt in electrical circles at the failure of the government once more during the session just closed to pass some modifications of the restrictions under which the industry is now bound. Three times has an attempt been made to improve the electric-lighting acts, but each effort has been abandoned at the end of the session. The same has happened again this year. For many years an agitation has been going on with this end in view, and a few years ago a deputation from the Institution of Electrical Engineers waited on the government with respect to the matter, but nothing has been done. The tramways act of 1870, passed when horse tramways were first inaugurated, still applies in these days of advanced electric traction, no effect having been made to amend it.

The annual report of the postmaster-general points to a decrease in the number of telegrams despatched during the year ended March 31st, but an increase in the number of telephone messages sent. Greater use is now being made of British telephone plant, consequent upon the home manufacturers now devoting more attention to this, but the use of foreign plant cannot be entirely dispensed with. Many new telephone wires are being laid between London and the continent of Europe. The number of telephones in the London Postoffice system has increased from 15,632 to 24,351, and additional subscribers are being connected at the rate of 150 a week. A new exchange is to be erected in the city consequent on the original one now being worked to its full capacity. G.

New York.

New York city, August 26.—Electrical contractors and their various commercial allies are expecting even better times than ever. The recent reduction of prices for electric current is leading quite a number of storekeepers who use other illuminants to inquire into the advisability of installing electric fittings both for internal lighting and for external signs, and probably nine out of 10 of all the many new apartment and office buildings now in course of erection will use electricity for lighting and some for elevator service.

The quarterly report of the Interborough Rapid Transit Company for the three months ended June 30th shows that the warm weather and the unpleasant atmospheric conditions in the subway—which in part have been alleviated—led to a falling off in the normal traffic, or in what was computed to be the normal traffic, for the subway has not yet been in operation for a complete year. Up to March 31st the daily passenger average had a tendency to increase, but for April, May and June there was an actual decrease of 2,544,900 passengers as compared with the preceding three months. On the elevated lines there was, however, a gain, but not sufficient to match the subway losses. The following figures show the gross earnings and the total passengers carried during the three complete quarters the subway has been in operation: October-December, $812,090, and 16,241,800 passengers; January-March, $1,477,116, and 29,542,320; April-June, $1,349,871, and 26,997,420.

Alleged legal blunders, more than probably inspired by politicians, will hold up the construction of the trolley terminal at the Williamsburg Bridge, details of which appeared last week. This is at least the second time that the bridge department has been hindered from the same cause, and the contracts will probably not be given out until after the November elections. Similar time-killing devices are holding up the construction of the Blackwell's Island Bridge, which is to be completed, according to official promises, two years from now; but as there are only 35 men at work on the whole structure, which will be over a mile in length, an algebraical calculation demonstrates that the bridge will be ready for trolley cars in 1965.

The Long Island railroad has decided to put in a stretch of fencing along its electrically converted tracks from Edgemere to Rockaway Park. The Long Island railroad has also voted as majority stockholders to dissolve the Metropolitan Ferry Company which operates the ferry between Manhattan and Long Island City. The ferry probably will be almost useless when the under-river tunnels are completed.

More apparent intentions of the Pennsylvania Railroad have been revealed this week by reason of some surreptitious surveying operations in New Jersey, which have been traced to the New York and Philadelphia Traction Company through the employment of Pennsylvania Railroad engineers on the work. The plan seems to be to fill in certain links between New York and Philadelphia so as to have a trolley freight service all the way. Freight is already taken over some of the existing lines, and the New York and Pennsylvania company is known to have secured large options both on these lines and for future rights-of-way.

August Belmont has purchased still more Long Island city property in connection with his tunnel enterprises. On a block on Jackson Avenue and Fourth Street there is to be a handsome station for the tunnel cars. Mr. Belmont and other financiers have also become interested in a large combination of lighting and traction companies in western Pennsylvania and eastern Ohio.

The New York Edison Company has ordered two new Curtis steam-turbine generating units to be capable of developing 9,000 kilowatts continuously. These will be the most powerful sets yet installed by the Edison company, but improved designs will enable each to occupy a floor space equivalent to a circle of 15½ feet in diameter. The turbines are for the Waterside power house No. 2.

Two electric motors, each of 30 horsepower, have been installed at the New York Hippodrome to drive machinery which will keep the temperature of the building cool. At a test on Monday the inside temperature was put down to 52 degrees while it was 81 in the street outside. A number of exhaust fans, motor driven, assist the brine-refrigerating plant.

The Westfield Street Railway Company of Westfield, Chautauqua County, N. Y., has been incorporated by G. J. Sontag and other New Yorkers with a capital of $40,000. D. W. W.

Southeastern States.

Charlotte, N. C., August 26.—The receivers of the Virginia Passenger and Power Company at Richmond, Va., are seeking the co-operation of teamsters all over the city in a well-directed effort to prevent as far as possible all accidents between cars and the teams of the city, and are receiving much encouragement.

Spencer, N. C., has contracted with the Salisbury-Spencer Electric Railway Company for electricity to light the streets of Spencer, the equipment having already been installed.

Statesville, N. C., at a recent election voted $20,000 for water and for improving the electric-lighting system of the town.

Polk County, N. C., is expected to vote about $100,000 bonds toward the construction of the Appalachian interurban electric railway to connect Henderson, Spartanburg and other points.

Three hundred men are already at work on the waterpower development of the Southern Power Company at Great Catawba Falls in upper South Carolina. The entire developments along the Catawba will represent an outlay of perbaps $2,000,000.

North Carolina financiers are discussing the advisability of building an electric railway from Danville, Va., to Yanceyville, N. C., to reach the large timber and other holdings of the section to be traversed.

The Great Falls Power Company, proposing a big waterpower development near Nashville, Tenn., has asked for an extension of time limit of its franchise and will likely be favored. The already sufficient money has been promised, it is said, for the construction of the electric plant which the company proposes to build and from which power will be furnished to Nashville. L.

Ohio.

Cleveland, August 26.—Further information has been made public regarding the merging of the street-railway and light companies in eastern Ohio and western Pennsylvania, the names of August Belmont, Governor Myron T. Herrick and James Parmelee of Cleveland and Murray Verner of Pittsburg being brought prominently into the deal. The merger will be known as the Mahoning and Shenango Railway and Light Company and will have a capital stock of $10,000,000, according to information at hand. Thirty-two incorporations will be involved in the deal, including street-railway, gas and electric-light companies. In all there are 175 miles of railway lines, connecting on the one hand Warren, Niles, Struthers, Girard, Lowellville, Youngstown and Newcastle and on the other Youngstown, Hubbard, Sharon and Sharpsville. These lines have branches running to a large number of smaller places. The largest interests are the Mahoning and Pennsylvania railway systems and the Youngstown Consolidated Gas and Electric Company. The light plants are located in New Castle, Sharon, South Sharon, Youngstown, Sharpsville, Struthers, Wheatland, Girard and Warren. So far it is understood that the Youngstown Park and Falls roads are not included in the merger, but that there is a probability that they will come in later on.

Hugh Blealley, representing Alliance business men in the Alliance - Akron - Cleveland Railway Company, is pushing applications for franchises and right-of-way between Alliance and Akron in competition with the Akron-Alliance Connecting Railway Company, which was incorporated some time ago.

Articles of consolidation have been filed with the secretary of state by the Toledo Gas Light and Coke Company, the Citizens' Gas Light Company and the Toledo Heating and Lighting Company. The new corporation will be known as the Toledo Electric and Heating Company, with a capital stock of $4,000,000. W. F. Robison is the president and Frank W. Caughling secretary. John Cummings is chairman of the board of directors.

It is said that plans for a passenger and freight station at Third and Towns streets, Columbus, have been about completed. The station will probably be built by a company made up of leading railway men, but will be independent of any particular road. The contracts will be made so that no road will be shut out and plenty of trackage will be provided. In a general way the plans of the Indianapolis station may be used.

James Culbertson of Cincinnati has made a proposition to the traction people of Ohio, Indiana, Illinois and Michigan, it is said, to form a freight and express company to operate over the roads of the four states. The corporation will be known as the Union Traction Freight Line. He will endeavor to secure from the traction companies the right to operate cars over their lines to take care of the freight and express business. As many of the lines are developing their own freight business, it is hard to tell how the plan will be received.

The Tiffin Edison Illuminating Company and the Consolidated Gas and Light Company have each bid $80 per light for furnishing all-night lights at Tiffin. At present these two companies are lighting the city, the territory being divided. It is said the city will readvertise for bids.

Robert C. Turner of Columbus has invented an electrical apparatus for purifying milk and killing the bacteria by subjecting the milk to a current at 2,200 volts. A company has been formed to manufacture the apparatus, and a milk plant has been started in Columbus.

In net earnings the Lake Shore Electric showed a gain for July of about $11,000 over the corresponding month of last year.

Within a short time a corporation will be formed to take over the property of the United States Carbon Company, which was purchased by M. B. Daly some time ago. The work of improving the plant is progressing well and it will probably be producing goods within a few weeks. It is said the new company will be incorporated in this state.

Thomas S. Callahan, one of the oldest telegraph operators in this section, died at his home in Cleveland a few days ago. He had been employed in one office 40 years up to six years ago, when he retired from work. He was well known among the old school of operators.

The car shops of the local company at Cincinnati are said to have been sold to the recent combine. The shops employ about 600 men.

It is said that Cleveland and Akron business men have taken hold of the Youngstown and Ohio River road and will complete it. Max Goodman of Cleveland secured the rights-of-way and franchises some years ago and built portions of the roadbed, but did not complete any part so that it can be operated.

Horace E. Andrews in an interview a few days ago said that he believed there would ultimately be a merger of the electric and steam railroads, and that this is the philosophical solution of the transportation question. Under this arrangement the steam roads would get the long-haul business and the electric roads the short haul. This, he thought, would also be satisfactory to the people. For a long trip Mr. Andrews thought people would prefer a steam coach, but for 100 miles or less they will take an electric car.

The line of the Scioto Valley Traction Company has been completed through to Chillicothe and regular service has been started. O. M. C.

Indiana.

Indianapolis, August 26.—The Huntington Light and Fuel Company will ask the town board of Van Buren for a 20-year franchise for the erection and operation of an electric-light plant in that city, offering 20 street lamps at the rate of $75 annually each. It will also furnish light for commercial use, and many of the merchants are anxious for the plant to be installed.

The Indianapolis Light and Heat Company now supplies the city of Indianapolis with current for 1,600 arc lights of 2,000 candlepower each, besides current for 225,000 incandescent lamps used in various office buildings, department stores, business houses and private residences. The company also furnishes electrical power for running elevators, newspaper plants, factories, etc. In addition the company has added the business of supplying steam heat, and this branch has grown to large proportions since it was started. Owners of many of the large buildings have ceased to employ the services of an engineer, instead getting the service of the light and heat company with satisfactory results.

The Indianapolis Suburban Belt and Terminal Railway Company has filed articles of incorporation with a capital stock of $100,000. The company is to maintain and operate street-railway lines. D. M. Parry, William E. Stevenson, Eugene H. Bundy, Charles S. Hernly and Eli Marvin are the directors.

The Fort Wayne and Wabash Valley Traction Company will erect a large supply house in Fort Wayne in connection with its power house and plant in Huntington, and from this supplies will be sent to all parts of the system from Fort Wayne to Logansport, and possibly west when the line is extended. The power house is to be the first "double decker" ever built, being made possible by the use of turbine engines and boilers to fit. The engines will lie on the floor above the tier of boilers.

Officers of the American Engineering Company of Indianapolis who are interested in financing the proposed extension of the Huntington, Columbia City and Northwestern traction line from Huntington southwest through Marion, Elwood, Noblesville and Malott Park to Indianapolis are pleased with the success with which they are obtaining subscriptions to stock in Indianapolis. Some of the most substantial professional and business men have subscribed to 100 shares each. When the organization of the company for the extension south to Indianapolis is perfected the two projects will be merged. It is proposed to eventually extend the line from Indianapolis through the northern Indiana lake district to Goshen, with Kalamazoo, Mich., as a future terminal. The American Engineering Company has the contract to finance and build the entire line.

Upon the long-distance electric lines in Indiana and Ohio a sleeping-car service has been introduced where there are runs of six or seven hours' duration.

The strike of the electric linemen in South Bend has been settled by an increase of wages and promise of another increase in the near future. The strike was independent of the electrical workers' union.

Work is to begin soon on the power house of the Muncie and Portland Traction Company, about two miles southwest of Portland. The company awarded the contract for stone ballast for all of the 30 miles of track to the Portland Stone Company. Sixty-five thousand yards of crushed stone are required for the contract.

The Kokomo, Marion and Western Traction Company has opened a freight depot on North Main Street, Kokomo, and is now prepared to handle all freight between Kokomo, Marion and intermediate points. The company recently placed round-trip tickets on sale for the first time, and as an inducement for Sunday forenoon business is advertising a special round-trip fare of 75 cents between Marion and Kokomo, the regular fare (95 cents) to be charged in the afternoon.

On September 1st tickets for use on the Indianapolis, Columbus and Southern traction line will be placed on sale at every station on the line.

Indiana has 24 traction companies now in operation in the state, with a total of 913 miles, with 213 miles now building. Nearly all of these railways have been built in the last seven years and all in the last 10. The United Gas Improvement Company of Philadelphia, or the contingent known in Indiana as the Widener-Elkins syndicate, controls 512 miles of the total.

From large stockholders who have agreed to sell their holdings it is learned that the Indianapolis and Northwestern and the Indianapolis and Western companies are about to pass to the control of interests allied with the United Gas Improvement Company, commonly known as the Widener-Elkins syndicate of Philadelphia. S. S.

Michigan.

Detroit, August 26.—The Detroit United Railway has announced that it will carry passengers from all parts of Detroit to the state fair in September for a five-cent fare. The state fair grounds are eight miles out on the suburban line toward Pontiac. The present rate of fare is 10 cents. The injunction of the Detroit and Birmingham Plank Road Company against the construction of tracks by the Detroit United was set aside and 400 men immediately went to work on a spur track into the fair grounds, and it is now completed.

The president of the Detroit council has a new plan for the testing of the city's right to own and operate a street-railway system. He proposes to have the city operate a trackless trolley line across Belle Isle bridge and around the island, the current to be furnished by the municipal lighting plant, a fare of two or three cents to be charged for the round trip. He believes the $10,000 recently appropriated for testing municipal ownership sufficient to install the system. The plan to test municipal ownership by the construction of a piece of track in Griswold Street has not been given up by its supporters.

The Lansing and Suburban Traction Company had a bad wreck on its line between Lansing and St. Johns this week in which a trailer jumped the track. There were 120 persons aboard the two cars. One man was killed and a number wounded.

The Grand Rapids and Muskegon Electric Company, which has already expended about $300,000 in flowage rights, right-of-way for lines and material and labor for the dam being constructed near Stanwood, will, it is said, erect a sub-station in Grand Rapids for the reduction of voltage.

The tracks of the Muskegon Lighting and Traction Company are to be extended to the Goodrich Transportation Company's docks in Muskegon, so as to allow the interurban line from Grand Rapids to make direct connection with the boats.

The Cadillac Water and Light Company, with a capital of $10,000, has filed articles of incorporation. C. G. W.

Northwestern States.

Minneapolis, August 26.—A new building is to be erected at Wadena, Minn., for the municipal electric-light plant.

The Pine City (Minn.) Milling and Electric Company has let the contract to the W. I. Gray Company of Minneapolis for a new switchboard for the electric-light plant.

The Almond Milling Company has applied for a franchise for an electric-light plant at Almond, Wis.

W. D. Lovell of Minneapolis has been awarded the contract for installing an electric-light plant at Greenwood, Wis. Bonds for $15,000 have been voted.

A municipal electric-light plant has been authorized by popular vote at Iron Mountain, Minn.

The Valley Junction (Iowa) Electric Light Company has completely remodeled its plant and now has a capacity of 7,000 lights.

H. A. Linn and others have incorporated as the Linn Electric Light and Power Company at Oxford Mills, Iowa, with a capitalization of $35,000. R.

Dominion of Canada.

Ottawa, Ont., August 26.—The earnings of the Toronto Street Railway Company continue to show large increases. The city's percentage has more than doubled in the last four years. The railway company's receipts for July were $242,698, against $213,854 for July last year, an increase of $28,844. The percentage paid the city last month amounted to $36,404.

J. G. Ridout of Toronto, Clarence Thompson of Montreal and Henry Aylen, K. C., of Ottawa, have been appointed by the Dominion government as arbitrators to meet shortly in Ottawa to ascertain who is the original inventor of the wireless telegraph. This step is the result of rival claims before the Canadian Patent Office by Sir Oliver Lodge, R. A. Fessenden and Lee De Forest.

With a capital stock of $40,000 and head offices at Stouffville, Ont., the Bethesda and Stouffville Telephone Company has received articles of incorporation from the Ontario government. This new company is to carry on a general Independent telephone business in the county of York and in the townships of Pickering and Uxbridge, adjoining.

Two years ago the light and power plants of the city of Guelph, Ont., were taken over by the city, the sum of $155,000 being paid the local company which owned the concern. The report recently made by the city shows net profits in the operation of the plants for the last two years aggregating $26,171.

The experiments in electric smelting, which are to be conducted at Sault Ste. Marie, Ont., will be commenced before the 15th of October next. Mr. Herault of Le Praz, France, the inventor of the Hérault system of smelting by electricity, will

come to Canada to give the Dominion government, which is promoting these experiments, the benefit of his experience and advice in the matter. The investigations so far made into the electric system of smelting and the valuable report thereon published by the Canadian government, have attracted world-wide interest, and no less than 2,500 commendatory letters have been received from all quarters of the globe by the Canadian authorities.

Prime Minister Whitney of Ontario states that he is very much interested in the development of Niagara Falls power. Both the government and the Hydro-electric Commission, he says, are losing no time in gathering information that will help the local government to deal with the question when the time comes for the government to frame a policy. There is said to be an impression in some quarters that the report of the government commission may not be handed in until the development companies have succeeded in securing such a footing that it will be difficult to dislodge them. For this reason the greatest haste is now being urged. W.

Mexico.

City of Mexico, Mexico, August 24.—The Luz Electricia de Tuxpam is the name of a company which has been organized at Tuxpam, state of San Luis Potosi, for the purpose of installing and operating a new electric-light and power plant. Among those interested in the enterprise is Luis M. Carsi of Tuxpam.

A new electric-light and power plant is to be installed at Allende. The organization of the company was promoted by Enrique Guerra of Ciudad Porfirio Diaz, state of Coahuila.

The electric-light and power companies in Mexico have to contend with many thieves, who cut and carry off the wire. The latest theft of this kind occurred a few nights ago, when nearly one mile of the main cable of the Mexican Light and Power Company, which extends from the City of Mexico to the mining town of Eloro, was cut and carried off by unknown persons. The stretch of wire which was stolen was near the city limits. There is no clew to the thieves.

It is officially announced that the Mexican Electric Light Company, which was recently organized at Montreal, Canada, will take over and merge the plant at San Ildefonso, S. A., and the La Compania de Gas y Luz Electrica. The new company has a capital stock of $12,000,000. It will be about three months before the legal transfer of the two companies to the merger company can be effected. Pending this transaction Charles H. Cahan, general attorney for the Mexican Light and Power Company, has been elected president.

The Mexican Electrical Contracting Company has been organized at Guadalajara for the purpose of importing and installing electrical machinery. E. W. D. Cummings is interested.

It is learned that a strong company is being formed in London and Berlin for the purpose of installing a large electric-light and power system in the City of Mexico. It is reported that representatives have been in the City of Mexico securing contracts for the furnishing of power and that enough of these have been secured to insure the financial success of the enterprise. The names of the persons interested have not yet been made public.

Nearly 500,000 duct feet of conduits for the Mexican Light and Power Company have been laid in the City of Mexico since last February. The G. M. Gest Contracting Company of New York had the contract for this underground work. C. B. Johnson, representing the contracting company, says that work will be resumed as soon as the present rainy season ends and that it is probable that ducts of Mexican manufacture will be used for the remainder of the job.

The Mexican Light and Power Company will erect 15 station and storage buildings along its power-transmission line between the main power plant at Necaxa and the City of Mexico. These stations will be used for the accommodation of the linemen and watchmen, who will constantly patrol the line, and for the storage of materials. The contract for the construction of the station buildings has been let to J. R. DeWitt of the City of Mexico.

The Guadalupe de los Reyes Mining Company will install an electric power plant on the Piaxtla River at Los Barras. The electric current will be used to operate the machinery in the mines. The proposed plant will cost about $100,000.

It is stated that the material to be used in the construction of the electric street-railway system in Santa Rosalia, state of Chihuahua, has been ordered in the United States. Paul Ginther, who is promoting this enterprise, is also organizing a company in Europe to take over a concession acquired by him from the Mexican government for the erection of a large electric power plant on the Conchos River above Santa Rosalia. This company will have a capital stock of $5,000,000. The proposed power plant will furnish electrical energy for operating the electric street-railway system in Santa Rosalia and will be transmitted to Parral and other towns of the state.

The Mexican government has granted another extension of time for the construction of an electric railway between the City of Mexico and Puebla by the Mexico and Puebla Railway Company. Benjamin Barrios, Zuleta 18, City of Mexico, is attorney for the company and can give information. H.

Pacific Slope.

San Francisco, August 25.—It has beeen decided by the city authorities of San Francisco to go ahead with the reconstruction of the Geary Street railroad, on which the franchise expired some time ago. J. C. Stut has been engaged as engineer by the Board of Works to prepare detailed plans for an electric road with underground conductor. The railroad company is expected to take steps to prevent the city from occupying the roadbed for its own use. The city's budget for the year includes an appropriation of $350,000, which was estimated to be about one-half the amount required to reconstruct the Geary Street road. It has been pointed out that to put in heavy rails and construct a thoroughly modern road with new equipment would probably cost over $1,000,000, and the mayor was disposed to postpone the work until more money was available. He was overruled by the advocates of the original plan.

Alfred D. Bowen, president of the Ocean Shore Railway Company, says that construction work will be commenced at Halfmoon Bay late this fall. Bids will be opened on September 1st for the construction of the double-track line between Scotts Creek and San Francisco. Rights-of-way are practically complete, although some condemnation suits are pending.

H. E. Huntington of the Pacific Electric Railway Company has returned to Los Angeles and is considering the extending of the Glendale line of the Los Angeles interurban system to Burbank and possibly further up the San Fernando Valley. It is expected that a third electric line of the Huntington system will soon be completed between Pasadena and Los Angeles.

An option on a majority of the stock of the Yreka railroad has been secured by Alex. J. Rosborough. The road at present connects Montague, on the Southern Pacific railroad, with Yreka, but it is the intention to extend to Fort Jones and Etna in Scott's Valley, a distance of about 40 miles additional. The road will be changed to an electric line by the new owners. It is stated that Scott Valley and Yreka will vote bonds amounting to $100,000 to provide additional funds for construction.

An ordinance has been adopted by the city trustees of San Diego, Cal., granting a franchise for a roadbed to the San Diego, Old Town and Pacific Beach Railroad Company of San Diego.

The city trustees of Pomona, Cal., have adopted resolutions requesting H. E. Huntington to extend his electric lines to that place.

The Snohomish Electric Light Company has commenced the construction of a new power station to replace the one destroyed by fire at Snohomish, Wash. A new generator has arrived and the new engine is in transit from the East.

The San Luis Obispo (Cal.) Gas and Electric Company, of which B. F. Thomas is manager, is receiving bids for the construction of a new power house with concrete floors and foundations.

The Board of Education has opened bids for electric wiring and electric clockwork on the new school buildings in course of construction in Oakland, Cal. They were referred to the proper committee.

H. H. Griffiths has been granted an extension of time until March 5, 1906, for the completion of about eight miles of electric street railroad in Stockton, Cal. A. M. Hunt of San Francisco is the company's engineer. A.

Texas.

Austin, Texas, August 23.—J. V. Watkins of Corsicana is promoting the building of an electric railway between that place and Palestine. Application will be made to the city councils of the two towns for franchises.

The Houston Electric Company, which owns the street-railway system at Houston, will erect new and commodious car barns.

It is proposed to build a street-railway line in Cooper. Dr. Joe Blackwell can give information.

Extensive improvements are to be made to the city electric-light and power plant of Greenville. The proposition to sell the plant to persons who propose to construct an electric street-railway system is being considered.

Collier Bros. of Whitney are considering the matter of establishing an electric-light plant at that place.

A large part of the capital stock of the company that is being organized to construct an electric-railway line between Bryan and College Station, where the state agricultural and mechanical college is situated, has been subscribed. Ed. Hall, A. M. Waldrop, James H. Webb and others are interested.

J. D. Beardsley of Gibsland, La., is still working on the project of building an interurban electric railway between Mineral Wells and Fort Worth. The distance is 60 miles, and the cost of construction is estimated at $1,500,000.

The Egan Electric Company has been organized at Dallas with a capital stock of $15,000. Its purpose is to deal in electrical fixtures and supplies. G. H. Egan is one of the incorporators. H.

PERSONAL.

H. T. Johnson, treasurer of the Manhattan Electrical Supply Company of New York, was in Chicago last week looking after the interests of the company.

Much regret is expressed at the sudden and accidental death of Charles Underhill, chief operator at the Edison sub-station at East One-hundred-and-twenty-first Street, New York city. Mr. Underhill went into the cellar to switch off a 6,600-volt circuit and was in some unknown way killed instantly.

John W. Ferguson, the little 10-year-old son of Louis A. Ferguson of Chicago, died August 25th of appendicitis. His death occurred at Mount Pleasant, Breton Wood, N. H., where Mrs. Ferguson and her four children were spending the summer. An operation had been performed a few days before which was unsuccessful.

John T. Young has been chosen as manager of the Muskegon Lighting and Traction Company of Muskegon, Mich., to succeed Samuel A. Freshney, who assumed the management of the public-service department of the city of Grand Rapids on September 1st. Mr. Young was formerly in charge of the mechanical and electrical department of the Cleveland Construction Company at Akron, Ohio, with which company he superintended construction work in Ohio, Illinois, Indiana and New York. Mr. Freshney was given a banquet by the employes of the Muskegon company before he left. The stockholders and officers of the company were present and the retiring manager was presented a silver loving cup.

C. Frederick Warner, electrical engineer and contractor, died Saturday, August 19th, at his home 121 South West Street, Rockford, Ill. He had suffered for a number of years from heart trouble and recently a complication of diseases confined him to the house. Mr. Warner was born in Bradford County, Pa., 61 years ago next October. He at times had resided in Chattanooga, Topeka and Chicago, making only a brief residence in each place, the greater part of his life being spent in Rockford. He was an electrical expert of much ability, and was district representative for the Northern Electrical Manufacturing Company of Madison, Wis. Mr. Warner's ambition was boundless, and he was also a keen observer of men and affairs. Those surviving him are his wife, one daughter, Mrs. Earl V. Case of Topeka, Kan., a brother, Henry Warner of Rockford, and a sister, Mrs. James H. Belcher of Topeka, Kan.

The death of Mr. Guthrie Gray at Muskoka Lake on August 26th has cut short at the early age of 31 years the career of one whose future was full of promise. Mr. Gray was graduated from the Lawrence Scientific School of Harvard University in the class of 1896 and was an electrical engineer of more than ordinary ability. After his graduation he was for a number of years employed in the engineering department of the Buffalo General Electric Company, whose employment he left to accept a position under Mr. Henry Rustin, the superintending engineer in charge of the extensive lighting system of the Pan-American and St. Louis expositions. For the last two years Mr. Gray was employed in the engineering department of the National Battery Company of Buffalo, N. Y., and in the short time that he was connected with that company his energetic work and cheerful disposition gained him the high esteem of the management and his business associates. Mr. Gray was a member of the American Institute of Electrical Engineers.

ELECTRIC LIGHTING.

The Fremont Light and Power Company of Teton, Idaho, has been incorporated with a capital stock of $25,000.

At Richmond, Utah, the High Creek Electric Light and Power Company has been incorporated with a capital stock of $7,000.

Willis Fertig of Titusville, Pa., has been granted a franchise for an electric-light plant in Shawnee, Okla. He will also operate and extend the present electric street railway.

W. J. Brock, W. P. Dixon, B. Sammons and E. Melville have been granted a franchise to construct and maintain poles, wires, etc., for lighting, power and heating purposes within the city limits of Kankakee, Ill.

The City Council of Toledo, Ohio, has passed a resolution allowing the issue of bonds amounting

to nearly $500,000 for the construction of a municipal lighting plant. The question will be voted on by the people at the fall elections.

An organization known as the Society for Beautifying Buffalo is installing a large electrolier at the corner of Main, Genesee and Huron streets in Buffalo, N. Y. The electrolier is of bronze and is being placed on an ornamental granite base.

The M. B. Wheeler Electric Company of Grand Rapids has been awarded the contract for installing a lighting plant at Rose City, Mich. It will provide for $500 incandescent lamps for both street and residence lighting. The plant is controlled by Bell & Monaghan of Rose City. The cost will be $2,500.

The city of Carthage, Mo., will, in a short time, purchase two 150-kilowatt two-phase 60-cycle 2,200-volt belted-type generators, and also condensing apparatus to handle the present steam-engine equipment. A. P. Knowles is superintendent of the plant and W. H. Stout chairman of the committee.

The council of Lansing, Mich., has let the contract for a 50-light circuit of alternating-current lighting to the Adams-Bagnall Company of Cleveland. This is the first step in the change of the city lighting system from direct to alternating current. The bid was $1,267. Seven companies furnished proposals.

The Lebanon (Ind.) Light and Power Company has installed two Diesel engines for operation in its plant, one of 400 horsepower and the other of about 200 horsepower. These two units were in the exhibit of the Diesel company at the St. Louis Fair, and were to be seen there at the "Tyrolean Alps." Lebanon, therefore, has the distinction of being among the first cities of the country to have a working installation of this sort.

The City Council of Springfield, Ill., by a vote of 10 to three, and with one alderman declining to vote, this week adopted the resolution authorizing and empowering Mayor Devereaux to take over the municipal light plant as soon as it can be obtained. This action brought to a close a struggle which at one time was marked by a riot in the council chamber. Mayor Devereaux when he started his fight for municipal ownership had only four aldermen with him. Six of the aldermen who had opposed him for months on every hand completely changed front and voted for the resolution.

Giving evidence before a special committee of the City Council of Milwaukee, which is investigating alleged discriminations in the charges for electric light, John I. Beggs of the Milwaukee Electric Railway and Light Company is quoted in Milwaukee papers as follows: "Electricity is sold on the basis of the quantity used, small consumers paying more in proportion than large consumers, which is a rule applying to all business transactions. Charges for electricity are only such as afford a reasonable margin of profit. While most consumers pay according to a sliding scale, we have some operating under a flat-rate contract. The government building pays five cents per kilowatt the year around. The Northwestern depot pays a like amount, and Gimbel Brothers pay four cents per kilowatt. The Sentinel company has a 50-year contract, under which we furnish power at 3¼ cents per kilowatt and light at four cents per kilowatt."

ELECTRIC RAILWAYS

S. T. Chambers of Blackwell, Okla., has been granted a franchise for an electric railway in Claremore, I. T.

The Bow River Lumber Company of Big Hill, B. C., is about to build an electric railway from its timber lands, about 13 miles, to the mill at Big Hill.

The Weir City (Kan.) Light and Power Company has made a contract to furnish the branch line of the Pittsburg (Kan.) Street Railway Company with power. This extension will go to Scammon and other points.

The Maysville, Carlisle, Millersburg and Parris Traction Company has filed articles of incorporation in the clerks' office of Mason County, Ky. The capital stock is $20,000, and the company will be limited in its bond issue of $1,500,000.

The electric railway being built between Chico and Oroville, Cal., is to be equipped with the most modern rolling stock for passenger service, and besides will have electric locomotives of 400 horsepower each for handling freight in standard freight cars.

For the convenience of its patrons, President Furth of the Seattle Electric Company is arranging to build stations at convenient points along the street-railway system in Seattle, where commutation tickets will be on sale, doing away with the inconvenience of going to the company's office to buy the books.

The Chicago and Milwaukee Electric Railroad Company opened the extension of its Evanston-Waukegan line to Zion City last Saturday. It is expected that the further extension of this line from Zion City to Kenosha will be completed and opened for traffic about October 1st. The entire distance between Chicago and Milwaukee will then be covered.

The Winnipeg (Man.) Street Railway Company, principal owner of the Lac du Bonnet water scheme for supplying the road with motive power and the city with light and power, reports that the road will be using this power before winter and that the company will be supplying power and light to the city within eight weeks. The steel work for the sub-station in Winnipeg is in place.

The Baltimore Terminal Company of Baltimore, Md., has been organized through the efforts of the Bishop-Sherwin syndicate of Cleveland, to provide terminal facilities in Baltimore for the Washington, Baltimore and Annapolis electric railway, which it is building. An ordinance is now pending before the council for a franchise to allow the company to operate cars as far as Baltimore Street and Hopkins Place.

After eight months of consideration, the Common Council of York, Pa., has defeated ordinances permitting Philadelphia capitalists to build electric railways in the city. Ordinances were adopted giving to the York Street Railway Company and allied corporations franchises to construct trolley lines and extensions. The ordinances demand of the York Street Railway Company five per cent. on gross receipts for the first five years, 6¼ per cent. for the next five years and eight per cent. thereafter, as well as taxation fees on all cars, poles and wiring, together with an assessment on all interurban cars entering the city.

Figures just made public show that the earnings of the Aurora, Elgin and Chicago electric railway for the month of July broke all records in the history of the company. The gross earnings were $74,830, or more than $10,000 larger than those of any previous month in the company's history, and an increase of $16,313 over the gross earnings of July of last year. The net profits were $41,901, a new high record, and an increase of $10,515 over those of July a year ago, or more than 33 per cent. The traffic alliance with the Metropolitan West Side elevated railway, by which the cars of the Aurora-Elgin company are brought into Chicago has not yet shown its full effects, it is said.

Three street-railway swindlers were arrested in Cleveland last week, two of them being fined $50 each and sent to the workhouse. Two of the men, who gave their names as Edward Benson and John Edwards, were arrested in the office of the Cleveland Electric Railway Company, where they appeared to file a claim for $200 damages for alleged injuries sustained by Edwards, who said he fell from a car at the Public Square a few days before. On being questioned, they confessed to working a swindling game in various parts of the country, Edwards doing the falling while Benson acted as a witness. They are thought to be the men who secured money in Brooklyn, Philadelphia, Washington and Baltimore, and made unsuccessful attempts in other cities.

Aurora and Elgin papers say that there is talk of merging under one management the Aurora, Elgin and Chicago Electric Railway Company, the Joliet and Plainfield, the Elgin, Aurora and Southern and all the city lines in Aurora and Elgin. The Elgin Courier says: "The new corporation under one management, with L. J. Wolf at the head, would have a trackage of 225 miles and a property valued at $15,000,000. It is said that Edwin C. Faber will be the general manager, a position which he now holds with the Aurora, Elgin and Chicago Railway Company. While it is a fact that all companies mentioned are financed by the same aggregation, a certain rivalry exists in all distinct corporations doing business in the same territory. Under the new plan all the financing will be done in Chicago."

A new corporation, called the Tractional Company, has been formed to take over the entire stock of the International Traction Company, which owns the street-railway lines of Buffalo. One share of the new company's stock will be exchanged for 100 shares of International common stock. The capital stock of the Tractional Company amounts to $100,000, only $76,000 of which is to be issued immediately; the International Traction Company is capitalized at $15,000,000. Henry J. Pierce, president of the International Traction Company, is also president of the new corporation. The directors are Thomas De Witt Cuyler, G. L. Boissevain, Nelson Robinson, Grant B. Schley and Henry J. Pierce. Arthur Robinson is secretary and treasurer. The total length of the lines combined is 375 miles.

POWER TRANSMISSION.

Charles H. Fisk of Detroit, Mich., is closing arrangements for the formation of a company to develop and furnish electric power for traction, lighting and general purposes at Nashville, Tenn. It is proposed to utilize a waterpower at McMinnville, between Nashville and Chattanooga, and furnish power to both cities.

It is reported that the Truckee River General Electric Company, which has waterpower electric plants at Floriston and Marmol, Nev., for supplying the Comstock mines at Virginia City, Nev., will run a pole line over the Virginia range into Olinghouse and White Horse Canyon, the new mining district 30 miles east of Reno.

It is reported that the Reno Power, Light and Water Company has taken over the water rights of the Verdi Lumber Company on Johnson Ranch, near Verdi, Nev., for the erection of an additional waterpower electric plant with a capacity of 5,000 horsepower. This company, which now supplies Reno with electric light and power, was recently bought out by Messrs. F. L. Brown and Victor Enginger of San Francisco.

SOCIETIES AND SCHOOLS.

The college of engineering of the University of Wisconsin recently adopted a course of chemical engineering and one of gas engineering. The steadily increasing demand for engineering graduates, who, aside from a general knowledge of engineering, shall be good chemists as well, has led to the institution of the former course. Chemical engineers in the gas industry find an opening oftentimes, and so the course in gas engineering was formed to supply the large demand for men of this sort. Prof. Charles F. Burgess is at the head of the two courses.

Mr. A. S. Richey has been appointed assistant professor of electric-railway engineering in the Department of Electrical Engineering of Worcester Polytechnic Institute and not as the head of the electrical engineering department as wrongly stated last week. Mr. Richey leaves his duties as chief engineer of the Indiana Union Traction Company to take up his new work on October 1st. It is the intention of the Institute to develop exceptionally strong courses in electric-railway works, both in the class and lecture rooms and in the provision of ample laboratory facilities.

PUBLICATIONS.

Bargain list No. 4, published by Joseph H. Thompson, Jr., 11 Broadway, New York city, contains a list of bargains in electric and steam machinery. Mr. Johnson says he will be pleased to submit an offer for any apparatus if the condition it is in is stated.

"Make Your Engineer Look Pleasant," says the L. B. Allen Company of Chicago. This, the company intimates, can be done by using Allen commutator lubricant, Allen soldering paste and other Allen products, the merits of which are set forth in a little folder which the company is distributing.

Type N motors, designed especially for crane service, are described in a bright-appearing new bulletin from the Sprague Electric Company of New York. The bulletin contains a complete description of this type of motor with illustrations, the whole being prepared in an attractive and readable style.

The new catalogue of efficient power pumps for every service has been issued by the Goulds Manufacturing Company of Seneca Falls, N. Y. The book has 192 pages with fine half-tone illustrations on nearly every page. It gives some interesting information about pumping aside from its connection with the Goulds product. The company builds power pumps exclusively, and in the 48 years of its existence Goulds pumps have become known the world over. The catalogue will be valuable to anyone interested in pumping of any kind.

The Allis-Chalmers Company of Milwaukee has just issued two new catalogues and two bulletins. The former are of the tasteful appearance which characterizes this company's advertising literature, and treat, respectively, of "Smelting Furnaces" and "Reynolds Corliss Engines." They are handsomely illustrated and nothing in the way of descriptive matter concerning these two classes of machinery is left out. The bulletins are devoted to a "Test and Record of the 30,000,000-gallon Pumping Engine" and the "Test of One of the 15,000,000-gallon Vertical Triple Expansion Pumping Engines." They give a complete description of these tests and their results.

Engineers and contractors connected with power-transmission work (rope and cable) will be pleased with the 1905 C-7 catalogue of the Dodge Manufacturing Company of Mishawaka, Ind. The book contains 416 pages and is written for the express purpose of furnishing all those interested in power-transmission equipment with the most up-to-date and dependable data that can be compiled, making it a veritable textbook on this subject. A commendable feature is the coding of the entire book, and that, too, in alphabetical order. Certain combinations have been effected requiring but one code word to designate certain information that in tables and price lists as ordinarily coded take from

eight to 10 words. The American system of rope transmission has been entered into and exploited very thoroughly. The standard edition is bound in library style, with rigid backs, and is intended for desk purposes only. To meet the demand for a four by six-inch pocket edition the company is having a complete reduction made which will be known as C-7 Junior, and will be ready for distribution about September 15th.

Quite a large and varied consignment of advertising literature has been received from the General Electric Company, as follows: Bulletins 4414, 4415 and 4416, treating, respectively, electrically driven turbine house pumps, Thompson recording wattmeter—type C—and service cut-outs; an index to the company's bulletins; 13 "flyers" dealing with various forms of electrical apparatus and supplies, such as rheostats, knife switches, combined service switches and cut-outs, porcelain ceiling boards, etc.; price lists on types HB and H transformers; supply catalogue for repair parts of form 3 and for 2 arc-lamp hangers and cut-outs, and a little pamphlet devoted to "Coffee Making by Electricity." The last-mentioned is devoted to the handy little coffee-making device known as the Percolator.

One of the most complete and up-to-date electrical catalogues issued is that of the H. W. Johns-Manville Company of New York. It is substantially bound in cloth and contains 349 pages, with a great many pictures, illustrating almost every line of the company's numerous products. The catalogue is divided up into 14 sections, each section treating some particular line of apparatus, such, for example, as trolley-wire hangers and pull-overs, strain insulators, tools, Noark enclosed fuses and devices, molded mica sockets, etc. This general method of classification enables one readily to turn to the part of the book desired upon consulting the table of contents. Each particular device is described briefly but concisely and a picture of it given, together with the code word, number, type letter and price. A complete telegraphic code is contained in section 13. In section 12 are given some good general information and a large number of reference tables, which will be appreciated by those who have the good fortune to receive one of the books. The number of the catalogue is 14, and it supersedes all previous issues.

MISCELLANEOUS.

An Indiana inventor, B. W. Harris of Waveland, has patented a unique transportation device which is intended for use in rural localities not served by railroads and where the wagon roads are hard to travel. It consists of an aluminum car suspended by cables and driven by means of a motor which derives its current from the cables. The car will hold five people, and the cost of construction per mile will not exceed $450, it is said. Mr. Harris expects in time that his invention will supplant the rural delivery of mail by wagon as it is now done. A stock company with a capitalization of $500,000 has been formed to build the car.

According to a dispatch from Shanghai, China, an imperial edict has gone out which declares that telephones and wireless telegraphs throughout China are government monopolies.

TRADE NEWS.

R. B. Ellis has succeeded to the electrical business of Ellis & Chamberlain in Denison, Texas.

Edward H. Perry of Niagara Falls, N. Y., will receive bids until September 9th for the installation of an electrical plant for the operation of the incline railway in Prospect Park. The plans and specifications for the proposed installation have been prepared and can be seen at Superintendent Perry's office in the Administration Building.

Sidney Hammerquist has purchased the entire stock of the Electric Construction and Machinery Company of Moline, Ill., and hereafter the company will be known as the Electric Construction Company. Mr. Hammerquist has been in the electrical business for several years, and for the last six months was manager of the business of which he is now sole owner.

The American Electric Company of the City of Mexico is a new company which has taken over the electrical supply business in that city of P. D. Olivera & Co. Mr. Olivera, who has built up a prosperous electrical supply trade in the last two years, will be general manager of the new company. G. W. Deits, vice-president of the Tuxpam Valley railroad, is president. The new company is making extensive changes in its salesrooms, and, in addition to a large line of supplies, will bid on heavy contracts.

The St. Louis Expanded Metal Fireproofing Company of St. Louis, Mo., cautions all persons having under consideration the building of structures of reinforced concrete, against the use of certain bars, attempts to introduce which for such work are now being made and which, it says, are infringements of its corrugated bar patents, which cover all bars that can be rolled, having ribs, or depressions, the sides of which make an angle with a plane at right angles to the axis of the bar, less than the angle of friction between the concrete and the metal.

Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until September 27th, for the installation complete of the conduit and electric wiring system for the United States custom house at Baltimore, Md., in accordance with the drawings and specifications, copies of which may be had at the above address or at the office of the architects, Hornblower & Marshall, 1509 H Street, Washington, D. C.

BUSINESS.

The National Battery Company of Buffalo, N. Y., is paying much attention to the promotion of the National sparker, of which it says 10,000 have been sold in the United States in the last year. Uniform quality, full capacity and long life are the characteristic features which make it a leader in the trade.

Forée Bain & May, Monadnock Block, Chicago, the well-known patent lawyers and experts in electricity and mechanics, have added a large number of clients to their already long list and have been exceptionally busy during the last few months. The firm has issued a card giving a list of references (by permission) which includes names of a number of well-known statesmen, as well as many representative business houses.

Baker & Co., refiners and manufacturers of platinum, of Newark, N. J., and New York city, are making extensive additions to their Newark works. The rapidly increasing consumption of platinum in the industrial arts has made this extension necessary, especially in the refining department, which will be enlarged over 100 per cent. New and larger offices are also being erected, and the entire plant will be equipped with the most modern appliances for the economical manufacture of the company's varied and high-grade products.

The Chicago Pneumatic Tool Company, Chicago, manufacturer of the Chicago pipe-bending machine and other well-known specialties, reports a flourishing business in its various department. The demand for the Chicago pipe-bending machine has shown a gratifying increase week after week, and the machine is now quite generally used. With this machine one man can bend a piece of two-inch iron or brass pipe to an S bend in three minutes without any other assistance or any other device. The machine is portable and is almost indispensable where pipe is used to any extent.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) August 22, 1905.

797,561. Telephone Hook Switch. Josephus M. Clement, Mineral Bluff, Ga. Application filed March 8, 1905.

The hook switch of a subscriber's set, provided with flexible contact members, is described.

797,570. Multiplex Telegraph System. Tullio Giara, Boston, Mass. Application filed July 5, 1904.

In a multiplex telegraph system, sending apparatus comprises a number of different series of sets of contacts, a key is connected to each contact to close a circuit thereto, an independent line is provided for each series of sets of contacts and a movable element has insulated contacts electrically connected to the independent lines for engaging the contacts of the respective series of sets.

797,586. Telephone System. Edmund Land, Grand Rapids, Mich. Application filed November 2, 1904.

The system embodies a trunk-line jack, trunk-lines, a visual signal, an automatic trunk-selector adapted to establish connection by automatic means between the spring jack and a non-busy one of the trunk-lines and means for displaying the visual signal during the period in which the connection is being established.

797,589. Electric Car or Locomotive. Nils D. Levin, Chicago, Ill., assignor to the Goodman Manufacturing Company, Chicago, Ill. Application filed April 22, 1904. Renewed April 6, 1905.

An electric motor is carried upon the car and a cable supplies current to the motor. A reel for the cable, a device contiguous to the reel for storing energy, means for supplying energy and connection between the device and the reel for using the stored energy to wind up the cable are the other parts.

797,591. Electrical Railway Signaling System. Leonidas N. Lyon, Jr., Flatonia, Texas. Application filed November 29, 1904.

An electrical railway signaling device for moving trains comprises a main circuit, electromagnetic means interposed in the circuit and connected with the train for shunting the current of the main circuit, forming thereby an auxiliary circuit co-operating with the main circuit to permit of signaling to or from the train from or to a station, and means for automatically breaking the auxiliary circuit.

797,593. Incandescent Electric Lamp. Albert W. W. Miller, South Orange, N. J. Application filed September 3, 1903.

Details in the shape of the bulb and attachment of the sleeve are described.

797,612. Telegraph Key. William H. Schermerhorn, Ree Heights, S. D., assignor of one-half to James J. Gahagan, Huron, S. D. Application filed February 24, 1905.

The mechanical parts are described.

797,628. Electromagnetic Compensating Device. Bernard A. Stowe, Cleveland, Ohio, assignor to the Jandus Electric Company, Cleveland, Ohio. Application filed May 24, 1904.

In an electromagnetic compensating device for arc lamps there are combined with a magnetic conductor, means for positively varying the magnetic conductivity thereof concomitantly with a change in temperature of the magnet coil and inversely relatively to such temperature.

797,629. Electric Arc Lamp. Bernard A. Stowe, Cleveland, Ohio, assignor to the Jandus Electric Company, Cleveland, Ohio. Application filed May 25, 1904.

An inclosed arc chamber has a member connected therewith embodying a horizontal or flanged portion and a body portion. The flanged portion is provided with an attenuated duct communicating with the arc chamber; the body portion being provided with a series of ducts forming a chamber of enlarged cross-sectional area, one end of the chamber communicating with the atmosphere and the other with the attenuated duct.

797,664. Automatic Gas-pressure Regulator and Cut-off. John W. Cottingham and Charles W. Franklin, Leipsic, Ohio. Application filed March 16, 1905.

A latch is constructed to hold the gas valve open, and electromechanical means operated by a lever release the latch and sound one of the bells when the pressure falls. Means including devices operated by the lever sound another bell when the pressure resumes.

797,678. Electric-railway Signal. Jake Friedlander, Fargo, N. D. Application filed December 27, 1904.

A stationary signaling device is connected electrically with the rails at one side of the railway. A signaling device is carried by the car. Electrical connection is made between the signaling device on the car and the track circuit.

797,679. Circuit-closer. Jake Friedlander, Fargo, N. D. Application filed March 20, 1905.

In a circuit-closer are circuit terminals, circuit-closing pins normally arranged adjacent to the terminals and adapted when moved to make electrical connection, a push button for moving one pin and thermal means for moving the other pin.

797,699. Incandescent-lamp Socket. Norman Marshall, Newton, Mass. Application filed January 21, 1904.

The switching mechanism within the socket is made the basis of the patent.

797,713. Automatic Fire Alarm. Karl J. Backman, Karisvik, Forshaga, Sweden. Application filed February 7, 1905.

A thermostatic circuit-closer operable by heat is the patentable feature.

797,718. Portable X-ray Apparatus. Eugene W. Caldwell, New York, N. Y. Application filed August 18, 1904.

In the portable X-ray apparatus there are a coil box, a coil within the box, the ends of the secondary winding of the coil passing through insulating pillars and connecting with removable terminals mounted at the tapered tops of the pillars, a removable primary winding for the coil, a terminal block detachably mounted on the box and connected with the ends of the primary winding and a reversing plug supplying the terminal block.

797,720. Trolley. Henry B. Clarke, Chicago, Ill. Application filed February 26, 1904.

The trolley is provided with a spiral groove device for directing the wire into its proper position relative to the wheel.

797,747. Electric Furnace. Henry N. Potter, New Rochelle, N. Y., assignor to George Westinghouse, Pittsburg, Pa. Application filed July 23, 1903.

The method of supplying heat to the furnace consists in heating the body of the furnace by any suitable means, and adding to the heat thus produced the heat energy derived from a conducting gap.

797,761. Composite Telegraph and Telephone System. Carlo Turchi, Ferrara, Italy. Application filed November 12, 1903.

In a system of simultaneous telegraphy and telephony are the line-wire and its telephonic apparatus and a circuit connected at one end both directly and inductively to the line, and at the other to the earth, divided in two branches each containing condensers and inductances, wound differentially around a core from which a telephone receiver receives inductively the magnetic flux.

797,774. System of Motor Control. Charles E. Lord, Cincinnati, Ohio, assignor to the General Electric Company, Schenectady, N. Y. Application filed April 12, 1905.

A series-parallel motor-controller comprises separately actuated contacts, operated by pneumatic means. Other means produce an automatic progressive operation of the operating means. Other parts are a pneumatically operated reversing-switch, two pipes connected to the reversing switch-operating means and the contact-operating means, a master controlling device for regulating the

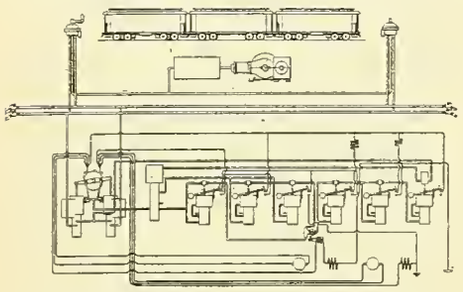
admission of compressed air to the pipes so that series and parallel connections of the motors in forward and reverse direction of rotation may be obtained and means for reducing the pressure in the pipes a predetermined amount to check the automatic progressive operation of the contacts without affecting the contacts already operated. (See cut.)

797,783. Railway Signal. Vibe K. Spicer, Kenilworth, Ill., assignor to the Union Switch and Signal Company, Swissvale,, Pa. Application filed September 12, 1902.

The signal arm is operated by a motor whose circuit is controllable from the signal tower.

797,787. Negative Electrode for Primary Batteries. David L. Winters, Chicago, Ill. Application filed January 30, 1905.

The negative electrode for primary batteries comprises an active body of copper oxid, and a casing formed of zinc-coated perforated sheet iron.



NO. 797,774.—SERIES-PARALLEL MOTOR CONTROL.

797,806. Arc-lamp Hanger and Cut-out. Charles E. Harthan, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. cation filed April 29, 1903.

Combined with an inclosing shell are an electric switch secured to the inner side thereof and provided with means for transmitting motion thereto, and a removable plate secured to the shell and provided with means for actuating from the outside the motion-transmitting means carried by the switch.

797,811. Watch Demagnetizer. Patrick Kerns, Chicago, Ill. Application filed March 9, 1903.

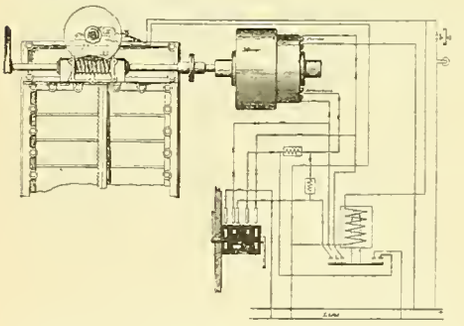
Associated with a solenoid are a pole changer, comprising two wheels each connected with a different side of the same circuit and having contact points, a disk of greater diameter than the wheels insulating the wheels from each other and brushes adapted to alternately engage the contact points of a different wheel but be held out of contact with the wheels by the disk.

797,825. Electric Lamp Socket. Albert P. Seymour, Syracuse, N. Y., assignor to Pass & Seymour, Solvay, N. Y. Application filed April 27, 1904.

Details are described.

797,845. Sheet Metal for Perforated Pockets of Storage Batteries. Thomas A. Edison, Orange, N. J. Application filed July 21, 1904.

Metal sheets for use in the make-up of storage batteries comprise a thin perforated sheet of iron or steel and a nickel coating applied thereto of materially greater thickness than that necessary for the protection of the sheet from electrolysis.



NO. 797,987 —APPARATUS TO CLOSE BULKHEAD DOORS.

797,859. Train-control System. Charles E. Lord, Cincinnati, Ohio, assignor to the General Electric Company, Schenectady, N. Y. Application filed January 27, 1905.

In a system of motor control are a motor controller comprising separately actuated contacts with pneumatic operating means therefor, electric maintaining means independent of the operating means and means for controlling the operation of the operating and maintaining means.

797,860. Train-control System. Charles E. Lord, Cincinnati, Ohio, assignor to the General Electric Company, Schenectady, N. Y. Application filed January 27, 1905.

In a motor-controller of the separately actuated contact type are resistance-controlling series and parallel contacts, with pneumatic operating means, a valve for controlling the admission of air to the operating means, and a pneumatically operated relay for controlling the operation of the valve.

797,863. Syntonic Signaling System. Maurice Milch, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 30, 1904.

Associated with a railway power circuit including a sectional conductor is a high-frequency circuit in parallel therewith. Car circuits are arranged to produce resonant conditions of the high-frequency circuit only when a predetermined number of car circuits are connected to one section of the conductor. A protective device is included in the high-frequency circuit.

797,868. Transformer. Edwin W. Rice, Jr., Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed April 4, 1904.

An air-cooled transformer is provided with a device for automatically closing the valve supplying the air.

797,872. Lamp Fixture. William H. Spencer, Brooklyn, N. Y., assignor to George Frink Spencer, Newark, N. J. Application filed May 23, 1904.

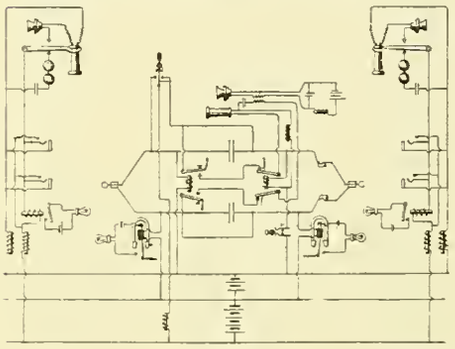
A wire casing for an incandescent lamp is provided with a handle at the bottom and a hook at the top to hang up the lamp.

797,889. Controlling Electric Motors. William Geipel and Frederick M. T. Lange, London, and George W. Mascord, Barnes, England. Application filed November 28, 1904.

A method of controlling shunt-wound electric motors consists in first directly connecting together the armature of a main motor that is to be controlled and the armature of the generator of a motor generator, and maintaining such connection until the motor has attained a speed that corresponds to the full electromotive force of the generator, then changing the connections of the motor and of the generator and placing them in opposition across a source of electric energy and gradually increasing the speed of the main motor until it attains a speed corresponding to the electromotive force of the source of electric energy.

797,907. Fire-alarm System. Judson McFell, Chicago, Ill. Application filed May 27, 1904.

A normally closed circuit includes a high resistance, and normally open signal transmitters are each adapted to transmit a predetermined distinguishable signal and adapted and arranged when actuated to short-circuit the resistance. A signal responsive device in the closed circuit is not responsive to the normal current flow through the circuit but operative by the flow when the resistance is short circuited.



NO. 798,043.—LISTENING APPARATUS FOR TELEPHONE OPERATORS.

797,917. Electrical Meter. Henry W. Sayles, Peoria, Ill., assignor to the Diamond Meter Company, Peoria, Ill. Application filed March 13, 1905.

Combined with an armature are a main field coil, an auxiliary coil disposed adjacent to and outside of the main coil and adjustable in its plane to assume various angles with respect to the main coil and means for securing the coil in any position of adjustment.

797,987. Mechanism for Operating Bulkhead Doors. David W. Taylor, Washington, D. C. Original application filed March 21, 1904. Divided and this application filed September 9, 1904.

The bulkhead doors are opened and closed by electric motors which are controllable from a distant point. (See cut.)

797,993. Automatic Regulator for Electric Circuits. Montgomery Waddell, New York, N. Y. Application filed June 28, 1904.

A dynamo has a principal or exciting coil and a counteracting coil on its field-magnet, the latter coil being wound so as to magnetically oppose said principal coil and the two coils being in parallel with each other. A rheostat is in series with the counteracting coil and means for varying the resistance of the rheostat are supplied. (See cut.)

798,008. Telegraph Apparatus. Henry C. Braun, Barnet, England. Application filed June 20, 1904.

In a telegraph system are transmitting and receiving stations, each provided with a suitably suspended pendulum normally held from movement. Means release the pendulum simultaneously to swing in one direction of movement, and other means impart a common return impulse at the end of such movement.

798,035. Telephone System. Calvin R. Green and David R. Green, Rising Sun, Ind. Application filed December 20, 1904.

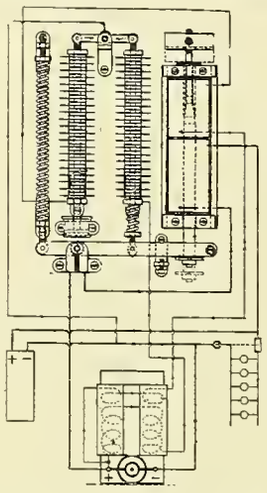
In a system of telephoning using main and party or branch lines is a switch lever with contacts movable with the lever and having connection with, respectively, the main and party lines. Other contacts co-operate with the movable contacts and have connection with, respectively, the ground and the main line. An electromagnet controlls the switch lever for establishing communication between the main and party lines and means lock the switch lever in its moved position. A second electromagnet effects a release of the switch lever to permit it to return to a normal position for interrupting communication between the main and party line circuits when required.

798,038. Apparatus for Electrical Regulation. Albert S. Hubbard, Greenwich, Conn. Application filed June 17, 1904.

Associated with the supply-conductors of a system of distribution is a pair of dynamos the armature of which are placed in other conductors connected to a source of electric supply. Means cause changes of the electrical condition of the system to alter the relative strengths of the field magnets of the dynamos. Controlling coils for an electromotive force generator are placed in the circuits of the dynamo armatures.

798,039. Apparatus for Electrical Regulation. Albert S. Hubbard, Greenwich, Conn. Application filed February 25, 1905.

The system embodies a conductor in a circuit subject to current fluctuations, a pair of dynamos placed in other conductors and connected to a source of electrical supply, a field winding for one of the dynamos receiving the current fluctuations, a third dynamo and a field winding therefor in the circuits of the dynamos.



NO. 797,993.—AUTOMATIC REGULATOR.

798,043. Automatic Listening Apparatus for Telephone Operators' Cord Circuits. Jacob W. Lattig, Wyncote and Charles L. Goodrum, Philadelphia, Pa., assignors to the Eastern Telephone Manufacturing Company, West Chester, Pa. Application filed June 6, 1903.

Means controlled by the answering plug relay connect the operator's telephone set to the cord circuit. Means controlled by the calling-plug relay disconnect the set. Circuit connections are made from the source of energy to the relays controlled in the use of their respective associated plugs. (See cut.)

REISSUE.

12,383. Telephone Selective System. Noble S. McKinsey and Anton R. Nelson, Susanville, Cal. Application filed August 16, 1904. Original application filed March 29, 1904.

In a telephone system are a main wire having a switch at each telephone station, a return wire, a bridge at each telephone station between the main and return wires having therein the secondary winding and ear telephone, a break closed by the opening of the main line and a second break closed by a revolving device, the revolution thereof being controlled by the opening and closing of the main line, only one of the devices making the closure at a time.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on August 28, 1905:

388,430. Galvanic Battery. Abraham V. Meserole, New York, N. Y.
388,442. Underground Electric Conduit. Edward H. Phipps, New Haven, Conn.
388,453. Loop Key. Charles E. Scribner, Chicago, Ill.
388,454. Electric Resistance-measuring Apparatus. Charles E. Scribner, Chicago, Ill.
388,477. Electrical Conductor. William A. Conner, Pittsburg, Pa.
388,481. Telegraphy. Patrick B. Delany, New York, N. Y.
388,482. Dental Electric Apparatus. Charles A. Eisenhart, York, Pa.
388,487. Suspending Overhead Electric Wires. Alfred E. Harris, London, England.
388,512. Electric Motor. Jean T. Van Gestel, New York, N. Y.
388,513. Commutator for Dynamo-electric Machines. Jean T. Van Gestel, New York, N. Y.
388,514. Electric Tram-car. Jean T. Van Gestel, New York, N. Y.
388,538. Traveler or Trolley. Leo Daft, Plainfield, N. J.
388,581. Electric Belt. Harry P. Pratt, Chicago, Ill.
388,583. Electric Meter. Karl Raab, Kaiserslautern, Bavaria, Germany.
388,592. Ice or Refrigerating Machine. John E. Siebel, Chicago, Ill.
388,594. Electric Arc Lamp. Lewis W. Spencer, Hoosick Falls, and Frederick P. Jaquith, Hoosick, N. Y.
388,601. Electrode for Secondary Batteries. Sylvanus L. Trippe, St. Louis, Mo.
388,622. Electric Motor for Self-winding Clocks. Frank W. Brainerd, Chicago, Ill.
388,631. Electric Fire-alarm Signal Box. Sidney A. Chase, Evart, Mich.
388,645. Apparatus for Hardening and Tempering by Electricity. Philip Diehl, Elizabeth, N. J.
388,668. Storage-battery Plate. Charles D. P. Gibson, New York, N. Y.
388,690. Electric Railway-station Indicator. George H. Kirwan, Wilkesbarre, Pa.
388,697. Arc Lamp. John Lea, London, England.
388,707. Electric Meter. Henry G. Morris, Philadelphia, Pa.
388,723. Electric Arc-light Support. Benjamin Schardt and George Jones, Dayton, Ohio.
388,746. Electrode for Storage Batteries. Jean T. Van Gestel, New York, N. Y.
388,753. Electric Motor. John Batley, Philadelphia, Pa.
388,791. Switchboard for Telephone Exchanges. Charles E. Scribner, Chicago, Ill.
388,803. Railway Telegraphy. Granville T. Woods, Cincinnati, Ohio.

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LIBRARY OF ELECTRICAL ENGR.

Recent European Developments in Single-phase Traction.

By C. Smith.

Single-phase railways are rapidly increasing in number in Europe, and there is a general opinion that single-phase traction is the best suited for heavy long-distance railway service there, although in Italy three-phase traction, represented notably by the Valtellina line, has also proved successful and has many advocates. Without going into a detailed discussion of the relative merits of the two systems it may be of interest to review the details of the equipment of some of the more recent single-phase lines constructed on the Continent.

The towns of Neiderschoneweide and Spindlersfeld, Germany, were recently connected by a single-phase electric railway over four kilometers in length, the current being supplied at a tension of 6,000 volts and a frequency of 25 cycles. The overhead equipment on this line is of special interest, two methods of suspension being employed. On some portions of the line a method of single suspension is in use for the overhead conductors, the line being suspended from side bracket arms. In other places double bridle wires are employed. The diagram on the next page (Fig. 4) shows that the wire is supported freely and yet so as to guard against a failure of one of the suspension wires. The trolley wire, in this case, is connected to the bridle wires by short lengths of wire, which are in turn supported by insulated chains from a bar insulated from the bracket arm. The bar below the bridle wire is connected to the metal pole and thence to the rails. If one of the suspension wires should break it would touch this earthed bar, produce a short-circuit and throw out the circuit-breaker protecting the line. This insures great security, and all high-tension apparatus on the car is arranged with the same object, the controllers receiving only current of low voltage.

In order to prevent telegraph and telephone wires from coming into contact with the high-tension trolley wires the latter are surrounded with a wire cage at points of crossing. Especially heavy insulators mounted on a wooden framework are used in those places where the line passes under the ordinary steel-girder road bridges.

The cars are provided with two motors whose capacity varies from 100 to 120 horsepower each. They are of the Winter-Eichberg type, which has been previously fully described in the Western Electrician. To raise and lower the trolley from the wire, compressed air is used. The average speed attained by a train consisting of two motor cars and three trailers, the entire weight being 170 tons, is about 34.4 kilometers an hour.

Ober-Ammergau, well known from its connection with the "Passion Play" that draws thousands of tourists there from all parts of the world, and Murnau, a small picturesque village in the Tyrol connected with Munich by a steam road, are now also connected by a single-phase electric railway which has just been completed and put in operation. The traffic between these two places is considerable and consists of tourists, peasants and hunters. Farm produce is also shipped in large quantities, and special arrangements were made to provide for it.

The River Ammer, rising in the Bavarian highlands, supplies the power, a hydro-electric station having been erected eight kilometers from Ober-Ammergau, where a considerable head is available. There are two turbines installed, each direct coupled to two alternators arranged in tandem on the same shaft, as seen in Fig. 3, which is an interior view of the power house. The single-phase machines which supply current for the railway are nearest the turbines, while the other alternators generate a three-phase current for lighting the surrounding towns.

The single-phase current is fed direct to the line at a pressure of 5,000 volts and a frequency of 16⅔ cycles per second, the return being grounded. The overhead construction varies, but for the most part the wire is single. There are, however, some experimental lengths of multiple suspension, comprising one steel catenary and two copper wires, as seen in Fig. 2.

The variations in temperature up among the mountains are extreme, varying from extreme heat and violent thunderstorms in summer to blizzards and intense cold in winter, the thermometer indicating temperature as low as — 20° F., so that the overhead equipment had to be carefully erected and constructed. Horn lightning arresters are installed on some of the poles, and at first it was noticed that the snow had a great tendency to short-circuit them, but through the special care and caution taken by the engineers in charge of the work—a well-known concern in Berlin—this difficulty has been overcome as well as many other minor troubles, as for instance, the freezing of the lubricants for the car axles and motors.

The general appearance of the trailers and motor cars can be seen in Fig. 1, which shows the type used during the present summer. The motor coaches are mounted on three axles and have a total weight of 26 tons. They have four sections, one second-class compartment, one third-class compartment, a division for baggage and a section for the motorman. They are electrically lighted, and radiators in the secondary circuit provide for the heating on the coaches used during the winter. The diameter of the running wheel is 800 millimeters. The trailers are used only for third-class passengers and are attached to the motor coaches as required.

The current is taken from the overhead wire by two bow collectors mounted on frames on top of the roof and carefully insulated from it. These collectors are kept in position by springs and are raised and lowered by an air cylinder supplied from the brake reservoir under the control of the motorman. Axle-driven compressors supply the compressed air necessary to operate the brakes.

Two 10-pole motors, which are rated at 80 horsepower each and are always in parallel, are geared to the end axles of the motor car through single-reduction gearing with a ratio of 1 to 5.2. They have special windings for reducing the sparking, which are said to work so successfully that the sparking at the commutator is very slight even over a very wide range of speed. If necessary the motors can be arranged to run with direct current. The steepest grade on the road is 1 in 25, and the cars have been started at this part of the line with a load of 50 tons in all. Even when two trains are at the end of the line farthest from the power house the drop in voltage does not exceed six per cent.

From the bow collectors the current passes through a horn lightning arrester, a choking coil and fuse, and down under the car body to an automatic circuit-breaker. The first movement of the controller mechanically closes the switch, which has two electromagnetic trip devices, one being in series with the primary of a transformer and acting as a maximum cut-out, while the other is

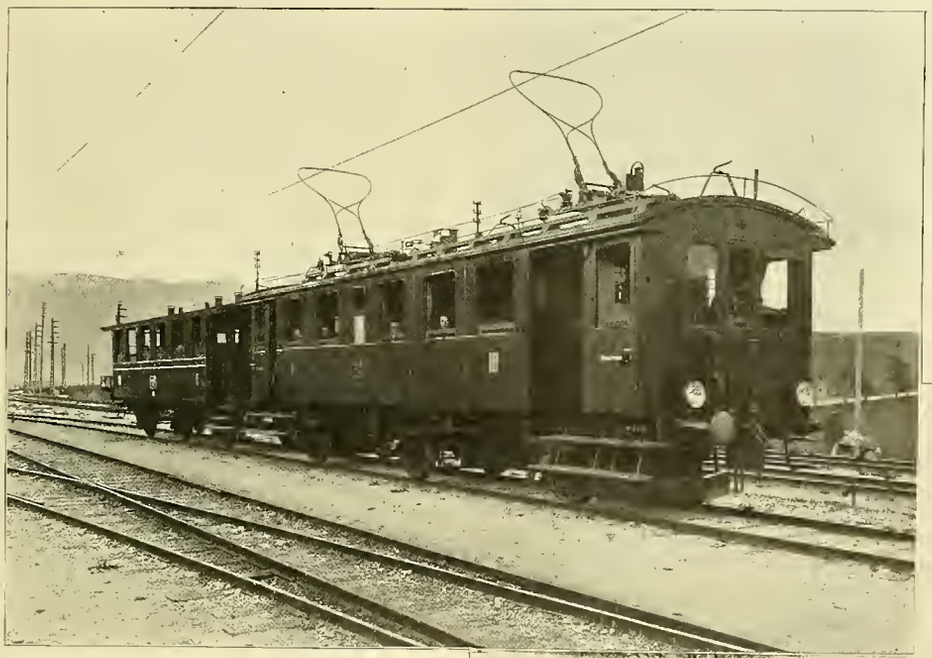

Fig. 1. Motor Car and Trailer on Ober-Ammergau Line.

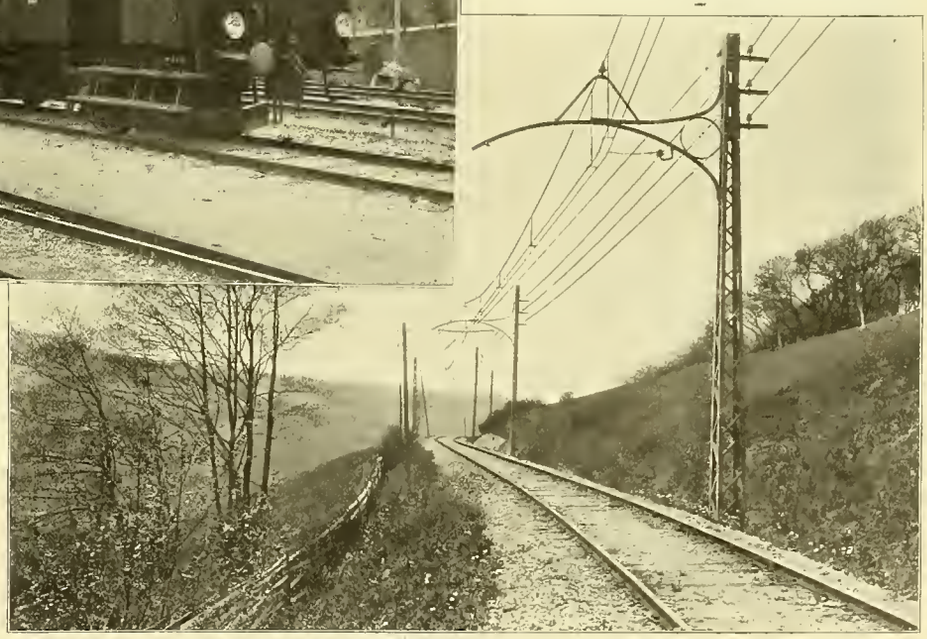

Fig. 2. Multiple Suspension on Ober-Ammergau Line.

RECENT EUROPEAN DEVELOPMENTS IN SINGLE-PHASE TRACTION.

controlled from the motorman's compartment and enables him to operate the principal high-tension switch. Each car is equipped with two transformers, one for each motor, which are enclosed in an iron tank filled with oil. They reduce the tension from 5,000 to 260 volts. The reversing switches have three positions—one for running forward, one for running backward, and the third position is used only when taking the cars into the sheds. For this purpose a special low-pressure overhead trolley line is provided.

The average speed attained is about 40 kilometers an hour when running either alone or with a trailer.

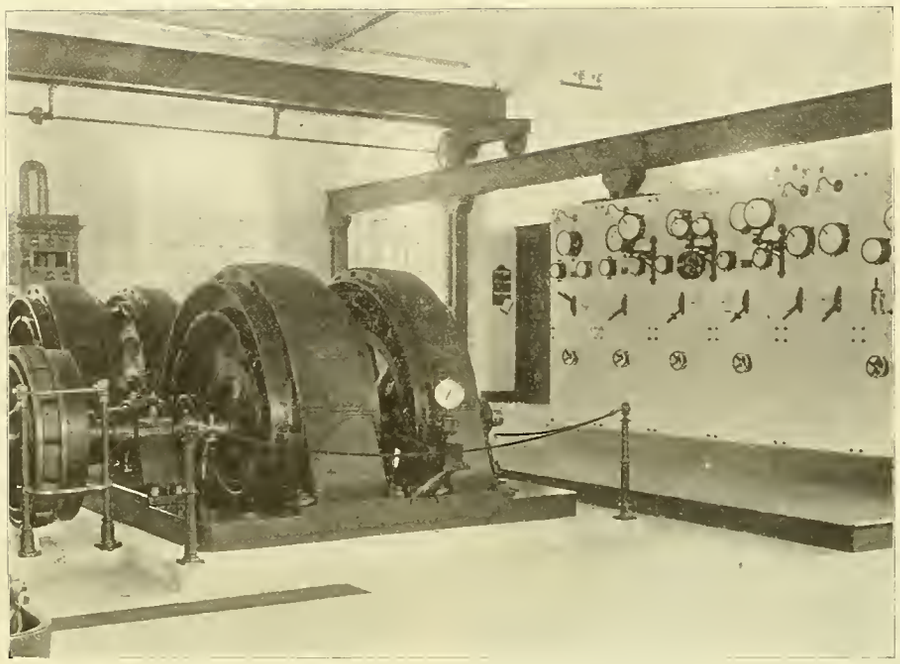

FIG. 3. HYORO-ELECTRIC POWER PLANT AT OBER-AMMERGAU.

A single-phase line of considerable importance has recently been completed between Vienna and Baden. The heaviest gradient is 27.5 per cent. The power station is located two kilometers from Baden and contains two 200-kilowatt alternators supplying a single-phase current at a tension of 10,000 volts; a 165-kilowatt and a 100-kilowatt direct-current machine generating current at a pressure of 550 volts. The high-tension 10,000-volt current is conducted to substations where 110-kilowatt oil-cooled step-down transformers reduce the tension. The cars are mounted on two axles and have four 50-horsepower motors similar in construction to those used on the Murmau-Ober-Ammergau line, being also adaptable to direct current if required. The highest speed attained is 60 kilometers an hour. At present 13 motor cars are used and 18 trailers.

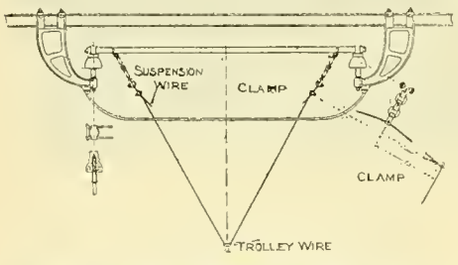

FIG. 4. DOUBLE BRIDLE-WIRE SUSPENSION.

The weight of the former is 18.5 tons, while that of the latter is 10 tons. The entire equipment of the line is very nearly finished, express trains being run regularly at present between the two cities.

Another single-phase line now under construction is that between Hamburg and Altona, which is being equipped by the Siemens-Schuckert Werke and the Allgemeine Elektricitäts Gesellschaft of Berlin, but which has not as yet been completed.

Single-phase electric railways are thus obviously rapidly increasing in number, and those lines which have been in operation for some time have given satisfaction. This argues much in favor of this form of traction, although time alone can decide definitely in its favor.

P. B. McCahey of Little Falls, N. Y., has commenced the construction of the electric power plant at Franklin Falls, N. Y.

Old Time Telegraphers and Historical Association.

The twenty-fifth annual reunion of the Old Time Telegraphers and Historical Association was held on Wednesday, Thursday and Friday of last week at the Waldorf-Astoria Hotel, New York city, when nearly a thousand old telegraphers, many of them very advanced in age, assembled with their wives and families. Meetings of the Society of the United States Military Telegraph Corps were held simultaneously.

At the business meeting on Wednesday morning W. H. Young of Washington, D. C., was elected to succeed John C. Barclay as president of the Old Timers. William L. Ives of the Western Union was elected vice-president and John Brandt of New York was reappointed secretary for the seventh time. Mr. Ives is familiarly called "Senator" both on account of his ability to make a good speech and also on account of the fact that he was formerly operator in the Senate at Washington, D. C. By resolution the meeting commissioned Major E. Rosewater to proceed at once to Oyster Bay and present President Roosevelt a request for an award of pensions to surviving civil-war telegraphers.

On Thursday most of the day was spent in sightseeing, including a visit to Coney Island. On Friday evening a dinner, attended by over 700, was held in the Waldorf-Astoria ballroom, when each guest received a souvenir in the form of a miniature telegraph instrument. This souvenir was an exact reproduction of the instrument now in regular use and was only a little too large to be used as a watch charm.

Melville E. Stone, general manager of the Associated Press, was toastmaster, and in giving "The President" he compared the length of time it required a hundred years ago for the news of the treaty of Ghent to reach Andrew Jackson's army at New Orleans with the 20 minutes or so needed for the news of the Russo-Japanese peace to be sent from Portsmouth to Linevitch and Oyama.

A toast jointly proposed to Robert C. Clowry, president of the Western Union Telegraph Company, and Clarence H. Mackay of the Commercial Cable Company was received with vociferous cheering. A similar demonstration greeted U. N. Bethell of the New York Telephone Company, who remembered the time when it took 10 days for a stage coach to travel from New York to Boston. He also discussed the remarkable growth of the telephone system during the last few years.

Thomas A. Edison was among those who attended the dinner, and there were many requests for his autograph. Mr. Edison, after 40 years, met again "Cam" Culbert of Knoxville, Iowa, who, speaking of Mr. Edison's early days, said: "He was a queer boy, even then. He used to keep me awake at nights explaining how the bed could be made to fold up to make more room, and he objected to kerosene light, which, he said, was not safe to have near the bed. Finally the old man at the office fired Edison because he was always trying to send two messages on one wire at the same time."

Among the many old-timers at the reunion were Charles Selden, now telegraph superintendent of the Baltimore and Ohio railroad; John Horne of Montreal, a former operator but now an art collector; H. A. Reed, who went out of the telegraph business but was glad to meet old friends; Jules S. Lombard of Omaha, Neb., now 74 years of age, and the oldest operator in the service; Joseph S. Greene of Philadelphia, who still handles the key and who, with W. A. Sheldon, was full of stories of telegraphy in the days of the civil war. Others prominent in the gathering were Frank A. Munsey, who left telegraphy for journalism; Jerome Hill, who abandoned telegraphy for cotton spinning, and T. W. Goulding, superintendent of the Western Union office in London, England.

Some Notes on the Use of Barriers in Alternating-current Switchboard Construction for Potentials Below 4,000 Volts.[1]

By H. L. Wallau.

It is my desire briefly to point out some of the advantages of barriers in the construction of switchboards for alternating-current potentials above 500 volts, illustrated by personal experience.

The chief function of the barrier is to be the proverbial ounce of prevention. Its use clearly is not to make line short-circuits and grounds impossible, but to minimize the destructive effect of these at the switchboard by localizing it when they cannot absolutely prevent it, and in this way to help maintain to the higest degree possible that continuity of service so essential to the commercial prosperity of any central station.

Let us consider some of the laws of current flow which govern grounds and short-circuits.

1. When a current flows through a circuit containing inductance energy is stored in the line by virtue of the magnetic field produced by that current. If the electromotive force producing the current is suddenly removed, the stored energy must be returned to the supply circuit before the current can stop. This action generates momentarily a potential higher than normal. This potential is in such a direction as to continue the current flow.

2. When a sudden rush of electricity encounters in its path a choke coil it experiences great opposition for an instant. This opposition, if the current be sufficiently great and practically instantaneous, will cause a very high voltage back of the choke coil, which tends to short-circuit it and sideflash. After the first instant the coil will allow current to flow through it at an accelerating rate, thus relieving the pressure.

3. When a condenser discharges suddenly into an inductive circuit of low resistance practically all of the charge is stored as magnetic energy. This, in turn, on cessation of the condenser current restores to the condenser almost the entire original charge, and so an oscillatory discharge takes place until all of the energy has been dissipated in overcoming the low resistance of the circuit. The condenser, therefore, oscillates between zero and double potential, gradually assuming the potential of the circuit.

Now, all conductors have electrostatic capacity, or are condensers. Lines have capacity between wires and between wires and earth. If transformers are connected to the lines, these have capacity between primary and secondary coils and between coils and core. If the secondaries are grounded, as is common practice, a large charge may be induced in the primary coils without greatly raising their potential. All lines also have inductance, and with transformers in circuit this may be quite considerable.

Assume a single-phase line with any given potential between wires. Both wires have the same electrostatic capacity to earth and an electrostatic capacity to each other. At any instant there is a definite potential at any point of the circuit, and each conductor carries a definite charge, due to its electrostatic capacity to earth and to the other conductor and to the potential at that instant.

Since the potential is alternating, this charge flows backward and forward through the generator with the same frequency as the electromotive force and is properly known as the charging current of the line. In long lines of high voltage this becomes a large quantity, and the energy absorbed by and restored to the circuit every quarter alternation becomes a very important item.

Suppose one wire becomes grounded. What results? The potential of the grounded wire suddenly becomes zero, while that of the other is full line voltage, or double is value with reference to earth under normal conditions. The difference in potential between wires remains unchanged. The charges on each wire due to electrostatic capacity to the other remain unchanged. The charge due to earth on the grounded wire bcomes zero, while that on the ungrounded wire is doubled. This charge, being produced by the generator, must flow to earth at the grounded point. In other words, sufficient current flows at the grounded point to maintain it at the earth's potential. And this current is a condenser current discharged in an inductive circuit of low resistance and is oscillatory in character.

Grounding, therefore, causes a sudden rush of current and also a sudden rise of potential, which may be further intensified by opposition from a

1. Paper read before the Ohio Electric Light Association at Put-in-Bay, Ohio, August 16, 1905. Mr. Wallau is assistant electrician of the Cleveland Electric Illuminating Company.

choke coil in circuit, and a side-flash more or less destructive may follow.

A short-circuit is governed by the same laws. Suppose both wires ground; a short-circuit results. We then have a sudden large volume of current flow, limited not by the charges on the conductors, but by the short-circuit currents of the generators supplying the line.

If this sudden current encounters a choke coil a side-flash may result. Suppose it does not, the current flows at an accelerating rate through the coil into an inductive circuit, storing a large amount of energy in magnetizing the circuit.

The fuses blow. All of the energy stored in the

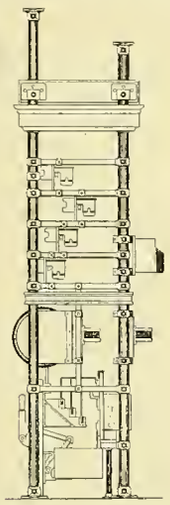

FIG. 1. END VIEW OF 2,300-VOLT SWITCHBOARD.

circuit must be returned before the current can cease flowing. This energy is equal to one-half of the product of the inductance of the circuit by the square of the current flowing. The potential piles up and breaks down the gap in the circuit caused by the blowing of the fuses, and, once broken down, the generator potential is ample to maintain the arc, which can now be extinguished only by shutting off the generator current.

Just how destructive to a switchboard such short-circuits may become can best be illustrated by reference to some troubles that developed on a three-phase 2,300-volt switchboard, without barriers, coming under my personal notice.

In Fig. 1 is shown an end view of this board as originally built. This is self-explanatory. The generator capacity connected to this board directly or through tie switches is 5,000 killowatts, of which

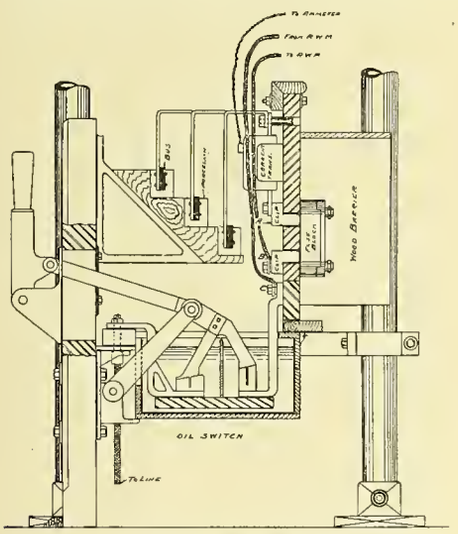

FIG. 2. CROSS-SECTION OF SWITCHBOARD AS ORIGINALLY BUILT.

from 1,000 to 5,000 kilowatts is liable to be in circuit at any time.

The feeder section consists of 17 three-phase panels, cut up into groups of five or six through tie switches. Some of these are lighting and some power feeders. The average load per feeder is from 175 to 200 kilowatts. The power factor varies from 90 per cent. on lighting to 65 per cent. on power feeders.

Having outlined the operating conditions, let me draw your attention to Fig. 2, showing a section through a feeder panel as originally installed.

You will note that the current leaves the bus to flow through the series bar of the current transformers supplying the indicating ammeters, thence into a fuse clip through an aluminum fuse mounted in an expulsion type of block, from which it loops in wire through the series coils of the recording wattmeters shown in Fig. 1, returning to one side of an oil switch, through which it passes to the line.

Now let us consider the effect a heavy short-circuit on the line would have on this switchboard.

The short-circuit comes on; a sudden rush of current takes place. The current transformers offer but little impedance to the flow, the fuses none, but not so with the series coils of the recording wattmeters. These very effectually choke back the current and allow a high potential to accumulate. This potential side-flashes and short-circuits the series coils of the meters. A heavy arc is established and holds, vaporizing the metallic parts at these points, and coating the marble panel with metallic copper deposits. Meanwhile the fuses blow. The magnetic energy now stored in the line is restored to the generating circuit with a sudden rise of potential. The conducting vapors due to the arcs below enable this potential readily to jump, and this is followed by short-circuits between phases at the back of the fuse panel.

The vapors generated continue to be deposited on adjoining panels until all the panels of one group have been more or less fouled by copper deposits, and several panels are blazing away. All this happens before the operator can open the tie switch, making that section of bus dead.

Before this section can be put in operation again, all of these fuse panels must be removed, the panels thoroughly cleaned of all copper deposit, meter leads inspected, etc.

It may seem strange to some that the series coils of the meters could possibly have such a large choking effect. It is well to recall in this connection that this effect is proportional to the square of the number of turns and to the rate of change of the current value in the circuit.

As a further proof of their choking effect, I may

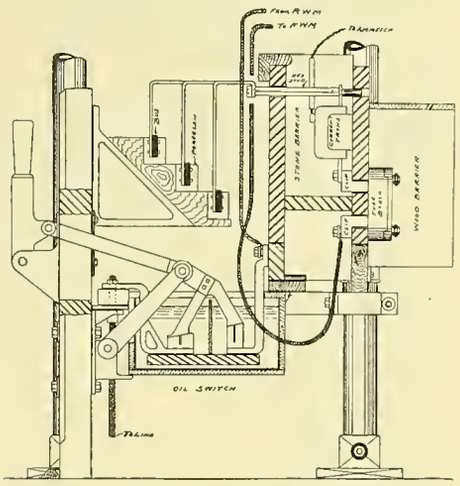

Fig. 3. Cross-section of Switchboard after Barriers Were Added.

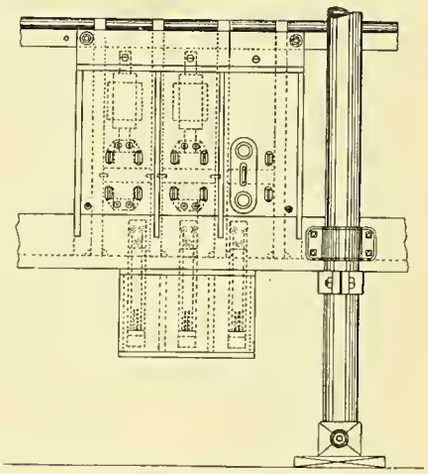

Fig. 4. Rear View of Switchboard; Barriers Shown by Dotted Lines.

SWITCHBOARD BARRIERS FOR LESS THAN 4,000 VOLTS.

add that if the short-circuit current passed through the meters, its volume would cause a very appreciable demagnetization of the drag magnets, and the meters would run fast. The fact that these meters seldom need recalibration after a short-circuit of this character shows that only a small part of the short-circuit current could have passed through them.

Naturally, short-circuits as destructive as the one described were not common occurrences, and with identical line conditions the effect at the switchboard would be very different with 1,000 kilowatts connected to the bus and with 5,000 kilowatts in operation.

In fact, instances of trouble of this kind become more and more numerous as stations grow, partly due to a larger territory for line short-circuits to develop in, but principally due to the increased short-circuit current available with increased generator capacity.

These troubles were remedied by the use of barriers. Figs. 3 and 4 show how this was done.

The panel supporting the fuse clips and current transformers was moved back a little over six inches. In its original place a panel of alberene soapstone was installed, perfectly blank, except for three holes at the top, through which hexagonal studs connect the bus straps to the upper end of the series strap of the current transformers.

Vertical barriers of the same material were installed, so that each polarity has a compartment by itself, and, furthermore, three horizontal barriers were installed between the fuse clips themselves.

The result has been entirely successful. Since their installation several of the heaviest short-circuits the operators ever noted came in on a highly inductive power feeder. The only damage done was the charring of the cherry barriers on the fuse panel, the coating of the exposed face of this panel with a deposit of aluminum oxide, due to the fuses blowing, and a slight burning of the extreme ends of the fuse-clip blades right at the outer surface of the panel.

After the trouble on the line was cleared new fuses were inserted in the blocks, and these put in the same clips again. At an opportune time the panels were cleaned.

I do not wish to imply that all 2,300-volt switchboards without barriers would be affected by short-circuits as this one was; but in this connection it must be remembered that this board was installed in 1898, before oil switches were manufactured for general use, at a time in fact where there was no three-phase experience to draw upon. The oil switches had to be designed locally, and the general design of the frame of this board was made to correspond with a direct-current board of which this is a continuation. The clearances between fuse clips, etc., were ample for the units originally installed.

There may, however, be some plants in which switchboards that are a trifle antiquated may be remodeled in a similar manner and made good for many more years.

A word as to material: Soapstone is undoubtedly the best for barriers. It is very tough, can be sawn into very thin slabs, can be cut and drilled with perfect accuracy, and, lastly, is absolutely non-absorbent. This property makes it possible absolutely to clean off any dirt, oil or other deposit—a feature more and more valuable as higher and higher potentials are used.

If the information that it has been my privilege to give you in this connection proves of assistance to anyone, I shall feel amply repaid for my effort.

Increased Assessments in Indiana.

According to the report of the recent session of the Indiana State Board of Tax Commissioners the interurban electric-railway assessment in that state has increased from $13,702,394 in 1904 to $15,452,321 in 1905, the increase being $1,749,927. The increase may be said to be due to the increase in mileage from 993.17 last year to 1,135.56 this year. Two of the items that make up the total interurban assessment were reduced, one being that on improvements on right-of-way, reduced from $769,655 to $756,830, and the sidetrack assessment from $91,462 to $87,905. The largest increase was in the main-track assessment, which was raised from $11,872,265 to $13,088,035, an increase of $1,215,770. Rolling stock was increased $41,259, or from $1,386,772 to $1,428,031.

Owing largely to the increased mileage of the many telephone companies, the increased assessment on telephone property amounts to $575,586, the figures for 1904 and 1905 being $7,296,922 and $7,872,508, respectively.

The total assessment for the three telegraph companies in Indiana is $2,258,805, an increase of $375,774 over last year. The largest increase comes in the Western Union and is $373,936.

Electric Searchlight on Pike's Peak.

What is said to be the largest searchlight in the world was put in operation on the summit of Pike's Peak on the night of August 29th. Current is furnished by a dynamo operated by a gasoline engine on the summit of the mountain. The lamp is built upon a track 120 feet in circumference, with rotating contact, and its light is said to carry 280 miles, this radius including the Kansas-Colorado state line, the Royal Gorge, Denver, and the Cripple Creek gold fields. David Jones planned the gasoline engine which is used, the construction of which, to operate successfully at that altitude (14,147 feet), involved unusual difficulties. Pike's Peak is a great resort for tourists, and the searchlight will add to its attractions.

Some Methods of Party-line Signaling.

By Charles H. Coar.

One can consistently say that the many different opinions regarding party lines and the results effected in the exchange service where such lines are in vogue are to a large extent due to defects in working qualities of former selective signaling apparatus. Reference is made particularly to central-energy systems having party lines over which it is possible to ring the bell of any subscriber without actuating the bells of the remaining subscribers on the same circuit. From a multitude of patented schemes, mention is made of the following

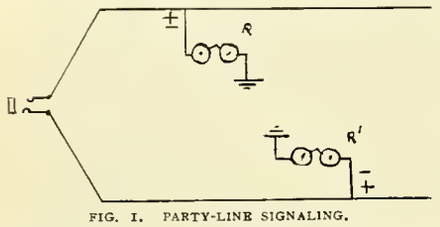

FIG. 1. PARTY-LINE SIGNALING.

methods that have been utilized to accomplish selective ringing:

(A) By placing a common polarized ringer on each limb of a metallic line, as shown in Fig. 1, and ringing the same with alternating current, using the earth as a return.

(B) By using polarized ringers, as shown in Fig. 2, which are adjusted by spring or otherwise in such manner that they respond to certain predetermined current impulses, either positive or negative, over each limb of a metallic line, using the earth as a return.

(C) By associating the ringers, as shown in Figs. 3 and 4, in conjunction with polarized relays, which are actuated by pre-determined current impulses, thus closing contacts which close the bell circuit proper.

(D) By associating ordinary polarized ringers, as shown in Fig. 5, in conjunction with impedance coils in such manner that the bells are operated by currents of different frequency.

(E) By using specially constructed ringers, reference being made to the length and weight of the armature and striking rods, as shown in Fig. 6, across the two limbs of a metallic line, where they are operated by currents of different frequency.

The operation of the signaling in the systems

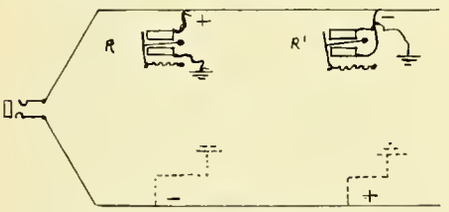

FIG. 2. PARTY-LINE SIGNALING.

outlined in (A) and shown in Fig. 1 is successful as could be desired, and in consideration of the fact that most central-energy systems have condensers in series with the ringing coils, it can be readily seen that the installation of such a scheme in exchanges already equipped otherwise would not involve any great amount of labor or expense. In the switchboard circuits of most systems it would necessitate the installation of a special ringing key unless the original key could be altered to ring on both the tip and ring conductors separately. The ringer at the instruments would require a ground locally. It is possible to ring two parties selectively in an arrangement of this kind, but it has the disadvantage of grounding the lines through the ringer coils, thereby making the circuit susceptible to foreign current or noise.

The systems designated in (B) and shown in Fig. 2 have proven quite reliable, especially so in magneto exchanges or in any other system wherein condensers are not applied in series with the ringers.

The arrangement as shown in Fig. 2 is such that two polarized ringers (R) and (R') are connected to each limb of a metallic circuit, (R) being so connected as to respond to positive impulses and (R') to negative impulses. On the armature of each ringer is a small rod extension, which engages a tension spring, the purpose of which is to hold the armature stationary by aiding any current impulses passing through these coils which are opposite the polarity impulses operating them. Thus, in the (R) ringer, which is adjusted to respond to positive impulses, the tension spring would tend to aid the negative impulses passing through this ringer in holding the armature stationary to one particular coil. The same would hold true with the (R') ringer.

The application of a condenser in series, with ringer adjusted and connected to operate selectively by current impulses, has the disadvantage of actuating at times the ringers adjusted to operate with currents opposite those being transmitted over this particular limb of the line for ringing purposes. Erroneous signaling of this description can be due to condenser discharges. For example, we will presume that on one limb of a metallic line there are two telephones with polarized ringers adjusted to respond to positive and negative impulses separately, utilizing the earth for a return. Now at the time the positive impulses are being transmitted to operate the positive ringer, the condensers in series with the ringers will discharge themselves at the cessation of these impulses in an opposite direction, negative, which would have a tendency to operate the ringer adjusted for negative impulses. The impulses were transmitted to the line. The discharge of long lines or cable conductors, also earth currents which may be collected at the ringing grounds or telephone earth connections, can effect the ringers of such systems. From this it would seem that a proper tension would have to be maintained on the armatures of the different instruments if satisfactory signaling be desired. Some of these features could be obviated by employing a common ringing return, which would also tend to improve the talking service in most instances, because of the absence of earth noises.

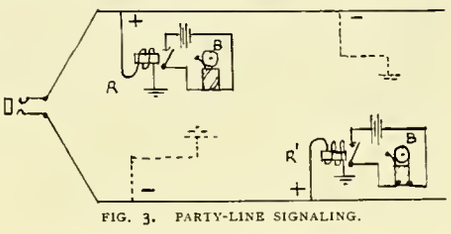

FIG. 3. PARTY-LINE SIGNALING.

Four subscribers can be rung selective in systems of this kind, but in case a subscriber removed his receiver at the time ringing impulses were being transmitted over the line, two bells would be actuated, because these impulses would find a circuit from one limb of the circuit they were being sent out on to the other limb through the subscriber's receiver circuit.

In the arrangement shown in Fig. 3 polarized relays are connected from each side of a metallic line to earth, where they are operated by a steady flow of current, depending on which direction this current is flowing through their windings. These relays, as shown, close a local circuit containing a battery and vibrating bell, which furnish the signal. The operating current can be transmitted to the line by means of a pole-changer and special key or by a special key alone arranged in conjunction with the regular ringing keys.

The vibrating bells ring only at the time that the relays close their contacts; therefore, it is possible to arrange a code of signals if it become necessary. The relay ground connection can be cut off when the switchhooks are raised if it is so desired. A system of this kind readily adapts itself to magneto exchanges, but has the disadvantage of necessitating more local batteries to maintain it.

Another method which employs a relay in conjunction with a bias ringer is shown in Fig. 4.

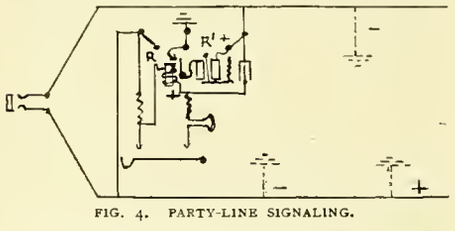

FIG. 4. PARTY-LINE SIGNALING.

In this circuit it will be noticed that the relay (R) is connected to both limbs of the line through a condenser, and also that the bias ringer is so connected in relation to the relay that it is placed into circuit with the ground when the relay attracts its armature. The relay is operated by the polarity impulses used in ringing the bias bells. In the arrangement shown, as soon as positive pulsating current is sent over the tip of the line it causes the relay (R), which is constructed to operate by this current, to attract its armature, thus closing the bell circuit (R') to ground. The current flowing through the relay completes its circuit over the ring conductor of the line to the office generator ground, but as the ringer circuit is closed the larger portion of these impulses flow through the ringer coils to the earth, and thus back to the office ground. This flow causes the signal. It is readily seen that the relay and bell proper are thus operated in multiple by the same identical impulses, and in order that the bell coils furnish the path for the larger portion of this current they are wound to 2,500 ohms resistance, while the relay winding has 2,400 ohms resistance, in addition to the resistance of the condenser in series with it, possibly some 5,000 ohms. The current impulses flowing through the relay winding have

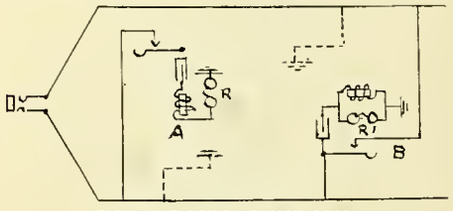

FIG. 5. PARTY-LINE SIGNALING.

also to overcome the impedance of the primary winding of the induction coil, so that in all the current flowing through this path is very small, in fact just enough to operate the relay.

This system necessitates the apparatus at the subscriber's station being rather complicated, because each station is required to have a relay in addition to the bias ringer of the previous arrangement, but the lines are free from grounds, except at the time of ringing, which was the point most sought for.

There are many ingenious methods of accomplishing selective signaling which are similar to the above described, although the larger number of such systems have rather complicated apparatus. Some systems of this class employ current impulses to operate four subscribers' bells, as already explained, in conjunction with other subscribers' bells which are on this same line and in multiple with both line wires and the earth; others are placed in multiple across both line wires.

There are systems which have no spring adjustments, relays or extra contacts, in which the ringers require no extra adjustments to meet all ordinary line conditions, and in which a condenser can be placed in series with the ringer coils, if necessary. One method worthy of notice in this class is shown in Fig. 5, which employs two bell circuits on each limb of a metallic line, using the

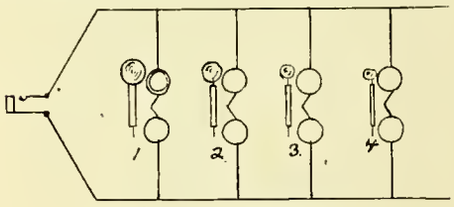

FIG. 6. PARTY-LINE SIGNALING.

earth for a return, one bell being so arranged that it will operate by currents of low frequency, and the other by currents of high frequency. A high and low-frequency bell is connected to each limb of the metallic line, thus allowing four subscribers to be called selectively. This system should not be confounded with the step-by-step systems in which a combination of different frequencies and strengths is employed. To prevent entirely erroneous actuation of the bells, currents whose frequencies vary widely with each other are preferably chosen. The low-frequency current is in this instance generated by a two-pole machine running at 1,200 revolutions per minute, while the high-frequency current is generated by a two-pole machine running at 3,600 revolutions per minute, or by a six-pole machine running at 1,200 revolutions.

In Fig. 5 the low instruments are marked (A), while the high-frequency instruments are designated by (B), and one such set is applied to a line if two calls are desired, and by arranging a set to each limb of the line and earthing, four selective calls are availabe. In the (A) instruments an ordinary polarized ringer is used, which is connected in series with an impedance coil and condenser, so chosen with relation to the resistance of the ringer that the high-frequency current is effectually blocked by the impedance coil, thereby allowing the (A) bell to remain at rest. However, when a low-frequency current is impressed on the line, the impedance coil offers but little resistance to this current, thus allowing the (A) bell to be actuated. In the (B) or high-frequency instruments the ringers are connected in parallel with an impedance

coil, and a condenser is placed in series with this group. Now when a low-frequency current is impressed on the circuit the condenser in the (B) instrument, being of much smaller capacity than the one in the (A) instrument, allows but little of the low-frequency current to flow through it to the impedance coil and ringer multiple. At this point the small amount of current which flows through has two paths provided for it to flow over, so that it is weakened sufficiently enough not to cause the (B) bell to ring. Now when the high-frequency current reaches the (B) instrument, the condenser in series with it offers but little resistance to this current; therefore, it flows to the multiple composed of the impedance coil and ringer, where the impedance coil chokes or prevents a flow of high-frequency current through it, thus causing the flow to occur through the ringer coils and actuating the bell.

In many instances the generators which are commonly employed in exchanges for ringing purposes could be utilized to furnish the low-frequency current, and by simply arranging a six-pole generator to the same driver shaft the high-frequency current could be obtained. A 60-cycle alternating current can be utilized for the high-frequency current if it is available, thus doing away with one generator.

Other satisfactory systems of selective signaling operate on the frequency plan, but use as adjustments armatures and striking rods of different weights and lengths for the different frequencies. Fig. 6 will give some idea as to the general arrangement or theory of such systems. At the central office there are four generators which supply four currents of different frequency for ringing purposes. In such systems the motor used to drive the ringing generator is usually equipped with some arrangement of automatic control, thus insuring that the proper frequency be delivered by each generator.

Using Fig. 6 for further explanation, the bell (1) would be actuated by the lowest frequency, say 1,000, because its armature and striking rod are heaviest; the next bell (2) would be actuated by a more rapid frequency, 2,000; the next bell (3) by a frequency of 4,000, and bell (4) by a frequency of 8,000. These are, of course, just comparative figures, and should not be taken to represent any special system.

[*Continued on page 201.*]

Block-signal System for Electric Railways.

In single-track electric railways where turn-outs are located at intervals along the way it is desirable to place signals at such points to indicate to the motorman upon entering the turn-out whether or not the section immediately ahead is clear. Also in double-track systems where a blocking system is used some system of signalling must be employed. A block-signal system adaptable to either of the above cases was recently patented by Messrs. Frank R. McBerty of Evanston and Malcolm E. Launbranch of Chicago, Ill., and assigned by them to the Western Electric Company. Fig. 1 is an elevation of the operating parts of the device, the cover of the containing case being removed.

As applied to single-track systems the invention embodies a pair of semaphore signals, one at each end of the block, normally resting in danger position, with means operated by a car entering the block for causing the block signal at that particular end to indicate whether a car is on the block or whether it is clear. Each of the semaphores is under the control of electromagnetic mechanism, and a car entering upon the block, in case it is clear, will cause the block signal at that particular end to display a clear signal or go-ahead signal. The operation of either block signal to display a go-ahead signal serves to render the semaphore at the opposite end of the particular section of track unresponsive to a car entering the track from that end, so that in case the operator of a car should disregard the danger signal displayed and should attempt to enter the track he would be unable to operate the semaphore to obtain a clear signal, and would thus be doubly warned of the use of the track. The car in leaving a block operates mechanism for restoring the semaphores at both ends of the block to their normal condition.

In the preferred form of the invention a pair of magnets are arranged to govern step-by-step mechanism controlling the circuit of the semaphore-operating magnet. A car upon entering the block at one end, in case it is clear, operates a switch which completes a circuit, including one magnet of the pair, which operates the step-by-step mechanism in such a way as to complete a circuit for the semaphore magnet. The magnet upon being thus energized moves the semaphore arm to display a safety signal. Each of the semaphores may carry two lenses of distinctive color—one to indicate "safety" and the other to indicate "danger"—and the danger lens may in the normal position of the semaphore lie in front of a signal lamp. The completion of the circuit by the trolley switch for the magnet controlling the step-by-step mechanism brings about the illumination of a lamp at

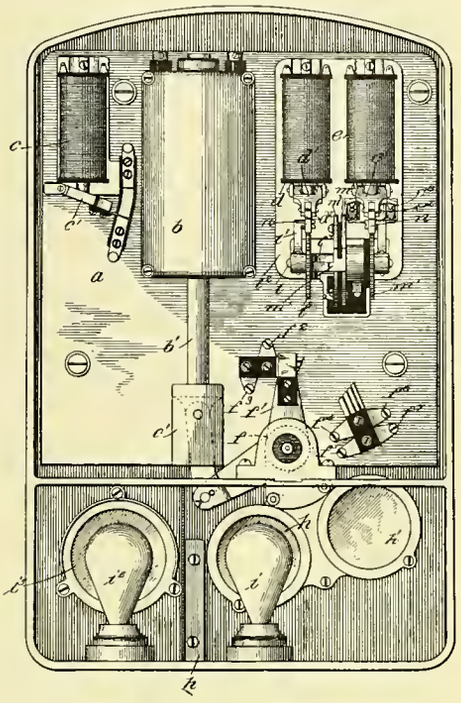

FIG. 1. OPERATING PARTS OF BLOCK-SIGNAL SYSTEM.

the distant block signal, and as the semaphore at that end is not operated the lens of the semaphore normally in front of the lamp is illuminated, thereby displaying a danger signal, the signal remaining displayed until the car leaves the block. A circuit for the corresponding lamp at the first block signal is completed by the semaphore arm in its movement, the arm in its movement bringing the safety lens in front of the lamp to give a clear or "go-ahead" signal. As the car leaves the block at the opposite end it operates a switch which serves to complete a circuit for the second magnet of the pair first referred to, which operates the step-by-step mechanism to open the circuit for the semaphore-controlling magnet, so restoring the normal condition of the apparatus at both ends of the block.

Fig. 2 is a diagram illustrating the circuit connections as applied to a single-track system. When a car traveling in the direction toward the right arrow reaches the switch (p) at the far end of the block where the signal (A) (not shown) is located, it moves the switch lever (p) into engagement with the contact (p), whereupon a circuit is completed from the trolley wire at that end of the block to energize relay (d) of the signal (A). The magnet (d) being thus energized draws up its armature (d'), causing the pawl (d^3) to advance the ratchet wheel (l^4) and move the finger (m^5) forward upon the insulation (m^4), whereupon the circuit (1) (2) (4) (7) (8) (9) (6) (3), including the solenoid, is broken, thus de-energizing the solenoid (b) of the block signal (A^1) and the magnet (c) of the block signal (A) at the other end of the block. The core of the solenoid in moving back to its normal position causes the arm (f') to reconnect contacts (f^2) and (f^3), and open the circuit through the magnet (c), which allows its armature to fall back, completing the circuit of conductor (2), which includes the lamp (i^2). The magnet (c) of the block signal (A) also allows its armature to fall back, restoring the normal circuit through the lamp (i^2) of such block signal.

It will be noted that whenever a car enters the block at the end where the block signal (A^1) is located a danger signal is displayed at the block signal (A) at the distant end of the section of track in question, and if the car approaching from the right toward the block signal (A) should attempt to enter upon the block, disregarding the danger signal displayed, the closing of the switch lever (p) against the anvil (p^2) could not operate to close a circuit for the magnet (e) of the block signal at that end of the section track, and thus permit the semaphore arm to move to a safety position, because such circuit would be open at the contacts (f^2), (f^3), controlled by the solenoid at block signal (A^1), and the operator of such a car would be doubly warned of the car coming toward him.

In order to prevent two cars which may enter a block or section of track from different ends at approximately the same time from both getting the safety signal by each completing a circuit through the solenoid (b) at the block signal at the end where such car enters, the magnet (e) is made "quick-acting" and the back contacts (e^7) and (e^8) are provided for the armature, so that the instant the armature begins its attracted movement the circuit including the contacts will be positively opened. Thus the first car to enter the block from either end will, by closing the switch (p) and energizing the magnet (e) of the block signal associated with that end of the track, render it impossible for a car attempting to enter the block from the opposite end an instant later to complete a circuit for the magnet (e) of the block signal at its end of the section, and so get the safety signal, for the circuit of such magnet will be open at the back contacts (e^7) (e^8) of the corresponding magnet (e) at the block signal at the distant end of the section, if such circuit is not already open at the contacts (f^2) (f^3), controlled by the arm (f') of the block signal.

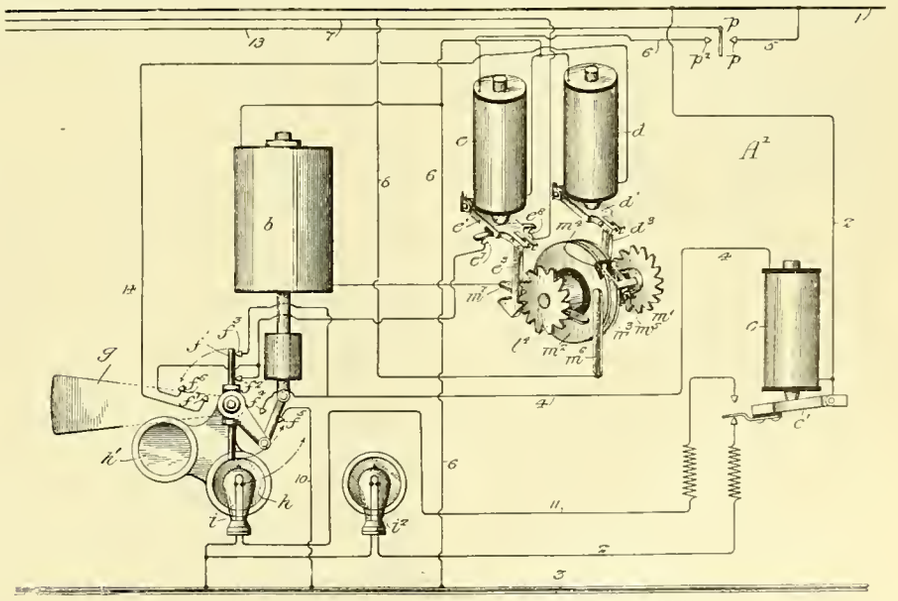

FIG. 2. DIAGRAM OF CONNECTIONS OF BLOCK-SIGNAL SYSTEM.

Articles of incorporation have been filed for the Sioux Falls Interurban Electric Railway Company at Sioux Falls, S. D. The capital is $500,000, and the purpose is to construct an electric line from Sioux Falls to Salem, a distance of 40 miles. The incorporators are R. F. Brown, J. P. Bleeg, Eugene Saenger, G. W. Abbott and George W. Pettigrew.

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DATES AHEAD.

Association of Edison Illuminating Companies (annual convention), Hotel Champlain, Bluff Point, Lake Champlain, N. Y., September 12th, 13th and 14th.

Colorado Electric Light, Power and Railway Association (annual convention), Glenwood Springs, Colo., September 18th, 19th and 20th.

American Electrochemical Society (general meeting), Bethlehem, Pa., September 18th, 19th and 20th.

American Electrotherapeutic Association (annual meeting), Academy of Medicine, New York city, September 19th, 20th and 21st.

American Street Railway Association (annual convention), Bellevue-Stratford Hotel, Philadelphia, September 25th to 29th.

Illinois State Electric Association (annual meeting), Peoria, Ill., October 5th and 6th.

CONSIDERABLE attention has been attracted by the new Uviol lamp developed by Dr. Zschimmer in Germany. Although the lamp has been previously referred to in the Western Electrician, opportunity is taken in this issue to give some further details in an article by Dr. Alfred Gradenwitz, and also to give illustrations showing the lamp and the effect produced by its rays when used as a therapeutic agent. The lamp, in principle, conforms closely to the ordinary mercury-vapor lamp, its peculiarity lying chiefly in the construction of the glass tube, which is pervious to ultra-violet rays.

MUNICIPAL and government telephony is practically non-existent in this country, although there are some municipal exchanges across the border, in Canada. However, in view of widespread discussion of the whole question of public ownership, it is of considerable importance to study the lessons to be drawn from the experience of Great Britain, where there are at present a great private company and the telephone service of the government Postoffice Department. We have already made various references to the existing situation and the future take-over of the private company's system, which has been arranged by the government, and in this issue we give a review of the condition of affairs, telephonically, in England, from the pen of our London correspondent. It is to be noted that the passing of the telephone agreement by Parliament, in the face of the recommendations of the committee which considered it, has caused considerable discontent and uneasiness on the part of those municipalities owning telephone systems. The number of municipalities which applied for licenses after the passing of the Telegraph Act of 1899 was so small as to preclude any hope on the part of the government that the telephone system of the country could ever be efficiently dealt with by a large number of small local systems in separate hands. The claim of the local authorities that they were led to believe they would be granted certain privileges, such as the extension of their present licenses after their expiration, is hardly borne out by facts. At present they have their licenses on the same terms as the company, and while on the one hand they seek the utter extermination of the company on as cheap terms as possible, they desire, on the other, that they shall receive some special preferential treatment when their franchises expire. At present the fate of municipal telephony in Great Britain seems to be sealed. Certainly it is an extravagant claim to suggest that municipal telephony was founded upon vague promises that it would be extended and facilitated when the company's license expired.

IT IS OF constant interest to observe how the lengthening and developing electric railway is approximating steam-railroad practice in many features of operation, administration and business promotion. We have before us the "folder" of a 44-mile electric railway in New York state that, considered in this respect, is an interesting piece of advertising literature. The territory served is described, with attractive pictures of the towns along the route or of scenery to be observed. Convenience of train service is emphasized, and there are maps and timetables to aid the traveler. Some of the electric trains are "limited," stopping only at important points; others are "local," stopping at all stations. Time-tables of connecting railroads and steamboat lines are given. Various pleasant excursions, with round-trip fares, are outlined. Rates of fare from the terminal points to all stations are given; also location of stations and waiting rooms and their telephone numbers. Under "General Information" it is stated that unused portions of tickets will be redeemed. No stop-overs are granted. Children under 10 years of age are carried free. Mileage books, good for 100, 500 or 1,000 miles, are issued. The price of the last-named is $12; the regular fare for the whole 44 miles is 70 cents, with round-trip rate of $1.25. The mileage books are good until used, by any person, and are issued with substantially no conditions, except that they are not good for local fares in cities traversed and that not less than four miles must be detached for any one fare. Commutation tickets are also sold. Dogs accompanying passengers are transported in smoking compartments or motorman's cab for a flat rate of 15 cents. The company maintains a Lost Article Department, and in each station will check parcels for a uniform fee of five cents. Special cars may be chartered. Instructions are given how to signal trains at regular "stops" both at night and by day.

The company which issues this folder says that its aim is "to give to the traveling public an up-to-date, accommodating, elegant and satisfactory service." If the pamphlet is a fairly accurate index of the spirit and accomplishment of the road and its officials—and it is pretty sure to be that—we should say that this creditable aim has been achieved.

ELECTROLYSIS of underground pipes continues to be one of the vexing problems with which operators of electric-railway systems have to contend at no little expense arising from damage suits and the cost of preventive means which must be provided. In relation to this subject a number of valuable suggestions are contained in a report submitted by the "electrolysis commission" of the German Society of Gas and Water Engineers at its meeting last year, and continued at this year's annual meeting. Some of the most important of the recommendations for protective precautions will be found of practical value. In connecting the generator to the trolley wire and to the track insulated leads should be used in each case. Proper bonding is of course a precaution well understood. Return feeders are recommended; they should be insulated, being connected at intervals to the track, and at points as far as possible from pipes. The cross-section of these feeders should be equal at least to that of the corresponding positive feeder. Resistances are recommended to be inserted in the return feeders, permitting the potentials at the track ends of the feeders to be adjusted to approximately the same value. In conjunction with the return feeders boosters are to be installed where necessary. Pilot wires from all points of maximum and minimum potential are desirable. It is important that the track be well insulated from the ground, and to this end it should be laid in a well-drained bed of highly insulating material, metallic connection between the rails and earth to be carefully avoided. A distance of at least three feet 3½ inches should be allowed between the rails and those parts of the pipe system which are on a level with the ground or not much below the surface. Where this distance cannot be maintained, the parts alluded to are to be insulated from the pipes by suitable non-insulating pieces or structures. Pipes which cross a track are to be insulated between points at least three feet 3½ inches on either side of the track, or are to be provided with a metallic protecting covering in good electrical connection with the pipe.

The commission made some experiments at Strasburg which lasted about eight weeks, beginning in December, 1904. Near the power station a pipe was found to be positive, the difference of potential between it and the nearest rail being on the average 2.2 volts, the maximum being 2.8 volts. Farther away a pipe was found to be negative, the difference of potential being four volts, with a maximum of 11.5 volts. Currents up to one ampere were measured in the pipes. All the return feeders were insulated, and it was found that in the longest one the current was less than one-third of the current in the corresponding feeder from the station to the overhead wire. On the other hand, the current in the shortest return feeder was more than four times that in the corresponding feeder to the trolley wire. Many of the rail bonds were unsatisfactory from an electrical point of view and presented considerable resistance (compared with the resistance of the rails) to the passage of the return current, an exception being the welded joints. By inserting a small resistance in the shortest return feeder matters were greatly improved, the maximum differences of potential at the junction points of the return feeders to the rails dropping from 6.5 to 2.8 volts. At the same time the differences in voltage between pipes and rails at all points of the system were reduced to about half the former values.

Electrical Apparatus for Sterilizing Milk.

Mention was made in the Western Electrician last week of an electrical device invented by Mr. Robert C. Turner of Columbus, Ohio, for sterilizing milk. This apparatus has been tested, and the city bacteriologist of Columbus found that in one sample analyzed 144,994 out of 194,500 bacteria were removed and that the remainder were not in a very healthy state. Some of the samples have been known to keep sweet for 21 days. They have been shipped to various cities in the United States and the inventor has not been disappointed in finding them sour on arrival at any time. He believes that cider and beer might be treated in the same way to preserve them.

The apparatus consists of a large porcelain tub and five small porcelain cups, all wired for the passage of an electric current. The milk is first passed through a separator which clears it of objectionable matter. Then it goes to the large tub, from which it runs slowly into one of the small cups and from that to the next and so on until it passes through all. The milk in its course is subjected to a current at 2,200 volts, which is said to be sufficient to kill the bacteria.

The current seems to follow the stream of milk through all the cups. In its course the milk is heated slightly and when it comes from the last cup is fresh and of about the temperature of new milk. A company is putting the milk on the market at Columbus. Mr. Turner has organized a company to manufacture the apparatus.

Electrical Exports for July.

Electrical goods exported from the United States in the month of July represented a total value of $970,674, which was an increase over the corresponding month in 1904 of $107,688. These figures include both electrical machinery and electrical appliances, the latter including telegraph and telephone instruments. The figures for each class of goods shown separately are as follows: Electrical machinery—July, 1904, $493,372; July, 1905, $597,483. Electrical appliances—July, 1904, $369,614; July, 1905, $373,191. A gain over July of last year is thus apparent in both classes Electrical exports for July, 1905, however, show a decline of $130,736 from June's figures and, further, a decrease of $266,720 from the figures for May. While there has been a gradual decline the last few months, still the total for the first seven months of the year exceeds that of the corresponding period last year by $1,321,835.

Considering only electrical machinery, the following countries were the principal buyers from the United States in July, the value of the machinery exported in each instance being given: British North America, $242,073; United Kingdom, $62,857; Japan, $60,441; Mexico, $49,215; France, $28,228; British Africa, $14,411; Cuba, $12,149; British Australasia, $12,172; Germany, $11,036; Philippine Islands, $9,200; Brazil, $7,217; Argentina, $4,497; British East Indies, $3,983; Hongkong, $2,615; Chinese Empire, $1,093.

Edison Convention Programme.

The convention of the Association of Edison Illuminating Companies which is to be held at Hotel Champlain, Bluff Point, Lake Champlain, N. Y., on September 12th, 13th and 14th, will be marked by a large number of interesting and valuable papers. Member companies are urged to send as many delegates to the convention as possible, as it will be well worth their while. A fine entertainment programme has been prepared and ladies attending will find that ample preparations have been made for their comfort and enjoyment. The place chosen for the convention is a beautiful one and such attractions as bathing, boating, yachting, fishing, tennis and golf are promised. Prizes will be offered the contestants in the various sports. On September 15th President and Mrs. Joseph B. McCall extend a cordial invitation to those present to be their guests on a trip to Au Sable Chasm, which is a short distance from the hotel.

The list of papers is as follows: "Practical Experiences with Steam Turbines," by J. A. Radford of Chicago; "Improvements in Steam Turbines," by W. L. R. Emmet of Schenectady; "Data on Various Manufacturing Requirements," by E. W. Lloyd of Chicago; "Refrigeration by Means of Electric Motors," by G. W. Goddard and H. K. Mohr of Philadelphia; "Experiences with Tests on All Kinds of Lamps for the Past Year, Including Nernst Lamps," by Dr. C. R. Sharp of New York; "The International Electrical Congress at St. Louis," by J. W. Lieb, Jr., of New York; "Magnetite Lamps and Mercury Vapor Arc Lamps and Mercury Arc Rectifiers in Connection with Electric Light and Power Service," by C. P. Steinmetz of Schenectady; "Methods of Starting Up Large Interconnected Systems Quickly After Partial or Total Shutdown," and "Instruction and Training of All Operating and Construction Men Who Work on High-potential Apparatus and Construction," by W. F. Wells of New York; "Relative Merits of Discharging Batteries on Edison Systems Through Reversible Boosters and Through End Cell Switches," by Gerhard Goettling of Boston; "The Use of Small-sized Carbons in Alternating-current Arc Lamps," by G. N. Eastman of Chicago; "Maintenance and Repair of Coal and Ash-handling Machinery," by Charles H. Parker of Boston; "Practical Operation of the Nernst Lamp," by W. T. Morrison of New York, and "Relative Advantages of 25 and 60 Cycles," by Philip Torchio of New York and W. C. L. Eglin of Philadelphia.

The secretary of the association is Mr. E. A. Leslie of Brooklyn, N. Y.

British Association in South Africa.

The British Association held its convention this year in South Africa, at Cape Town, Durban and other points of interest, beginning August 15th. On that date about 200 delegates, constituting the official party from England, landed at Cape Town. A business meeting was held the first day, Sir William Crookes introducing the new president of the association, Prof. G. H. Darwin. At the new city hall in the evening Prof. Darwin delivered his presidential address. In his address the president dwelt at some length upon the subjects of natural selection and continuous transformation of species. The subject of natural selection and its relation to the atom were especially well brought out in the address, some abstracts of which are as follows:

"The object of alchemy, as stated in modern language was to break up or dissociate the atoms of one chemical element into its component parts, and afterward to reunite them into atoms of gold. Although even the dissociative stage of the alchemistic problem still lies far beyond the power of the chemist, yet modern researches seem to furnish a sufficiently clear idea of the structure of atoms to enable us to see what would have to be done to effect a transformation of elements. Indeed, in the complex changes which are found to occur spontaneously in uranium, radium and the allied metals we are probably watching a spontaneous dissociation and transmutation of elements. Natural selection may seem, at first sight, as remote as the poles asunder from the ideas of the alchemist, yet dissociation and transmutation depend on the instability and regained stability of the atom, and the survival of the stable atom depends on the principle of natural selection. Until some 10 years ago the essential diversity of the chemical elements was acceped by the chemist as an ultimate fact, and, indeed, the very name of atom, or that which cannot be cut, was given to what was supposed to be the final indivisible portion of matter. The chemist thus proceeded in much the same way as the biologist who, in discussing evolution, accepts the species as his working unit. Accordingly until recently the chemist discussed working models of matter of atomic structure, and the vast edifice of modern chemistry has been built with atomic bricks.

"But within the last few years the electrical researches of Lenard, Röntgen, Becquerel, the Curies, of Larmor and Thomson, and of a host of others, have shown that the atom is not indivisible, and a flood of light has been thrown thereby on the ultimate constitution of matter."

On succeeding days of the convention the presidential addresses of the various sections were read. Included among these was that of Prof. A. R. Forsyth to the mathematical and physical section. Prof. Forsyth gave a summary of the important things which mark the growth of mathematical and physical science during the last 300 years. The progress of physics, alike on the mathematical side and the experimental side, has not been less remarkable nor more restricted than that of astronomy. The elaborate and occasionally fantastic theories of the eighteenth century, in such subjects as light, heat, even as to matter itself, were rejected in favor of simpler and more comprehensive theories. There was one stage when it seemed as if the mathematical physicists were gradually overtaking the experimental physicists; but the discoveries in electricity begun by Faraday left the mathematicians far behind. Much has been done toward the old duty, ever insistent, of explaining new phenomena; and the names of Maxwell, Weber, Neumann and Hertz need only to be mentioned in order to suggest the progress that has been made in one subject alone. We need not hesitate to let our thoughts couple, with the great physicists of the century, the leaders of that brilliant band of workers upon the properties of matter who carry us on from wonder to wonder with the passage of each successive year.

Section B was devoted to chemistry. Mr. G. T. Beilby in discussing under this section the recovery of gold from sea water went on to marshal arguments tending to show that the energy of solution, of diffusion, and of osmosis is due, not to the imaginary gaseous energy of the solute, but to the actual liquid energy of the solvent molecules. If the view is accepted that the phenomena of solution are largely due to the kinetic energy of the solvent molecules, the phenomena of dissociation appear to follow logically. The "rude mechanical jostling" given by some million of water molecules to the singe molecule of dissolved salt, tends to break up the latter into simpler and more stable forms; just as the complex crystalline molecule can be broken up by purely mechanical means into the simpler amorphous molecule during the processes of rolling or hammering a metal.

On August 22d the delegates arrived at Durban, and 230 persons assembled in the city hall. They were addressed by Mayor Henwood of Durban and other government officials. President Darwin was enthusiastically received and made a short address. The party then proceeded by special electric cars to Caister House, where it was entertained at a garden party by Sir Benjamin Greenacre, ex-mayor of Durban.

A lecture was given at the city hall by Mr. Douglas Freshfield, on "The Mountains of the Highest Himalaya." The hall was crowded with an enthusiastic audience, the meeting being presided over by Sir William Crookes.

The annual report of the council for the year 1904-05 states that the arrangements for the meeting of the association in South Africa had been directed, under the sanction of the council, by a special South African committee, sitting in London, and consisting of the general officers of the association (the president and president-elect, the general treasurer, and the general secretaries), Professor Armstrong, Dr. Horace Brown, Sir William Crookes, Sir James Dewar, Sir Archibald Geikie, Prof. H. A. Miers, Sir Henry Roscoe and Dr. Sclater. The coordination of the work of the various local committees had been carried out under the direction of the central organizing committee for South Africa, sitting at Cape Town, consisting of Sir David Gill (chairman) and Dr. J. D. F. Gilchrist (secretary).

The appointment of vice-presidents of the association having been left by the general committee in the hands of the council, the following gentlemen had been appointed: Lord Milner, formerly high commissioner for South Africa; the Earl of Selborne, high commissioner for South Africa; Sir Walter F. Hely-Hutchinson, governor of Cape Colony; Colonel Sir Henry E. McCallum, governor of Natal; Captain the Hon. Sir Arthur Lawley, lieutenant-governor, Transvaal; Major Sir H. J. Goold-Adams, lieutenant-governor, Orange River Colony; Sir W. H. Milton, administrator of Southern Rhodesia; Sir David Gill, F. R. S., his majesty's astronomer, Cape of Good Hope; Sir Charles H. T. Metcalfe, Theodore Reunert, members of the institution of Civil Engineering; the mayors of Cape Town and Johannesburg; the president of the Philosophical Society of South Africa; the mayors of Durban, Pietermaritzburg, Bloemfontein, Pretoria, Kimberley and Bulawayo. An agreement has been made between the British Association and the South African Association in the matter of financial arrangements respecting the meeting. Mr. A. Silva White was unanimously appointed assistant secretary in place of Dr. Garson, resigned. The books and other publications presented to or received in exchange by the association, with the exception of the publications of the corresponding societies of the association and the annual volumes of reports of the various associations for the advancement of science, had been transferred to the library of University College, Gowerstreet, the council of University College having undertaken to give the same facilities to members of the British Association for the use of University College library as were granted under similar circumstances by the University of London.

The total attendance at the convention was something over 1,000.

Chicago to Use Freight Tunnels.

The city of Chicago has decided to take advantage of a provision in the franchise ordinance of the Illinois Tunnel Company which gives the city the right to run its wires in the tunnels of the company. The government order which may result in the destruction of the present street railway tunnels under the river at La Salle Street and Washington Street, through which the city's cables connect the North and West sides, made it necessary for the city to seek a new place for its wires. City Electrician Carroll then investigated the Illinois Tunnel Company's property with the result that the tunnels will be used by the city.

It is planned for the future to place the city lighting distribution for the downtown district, as well as the police and fire-alarm systems, into the tunnels. At present and as a starter only the new connections in the police and fire-alarm system to the North Side, made necessary by the proposed changes in the street railway tunnels, will be installed. To do this work Mr. Carroll is asking bids for 10,000 feet of 100-conductor paper-insulated lead-encased cable and 5,800 feet of 60-conductor rubber-covered cable. The city electrical department is also asking bids for a considerable amount of wire and other supplies for repair work in the downtown circuits.

Unsolved Problems in Electrical Engineering.[1]

By Col. R. E. B. Crompton.

In these later days of large power schemes, the importance of protecting our works against lightning stroke has become increasingly evident. For a long time we thought that the damage caused by lightning was confined to systems of overhead conductors, as its effect on these was at once evident, but during recent developments of large power schemes, employing systems of conductors to carry the energy into districts where the use of overhead conductors is inadmissible, the influence of lightning discharges, or of earth strokes connected with them, on our underground systems, has been undoubtedly the cause of many failures and interruptions to service, the investigation of which forms a problem of the first magnitude. The problem has been insufficiently investigated, but it appears probable that many of the mysterious perforations of the insulation of our underground cables are commenced by static charges due to condenser effects produced on a gigantic scale in the system. I have been slowly gathering evidence during the last few years, and find that most of the engineers who have studied this question are in agreement with me, that our present methods of detecting or guarding against the effects of frequent and hitherto unnoticed static discharges, are altogether inadequate to protect our works. During a recent conversation with Prof. Elihu Thomson he reminded me of the undoubted fact that lightning strokes very frequently follow one another over nearly if not the same identical air path. He seems to think that the dielectric strength of the air at this point is reduced or partly broken down by the passage of a powerful lightning stroke, which facilitates the passage of subsequent strokes at the same point. Are we to conclude that corresponding conditions of weakened path are set up below the earth's surface and consequently affect us by affording paths for disruptive discharge through underground mains?

There appear to be three hypotheses of the cause of terrestrial magnetism, the first being that the crust of the earth has at some time, probably shortly after solidification, become a permanent magnet owing to the circulation of electric currents, which possibly may have been produced by thermal causes; the second being that the cause was originally, and may still be, connected with the earth's rotation, which has gradualy accumulated its magnetic field much as is the case with an ordinary self-exciting dynamo; the third hypothesis being that the sun itself is a power station for the whole solar system, and that each of the planets is merely a distributing station for the energy generated in the sun. It can, however, be shown that the direct magnetic effect of the external field produced by the sun must be small, although we know that changes taking place in the sun are unquestionably associated with the appearance of the magnetic storms which are of such importance to the navigator and the telegraphist.

Another problem which is only now commencing to pass outside the domain of the physicist into that of the engineer is that of the etheric transmission of power. The development of electric-wave telegraphy is an excellent instance of the various stages of the solving of an electrical problem. We may consider that the etheric transmission of signals up to a given distance, and notably for the purposes of signaling to and between ships at sea, is practically solved, although there are many secondary problems arising out of it. No doubt the first and most important of these is the production of wave trains sufficiently powerful and of the right character to yield the best results. Fleming has particularly devoted himself to this subject, and the value of his inventions has been fully acknowledged by Marconi. What we require is a better method of originating a continuous train of waves rather than intermittent ones, and here we can formulate our problem, which may be solved by the mechanical engineer, or probably by the electro-chemical engineer. None of us has as yet succeeded in constructing an alternator with a frequency approaching 1,000,000 per second; but who can say that recent developments in extremely high-speed turbo-generators of the De Laval type may not furnish us with a good start in obtaining such frequency by mechanical means? Again, turning to the possibilities within reach of the electro-chemist, very promising attempts have already been made by Lodge and others to produce electrical oscillations from condensers charged by a Cooper-Hewitt mercury vapor lamp. Duddell has shown by his investigation of the singing arc that herein lies a method of producing a continuous series of discharges, although in this case the frequency obtained is not sufficient for the purpose. One problem connected with electric-wave telegraphy requires mention, although I believe it has been already nearly, if not completely, solved by Fleming. I refer to the noise caused by the signaling spark used in wireless telegraphy, especially on board ship. The loud cracking discharge of this spark has the two-fold disadvantage of being a nuisance to anyone in the neighborhood of the apparatus and of entirely defeating secrecy, as the message can be read by anyone conversant with the Morse alphabet. Fleming has caused the discharge to be produced in cast-iron vessels filled with nitrogen or carbonic acid under pressure, and by this means has practically succeeded in silencing the spark, even when large powers are employed.

It is evident that the consequences which would follow on the etheric transmission of considerable amounts of power would be so startling, from every point of view, that they would revolutionize our ideas socially and politically, and would profoundly affect all our present conditions of life.

The recent introduction of high-speed turbo-generators has called attention to the difficulties of designing both the cores and the winding of the revolving fields so that they can successfully withstand the severe mechanical stresses to which they are exposed at these extreme speeds. Much ingenuity has already been exercised in attempting to reconcile the antagonistic requirements of great mechanical strength to resist centrifugal forces combined with minute subdivision of the core to prevent a free path for the eddy currents. It will be seen that here the difficulties of the designer are very great, and the problem of overcoming them is yet in its early stages.

It may surprise many of you to hear how great have been the improvements in the lead-couple accumulator during the 15 years or so that it has been in practical use. The causes of these improvements are two-fold. Our early troubles arose partly from difficulties in the manufacture of the plates; means were adopted to hasten the formation of these plates during their manufacture, for which we paid somewhat dearly by their shortened life. Another and very important cause of our early troubles was that for a long time we continued to use the cells themselves as a means of regulating our electrical pressures. This introduced conditions extremely unfavorable to the regulating cells of our batteries of accumulators, but since, owing to the introduction of the Chamen and Highfield boosters, this difficulty has been largely removed. The value of recent improvements may be gauged by the fact that the formation of deposit in the bottom of the cells from detached active material has been reduced to one-quarter of its quantity during the last five years, and we may safely say that the cost of upkeep of these accumulators has been reduced in the same proportion. When the demand for electrical energy is intermittent, or is confined to short hours, such as in towns or villages where the demand up to the present has been principally for domestic purposes during hours when artificial light is required, my view is that we can design far the most economical plant by combining the internal-combustion engine with a suction-gas plant worked for long hours, and thereby charging storage sufficient to deal with the bulk of the load, but supplying the short hours of peak load from steam plant specially designed to work for short hours at a maximum efficiency.

After long years of disappointing delay we now see in the streets of London and Paris a very considerable number of private carriages driven by electrical means. Here again we have been told that the lead-couple accumulator is hopeless, and that we must wait for something lighter and stronger, such as Edison has been working on for some years past, but again practice has shown that we are far from obtaining anything to take the place of the lead-couple, and it is reasonable to suppose that great progress will be made in portable accumulators, and that a few years hence we shall see great developments. It is quite certain that an enormous impulse will be given to the production of electrically driven vehicles when the boxes of accumulators and the means of charging them are sufficiently standardized.

One solution of the railway problem seems already within our reach—namely, that of the utilization of single-phase alternating currents for long-distance transmission. We have the choice between the type of series motors as made by Finzi in Italy, and that of the Winter and Eichberg compensated repulsion motors made by the Allgemeine company. The difference between these two types lies principally in the size of the transforming apparatus which must be carried on the train. In the first instance, this must be equal in capacity to the total output of the motor equipment, whereas, with the repulsion motor the transformer need only have a capacity of one-tenth the rated capacity of the motors. As regards the problem of the third rail, its difficulty and dangers, and of substituting the overhead work necessary for these single-phase motors, it is a mere draughtsman's question, and is quite certain to be satisfactorily dealt with. I think we can even now answer two questions. This first is: Can electric traction supersede the existing steam haulage at the schedule speeds which are at present in use on our railways? We have no doubt whatever that we can answer the question in the affirmative. The second railway question is: Can we by the introduction of electric haulage raise to a notable degree the present schedule speeds, and from this cause alone become very formidable competitors to long-distance steam haulage? Although there are many electrical engineers who would answer this question in the affirmative with as much confidence as they answer the first one, yet personally I am not quite so sure. I see that, spurred by our electrical competition, the designers of the steam locomotive are likely to make further efforts, and I feel sure that if we electrical men can work to schedule speeds of 100 miles an hour, the steam locomotive also can be improved so as to work at the same speed with equal safety. As to long-distance goods traffic, I do not think we are likely to attack this problem for years to come.

A problem of real moment to both suppliers and users of electrical energy would be the discovery of a direct method of producing artificial cold by electrical means. Of course, we can now produce artificial cold by connecting an air compressor to be driven by an electric motor, and by expanding the air into the cold-storage chamber, but the method is costly and cumbrous. Probably something may be done by a well-designed high-speed air compressor, but the real solution we are looking forward to is a direct method of producing cold from the electrical energy in our supply mains, and this probably is a problem for the electro-chemist, as we may conceive the apparatus taking the form of a battery abstracting heat from the surrounding air.

Time will not permit me to speak at any length on the interesting subject of electric heating. The importance to the mechanical engineer, chemist or physicist of being able to maintain in quite small furnaces extreme regularity of high temperature for very long periods of time cannot be over-estimated, and this problem is already satisfactorily solved; but when we deal with electrical furnaces on the larger scale I may point out that, although when Keller read his paper on electrical metallurgy before the Iron and Steel Institute in 1903 the possibility of electric smelting taking the place of heating direct by fuel was received with much incredulity. Since that time so much attention has been given to the matter that this problem has already been successfully grappled with, and appreciable advances have been made in the practical application of electrical smelting.

Finally, I believe the greatest problem of all, and the one which will have the most profound influence on the well-being of our fellows, is the satisfactory development of our power schemes, by which we hope to send the population back to the land. We already see that the necessity for bringing our working population into huge factories, so that they may work within the range of power allowed by revolving shafting, is already at an end; that nearly all power can be supplied through electric motors, and therefore the factory units themselves can be small, spaced more widely apart, and many classes of manufacturing processes can be carried out most perfectly in the workers' own home unaided by the other members of his family.

1. Extracts from a lecture recently delivered before the Institution of Civil Engineers in London.

Annual Electrical Exhibition for Chicago.

Chicago electrical men have started a movement for an annual electrical exhibition to be given in the Coliseum, Chicago, each winter. Many of the leading men in all branches of the industry have become interested in the project, and others are expected to join the movement before final arrangements for the first exhibit are completed. To carry out the plan successfully a company has been incorporated to be known as the Electrical Trades Exposition Company. Homer E. Niesz, E. B. Overshiner and Charles E. Gregory are the incorporators. The capital is $10,000, which amount is divided into 1,000 shares of $10 each.

The first exhibition is to be held in the Coliseum next January, beginning on the 15th and continuing to the 27th. The exposition is to be on a large scale, not limited only to the United States, and it is hoped eventually to have exhibits from many foreign countries.

A few of those who have already become interested in the new company are John J. Abbott, W. L. Abbott, William Carroll, L. A. Ferguson, G. B. Foster, W. A Fox, T. P. Gaylord, J. F. Gilchrist, C. E. Gregory, H. A. Harris, M. J. Insull, E. F. Kirkpatrick, W. W. Low, H. E. Niesz, E. B. Overshiner, Frank L. Stagg and James Wolff.

Navy Wireless Tests.

It is understood the bureau of equipment of the Navy Department is preparing for some additional tests of space-telegraph systems. One of these tests will be with the Stone apparatus, which will be installed at the Boston navy yard, the Portsmouth (N. H.) navy yard and on the collier Lebanon. The other system to be tested will be the Rochefort, which will be operated between the naval stations at Cape Elizabeth, Cape Ann and Cape Cod. These two systems were among those which were tested with satisfactory results last year by the bureau of equipment, and it is expected that with the improvements which have been made they will make a better showing in the next

practical trial. The bureau is continually in receipt of all sorts of propositions respecting wireless telegraphy and is preparing for an active season of experimental work which shall serve to develop into a state of greater usefulness this means of communication.

The New Uviol Lamp.

By Dr. Alfred Gradenwitz.

Much has been written concerning the curative properties of the ultra-violet rays, which have heretofore been produced chiefly by the Finsen light. The Finsen light, fitted as it is with ordinary carbon arcs, water-cooling devices and projecting apparatus, gives off but a relatively small amount of the short waves forming the ultra-violet light. Obviously, also, its scope of action is limited, as only small surfaces can be treated, thus calling for repeated sittings. In connection with this subject, as well as for other important reasons, it is of considerable interest to learn that at the glass works of Schott & Gen, of Jena, Germany, Dr. E. Zschimmer has been engaged in experimenting upon a mercury-vapor lamp which is transparent to ultra-violet rays. As the result of these experiments Dr. O. Schott has been led to construct a new type of ultra-violet mercury lamp, to which he gave the name of Uviol lamp.

This lamp consists of a glass tube transparent to ultra-violet rays and mostly rectilinear in shape, measuring six to 30 millimeters in diameter and 20 to 130 centimeters in length. Fig. 1 shows the lamp and its controlling apparatus. Platinum wires connected to carbon buttons in the interior of the tube are sealed to the ends of the latter, and allow either pole to be used as negative or positive. The amount of mercury used in the lamp ranges, according to its size, from 50 to 150 grammes. This mercury is not only intended to produce the luminous mercury vapors, but as well to effect ignition and lead away enough heat to cool the negative

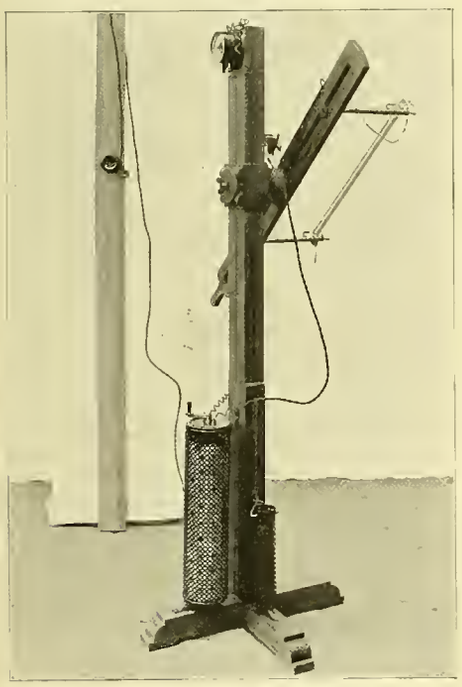


FIG. 1. NEW UVIOL LAMP AND CONTROLLING APPARATUS.

pole. The dimensions of the tube are so calculated as to allow it to be connected immediately to pressures of 220 or 110 volts, as usual in connection with electric central stations. An additional resistance and a compensation coil is then inserted. The lamp is started by tilting.

It has been found rather difficult to maintain the tube sufficiently exhausted, even with high pressures. This, however, is very important, as the lamps would otherwise fail to work and be extinguished after a short time.

In order to convert in the lamp as great a portion as possible of the current into radiating energy, the tube should be at least 130 centimeters in length. As the handling of such tubes is rather inconvenient, U-shaped tubes are used to advantage in many cases, this shape being suitable also in the event that cavities of the human body (such as, for instance, the throat) have to be treated by the lamp. It is obviously possible also to connect in series two or three shorter lamps.

The spectrum of the Uviol lamp is exceedingly rich in lines, no less than 25 lines having been observed by Arons in the visible portion, while the number of those actually existing is doubtless far greater. Any lines lying beyond 405 can be regarded as pertaining to Uviol and including about four-fifths of the ultra-violet light.

As to the mechanism of the luminous phenomena in the interior of the lamp, a definite idea cannot be formed without difficulty. It may be presumed that the smallest particles of mercury existing in the vacuum are thrown with enormous speeds from the negative to the positive pole under the action of the electric current, assuming an exceedingly high temperature, and becoming intensely luminous. The short-wave rays thus given off become a conductor of electricity, and the otherwise non-conductive mercury vapor and the smallest particles, moving essentially along the axis, act like small projectiles. These views, though being borne out by experiment, will have to be confirmed definitely by further investigation.

As regards the efficiency of the new lamp, tests of the visible light is gives off, compared with that of a Hefner lamp, have shown a working current of 0.64 watt, consumed in the most favorable case by the Uviol lamp to produce the light of a Hefner flame, the specific intensity of the visible radiation ranging between 0.31 and 4.3 Hefner candles per square centimeter of the cross-section of the lamp turned toward the photometer. Working a mercury lamp of about 400 to 800 Hefner candles will involve an expense of 2½ cents to five cents an hour, the cost of one-kilowatt current consumption per hour being taken at five to 10 cents. As the ultra-violet portion of the radiation is about equivalent to the visible portion, the Uviol lamp may be said to be an exceedingly advantageous apparatus for converting electric energy into useful radiation energy of small wave lengths.

As regards the uses the Uviol lamp might be put to, photography should be mentioned in the first place, experiments having shown the lamp to be very much adapted for taking views and printing positives with artificial light. The local extension of the lamp will result in very soft and deep shadows.

Chemistry will no doubt profit by the new lamp with a view to starting reactions: e. g., bringing about the combination of two individual bodies, in the same manner that chlorine and hydrogen are known to combine to form hydrochloric acid in the sunlight. Experiments so far made have shown Uviol lamps to be able in many cases to convert certain compounds from one modification into another or to produce polymerization. In view of the unstable equilibrium of many organic compounds, chemistry requires some subtle agents to alter the arrangement of atomic complexes, and Uviol radiation is likely to prove useful in this connection also.

Acting on a suggestion by Professor Vongerichten, experiments have been undertaken with a view to ascertain, by means of the Uviol lamp, whether certain colors that are used in dyestuffs or as printing colors possess sufficient resistivity against the bleaching action of the sun. Such bleaching effects of sunlight are slow chemical processes based on the existence of ultra-violet rays. Owing to the unfavorable climatic conditions of northern latitudes, continental factories had to carry out any tests as to the genuineness of colors in the south of Europe, while Uviol lamps will afford a means of performing the same tests at home without the aid of sunlight.

The radiations from Uviol lamps are said to exert a deadly effect on smaller insects, a fly being killed in about one minute if placed at about 1½ centimeters distance, where no fatal effects can be produced by the heat. Large numbers of small night insects are found dead beneath the lamps suspended during a summer night in a room with open windows. Uviol lamps will, moreover, exert a deadly action on still smaller organisms, viz., bacteria, as in the case of the Finsen light, and extensive researches in this respect have been undertaken by Prof. R. Gärtner. It is thought that Uviol lamps will be used to much greater advantage in this connection than the Finsen light, an area of up to 1,400 square centimeters being intensively radiated on by means of it, while the lamps can be approached to within less than one centimeter without producing any discomfort, owing to the smallness of its heat radiation. As the skin is transparent to part of the Uviol rays, the blood below the skin might be acted on as well by these rays, producing chemical reactions liable to exert a favorable action even on such morbid processes as do not take place within the skin itself.

If a Uviol lamp be allowed to act from about one to three centimeters distant from the sound skin—e. g., of the arm—for five to 15 minutes, there is at first no alteration to be noted, and only a few hours after radiation will a reddening effect be observed there. This reaches a maximum after about one day, while a slight burning sensation is noted at the same time. After a few days the skin peals off and the red portions disappear after two

FIG. 2. EFFECT OF RAYS OF NEW UVIOL LAMP.

to three weeks. The accompanying photograph (Fig. 2) shows the red spot on an arm radiated upon for 15 minutes, as it looked two days afterward. One of the two spots had been kept under water during radiation, so as to ascertain what effect the heating of the skin might exert; the two spots did not, however, show any difference.

Professors Stintzing and Matthes are engaged in extensive experiments to ascertain the curative effects of Uviol lamps in connection with diseases of the skin, and much valuable information has already been collected.

Survey for New Magnetic Chart.

The Carnegie Institution has outlined a magnetic survey of the North Pacific Ocean with a view to procuring data for a new magnetic chart. The expedition has already started from San Francisco and will pursue a spiral course across the entire North Pacific.

The present magnetic charts for this region are practically made up from coast and island observations which are not altogether correct. It is thought that the entire work of observation and reduction can be accomplished in three years at a maximum cost of $25,000. The total length of the spiral course will be at least 70,000 miles.

The brig Galilee has been procured for the purpose. The director of the work is Dr. L. A. Bauer, who is likewise in charge of the magnetic work of the United States Coast and Geodetic Survey. The commander of the Galilee is J. F. Pratt of the United States Coast and Geodetic Survey. With them are Dr. J. Hobart Egbert, magnetic observer, surgeon and naturalist; J. P. Ault, magnetic observer, and V. W. Whitney, magnetic observer and watch officer.

List of Decimal Equivalents.

A useful card for pocket or desk use is being distributed by the Turner Brass Works of Chicago. It contains a list of decimal equivalents, as shown

LIST OF DECIMAL EQUIVALENTS.

by the accompanying illustration. The company has already mailed several thousands to its customers and has received many complimentary replies and requests for more copies. The card is 3½ by 5¾ inches in dimensions, and the fractions with their decimal equivalents are printed in bold, clear type. It will be mailed, postpaid, to any one desiring a copy.

Report of Allis-Chalmers Company.

The report of the Allis-Chalmers Company for the fiscal period of 14 months ended June 30th was made public September 1st. Owing to the change of the fiscal year from ending on April 30th to ending on June 30th, exact comparisons cannot be made. The net profits for the 14 months were $68,981. This was, however, after heavy charges for plant alteration, depreciation, maintenance and repairs, more than $1,000,000 being spent on these items and charged out of earnings.

The company is prepared to enter extensively into the manufacture of turbines, and it was to reorganize its plants for this business that heavy outlays were entailed. The result of these expenditures and the business resulting therefrom should appear in the earnings of the current fiscal year, and a greatly improved showing in the matter of profits is expected. So far as orders go, the company has more booked ahead now than at any time previously in two years.

The total capital expenditures for the last fiscal period were $289,685, which include only actual additions to the productive capacity of the plants, all expenses for patents, licenses and experimental and development work during this period having been charged off.

The financial statements are as follows:

Consolidated profit and loss account for the 14 months ended June 30, 1905, including the results of the Bullock Electric Manufacturing Company for the 16 months ended that date:

Balance April 30, 1904		$624,835
Profit on operations of the period, after deducting expenses of manufacturing and selling and provision for bad and doubtful accounts, but before charging repairs and depreciation	$1,146,980	
Less maintenance, repairs and renewals on buildings, machinery, tools, etc.	$752,859	
Less depreciation on same	325,139	
	1,077,998	
		68,982
Total		$693,817
Deduct special expenditures incurred during the fiscal period ended June 30, 1905, as follows:		
For the development and the purchase of rights for the manufacture of new lines of apparatus, including steam and hydraulic turbines, gas engines and electrical and other machinery	$197,613	
For cost of exhibits at St. Louis Exposition, of removal of general offices to Milwaukee and experimental work in improving other products of the company	147,914	
		345,527
Surplus June 30, 1905, as per balance sheet		$348,290

Consolidated balance sheet June 30, 1905:

Assets.	June 30, 1905.	June 30, 1904.
Real estate, buildings, plant, machinery, good-will, etc.	$30,535,770	$30,246,084
Bonds and shares	165,000	.....
Bills and accounts receivable	3,628,778	3,437,519
Stocks of merchandise, material and work in process (less payments on account), at factory cost	3,478,724	2,914,878
Cash	516,482	1,060,113
Bullock Electric Manufacturing Company, for working capital	.....	463,000
Totals	$38,324,754	$38,121,594
Liabilities.		
Preferred stock	$16,150,000	$16,150,000
Common stock	19,820,000	19,820,000
The Bullock Electric Company, payable March 1, 1929	110,128	.....
Accounts payable	1,080,950	1,048,395
Depreciation reserves	815,387	478,364
Surplus	348,289	624,835
Totals	$38,324,754	$38,121,594

Concerning the charges made in connection with the work of development for the manufacture of new lines of apparatus, the report says:

"Although these charges are for expenses incurred in preparation for new branches of business and might be carried forward as assets or deferred charges to be gradually or otherwise provided for from the future operations of the company, yet it has been considered wisely conservative during this period of suspension of dividends to charge off the entire amount of such disbursement of the last year."

Concerning business prospects, President B. H. Warren says: "Soon after the commencement of this calendar year an improvement was manifested in the general business of the company, the orders increasing in April to the normal volume, and since then exceeding in extent the previous records of the organization; but the results of these orders will be realized only upon their execution and the delivery of the work. This increase pertained more particularly to the older branches of business of the company.

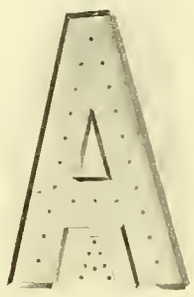
"The works are now engaged in filling one of the largest single orders for steam turbines that has ever been placed in this country, the installation of which will be completed by the end of the present calendar year."

The preferred stock is seven per cent., cumulative. The last dividend was paid February, 1904. On August 1, 1905, the company was in arrears six quarterly dividends, or 10½ per cent. on the preferred stock, being a total of $1,695,000.

A trust deed for $3,000,000 has been filed with the county recorder at Salt Lake City, Utah, by the Utah Independent Telephone Company, that being the amount of a recent bond issue.

Electric Signs for Manufacturing Plants.

Of late some of the largest manufacturers in this country have come to the conclusion that they can advertise themselves and their products to advantage and at a comparatively low cost, by placing electrically illuminated signs on the roofs of their factory buildings. These buildings are usually located near some well-traveled railroad, and naturally the signs are read during the evening hours by a great many buyers from all parts of the country. These factories nearly all have their own electric-light plants, and the operating expense of a well-built and substantial sign is therefore small. A well-constructed electric roof sign consists of all-metal grooved or channel-type letters, usually made from two to nine feet high, according to the distance at which they should be plainly readable, mounted upon a substantial and well-designed angle-iron frame. The channels or grooves of the



ELECTRIC SIGN LETTER WITH FULL METAL BACKGROUND.

letters are white enameled, the light thus being concentrated and reflected from these surfaces. It is therefore not necessary to place the sockets very closely together, or to use larger than four or eight-candlepower lamps. A large current saving is thus effected. Moreover, a sign built with these letters can be distinctly read at an exceedingly sharp angle. These signs may also be built with full metal backgrounds, as shown in the accompanying illustration.

These constructions have been thoroughly developed and put into actual practice by the Haller Machine Company of Chicago, which is prepared to submit designs and quotations on anything in this line.

The same firm also manufactures a line of electrically driven direct-connected vacuum-pump and air-compressor outfits of one-fourth and one-half-horsepower capacity.

New National Code Fuse Plug.

An all-porcelain Edison fuse plug has been designed recently by the Peru Electric Manufacturing Company of Peru, Ind. This plug embodies entirely new features, and is so constructed that no spark or molten metal is thrown from the plug when the fuse is blown. On account of this special factor of safety, and the fact that the fuse has gravity action, insuring the circuit to open at the proper time, this device is a National Code standard.

Fig. 1 shows the neat appearance of this plug. There are openings in the cover which enables one to see when the fuse is blown. The rating of the

FIG. 1. GENERAL VIEW OF NEW FUSE PLUG.

FIG. 2. INSIDE CONSTRUCTION OF NEW FUSE PLUG.

plug in volts and amperes is placed in the center of the cover, making it plainly visible when the plug is installed. A feature of special merit is found in the plastic material holding the cover and base securely together, and which in addition serves as a cushion between the base and the cover and reduces breakage to the minimum, even when the plug is dropped or thrown on the floor.

Fig. 2 shows the inside construction of the plug. It will be noted that this device takes an extra long fuse, assuring perfect action. Also the fuse lays across knife-edge projections in the porcelain, which enables gravity to pull on the fuse in the molten state, opening the circuit exactly in accordance with the New Code rating. The fuse wire is soldered to a square lug, which is held in a deep countersink by the center screws. The other end of the fuse wire is soldered to a terminal connecting with the contact shell.

The manufacturer asserts that the Peru plug is the only plug on the market that will not throw out molten metal and flame when the fuse is blown, at the specified rating, under any conditions, and is, therefore, as safe and much more desirable for open work than the enclosed fuse type

The Telephone Situation in Great Britain.

[From the London correspondent of the Western Electrician.]

The telephone business of Great Britain, by the agreement entered into between the postmaster-general and the National Telephone Company, and recently ratified by Parliament, practically becomes a national monopoly at once, and definitely will in 1912. This is a condition of things which a large number of people here have thought desirable for many years, with the one exception, viz., the municipalities.

The history of telephony in Great Britain has been on a large scale what has happened on a small scale in several other directions in relation to municipal versus private trading. In the early '80's it was decided that the postmaster-general, by virtue of the Telegraph Act of 1869, had a monopoly over all telephonic communication, and that, therefore, no telephonic business could be carried on except by the postmaster-general or under license from him. For some reason advantage was not taken of this legal decision, on the part of the postmaster-general, presumably because the possibilities of the telephone were not at that time foreseen by the government. Several companies were then in existence throughout the United Kingdom, and between 1880 and 1895 a process of absorption, amalgamation and litigation resulted in the survival of what is now known as the National Telephone Company with a franchise expiring in 1911. At this period of progress it is curious to note that the company's license expired automatically in 1911 without any provision for the business being purchased by or reverting to the state. At the same time, the government could have purchased the undertaking at certain defined periods, opportunities which were not taken advantage of.

By 1895, therefore, a monopoly had been secured by the National Telephone Company, and it was about this time that a great expansion took place in connection with municipal trading generally, and the history of telephony from this date is closely interwoven with municipal activity. Having seen the telephone business made to possess an enormous future by private enterprise, the local authorities set to work to secure some control either by the extinction of the company or by competition. Accordingly, in 1897, Glasgow took the lead and called for an inquiry into the inefficiency of the service of the national company in that city, together with the high rates of subscription. This having been granted by the government, certain influences were brought to bear which culminated in the introduction of the Telegraph Act of 1899, authorizing competition with the National company under license from the postmaster-general. Certain conditions were attached to these licenses, one being that in any area where a municipal telephone license was granted for a period extending beyond 1911 the company's license in that district should be prolonged to a similar date. The opportunity thus afforded the local authorities, at their own request, was taken advantage of to but a small extent and the results generally have been disappointing. In fact the local authorities have hastened their own death as municipal telephone competitors. Less than a dozen applications were made for licenses, and of these only five applicants proceeded to put up exchanges, viz., Tunbridge Wells in 1001, Glasgow in 1001, Brighton in 1903, Swansea in 1903, Portsmouth in 1903 and Hull in 1904. The licenses expire at varying dates from 1911 to 1926. In 1902 the Tunbridge Wells undertaking was transferred to the National Telephone Company, and thus early was an indication given of the probable effectiveness of municipal competitive telephony. The other exchanges above mentioned are all in working order and the financial results on paper are satisfactory, but strong opinions have been expressed as to their financial stability, partly owing to the principles applied so far as depreciation of plant is concerned and partly owing to the exceptionally low tariffs in vogue.

In the meantime the government had decided to set up a competitive exchange system in London, where about this time a great outcry was being made against the high charges of the company in relation to what was being done in the provinces. But telephone service obviously is of such a nature that two distinct competitive systems in one town can never be made to work commercially on anything like a large scale. Intercommunication is absolutely necessary to prevent a subscriber having to pay two subscriptions and having two instruments on his premises and the attendant inconveniences attached thereto. Looking at the matter in a calmer spirit than many of the agitators, the Post Office realized that the interests of the public would be best served by an arrangement with the company to secure intercommunication, and the two parties meeting in an amicable spirit came to terms. These terms were that the existing rates should be maintained so far as the unlimited service subscribers were concerned, but the postmaster-general initiated a message-rate system in addition. The view of the parties was that under these conditions the competition would add to the efficiency of the service and the convenience of the public—in other words, there would be competi-

tion as regards quality of service and co-operation as regards working arrangements. Up to the present this agreement has worked satisfactorily.

This agreement was come to in 1901, and in the meantime two things were happening which were tending toward the ultimate extermination of their originators. As has been indicated, the progress made by the municipalities—in point of the number of licenses applied for—was very unsatisfactory, but at the same time an agitation was on foot for the extinction of the company, but very little indication was given as to how that extinction was to take place. In fact a difference of opinion was manifest here, for while some were in favor of the company being bought out, others preferred that the government should set up a competitive system. Still further, subsequent events have proved that another section was of the opinion that greater facilities should be given to the municipalities for setting up competition, forcing the company to give free intercommunication. However, things went on in this more or less uncertain state until the end of 1904, when rumors went the rounds that negotiations were in progress between the company and the Post Office. These were semi-officially denied, but early in February, 1905, there appeared in the official papers of the House of Commons the unassuming statement that there had been presented to Parliament a copy of an agreement between the postmaster-general and the National Telephone Company by which the latter's undertaking was to be taken over by the state. The terms of this agreement have been given in the Western Electrician already, but in consequence of subsequent events the substance of them may be repeated. They are as follows:

"On November 18, 1901, the postmaster-general entered into an agreement with the National Telephone Company (ltd.) for the purchase of the plant of the company in the London exchange area on the termination of the company's license, that is, on December 31, 1911. The plant was to be purchased at its value in situ, and no payment was to be made in respect of compulsory purchase, good will or past or future profits—in other words, the purchase was to be made on what are know as 'tramway terms.' The agreement also provided for intercommunication between the systems of the postmaster-general and of the company in London during the continuance of the company's license, and for uniformity of rates. This agreement was in effect approved by the House of Commons after full discussion on January 27, 1902.

"An agreement on similar lines has now been made in relation to the whole country. On December 31, 1911, the postmaster-general will take over the whole business carried on up to that date by the company, and will acquire the plant of the company on 'tramway terms.' No payment will be made in respect of good-will or profits except in the case of the private-wire business of the company (which can be carried on without the postmaster-general's license) and in the very few cases where the company's license has, under the provisions of the Telegraph Act, 1899, been extended beyond 1911.

"At the option of the government three-fourths, and, with the consent of the company, the whole, of the purchase money may be paid by way of annuity for a term not exceeding 20 years.

"Certain powers of objecting to plant as unsuitable for purchase are reserved to the postmaster-general; and rules for the construction of plant are laid down.

"During the continuation of its license the company is to allow intercommunication without additional charge between the systems of the postmaster-general and of the company. The company will be precluded from showing favor or preference as between subscribers, and the rates charged by the company will be confined within certain limits. If, on complaint and after full inquiry, it is proved that the company is giving an inefficient service in any district, the postmaster-general may take over the company's business in that district at once without any payment for good-will.

"Certain provisions of the London agreement which are not of general application remain in force. In other respects the provisions of that agreement have been assimilated to those applicable to the rest of the country.

"The agreement will become binding when confirmed by a resolution of the House of Commons, or on August 31st, if not disapproved by Parliament before that date."

With that curious inconsistency which is characteristic of the municipal idea the very party previously so anxious that the company should be got out of the way were now dissatisfied, presumably because the government proposed to pay for what it was going to take over, and a number of resolutions in the House of Commons to appoint a committee to consider the agreement in the public interest were prevented from being put to the House. With commendable foresight the Post Office authorities had provided for this, for the last clause in the above digest made it to the interest of the opponents to give way if the agreement were not to be passed sub silentio. Eventually at a somewhat late period of the session a committee was appointed, consisting somewhat largely of municipal men—by concession of the government—with the result that several drastic alterations were proposed in the agreement in favor of the municipalities. These amendments were opposed by the telephone company, and indeed from the commencement it was fairly obvious that the agreement embodied the utmost that could be agreed between the company and the Post Office. In their desire to oust the company by any means the local authorities overlooked one very important fact which the company clearly was entitled to take the fullest advantage of. It is quite true that the company was not entitled to convey a single telephone message after December 31, 1911, but the postmaster has no right to acquire the business compulsorily. Therefore seeing that the Post Office engineers are of the opinion that the time between now and then would hardly be sufficient to construct a duplicate system and that the cost would be prohibitive, apart from such a construction involving a flagrant waste of capital, it was only natural for the company to take the view that, expiry of license or not, the telephonic business of the country must be continued after 1911. The trading community would not tolerate for one moment such a dislocation of business as would inevitably follow the shutting down of all means of telephonic communication, and consequently the company claimed some consideration for this factor. In fact, had it been so minded, it was almost in the position of being able to hold out this threat. On the other hand, the shareholders had to be considered. The postmaster-general had had both sides of the question carefully put before him and decided to adhere practically to the original agreement, the main addition he was willing to make being some extra provision for the transfer of the staff, with the exception of those officers in receipt of salaries of $3,500 and upward. The House of Commons was asked to vote for the amendments suggested by the committee, and for the original agreement, the result being that the committee's recommendations were rejected.

The telephone situation in Great Britain today therefore is that between now and 1911 the company's system will be carried on as heretofore, with the addition of a modified supervision on the part of the postmaster-general, a certain specification having to be followed in carrying out new works and so on. Thence forward it will be a state undertaking. The attitude of the government on this question has made it abundantly clear that the policy of municipal competition laid down in the act of 1899 has been a failure, and that, at any rate after 1911, no further municipal licenses will be granted, those municipal exchanges now existing being acquired by the state, although, as in the case of the company, there is no compulsion on the postmaster-general so to do. Thus the words uttered by Sir William Preece (late engineer to the Post Office) several years ago, when municipal competition was very much in the foreground, have come to pass. He stated: "Twenty-four years have passed since I brought the first pair of telephones to Europe, and it would have been everywhere but for mismanagement. The law decreed that telephony, as a message-earning machine by electricity, was included in the postmaster-general's monopoly. The government never firmly faced the situation; confusion became worse confounded; the real and only solution has not yet been taken. A cheap, efficient and reliable telephone service is imperial."

Some Methods of Party-line Signaling.

[*Continued from page 195.*]

The theory of the system is that in each instance the armature and striking rods, as a whole or part of the different bells, must be so chosen that their natural differences of vibrations shall be in accord with the current frequencies which actuate them.

In many instances investors in telephone stocks are led to believe that party lines are a decided detriment to any exchange, but such has not been proven the truth in such systems as have installed good apparatus. Much judgment has to be exercised at all times in placing the various subscribers on party lines, in order that the subscribers themselves be in harmony among themselves. It is generally conceded that it is poor policy to place more than four subscribers on one line in city service. Ordinarily, the placing of business firms on party line can hardly be recommended, although this is a matter for the management to decide.

Another boom to party lines will be accomplished when a simple lock-out device is placed on the market, the object of which should be to prevent any listening in by subscribers on party lines when that line is in use. While there are many such arrangements patented, they, as a rule, do not meet with approval, because of complications or cost.

The party line is a happy solution for the small user and for those persons who cannot afford to pay the rate telephone companies are compelled to put in effect in order that individual lines be a paying proposition. In conclusion, I will say that, by adopting a good system of party-line apparatus, many of the companies which are not in the best of financial condition could be so managed as to accomplish very favorable results.

Telephone News from the Northwest.

The Waseca Telephone Company will install a local exchange for Morristown, Minn.

The Douglas County Telephone Company of Superior, Wis., is making improvements at the East End, including the installation of a central-energy system and cables.

The Chicago and Northwestern railway, it is said, will soon have a private telephone system connecting all points in the Fox River Valley in Wisconsin. The telegraph wires will be used for telephoning.

The Ruthton Telephone Company of Ruthton, Minn., has filed articles of incorporation with $10,000 capital stock. George Bingham is president.

The New Ulm Rural Telephone Company of New Ulm, Minn., is somewhat in a predicament. The council has directed that the poles and wires of the company be set in the alleys of the city, occupying the same side which is also used by the Minnesota Central Telephone Company, as the other side is occupied by the poles and wires of the city's lighting plant. The Minnesota Central company objects to this arrangement, and threatens injunction proceedings.

The Tri-State Telephone Company is running two new copper circuits into Winona, Minn., from the south.

The Western Electric Telephone Company will expend $150,000 in improving its lines from Sioux City, Ia., to Spencer, Emmetsburg and Algona.

The Independent Telephone Company has decided to use the manual system in its new exchange at Council Bluffs, Ia., instead of the automatic, as at first proposed.

M. C. Hurd of Waterloo has purchased an interest in the Conrad Telephone Company of Reinbeck, Ia., and will act as manager.

The Clinton County Telephone Company of Delmar, Ia., has filed articles of incorporation, with a capitalization of $15,000. C. C. Davis is president and C. W. Means secretary.

The Northwestern Telephone Exchange Company has consolidated its toll service in the new exchange building erected on the east side in Minneapolis, and all calls for the Twin Cities go direct to this building and are there relayed to the connection desired. Some objection is raised to the Northwestern Company installing an interior switchboard in the City Hall and Courthouse in Minneapolis, on the ground that no operator is on duty at night, making it impossible to use the system at night. The company is making many extensions. A toll line is being built from Stillwater, Minn., to Ashland, Wis., work is in progress on laying underground cables at Owatonna, and the company will soon have another circuit from Minneapolis to Lesueur, Minn. R.

Indiana Telephone Items.

The Luther Rural Telephone Company of Luther has been incorporated with an increased capital stock of $15,000. John J. Schwartz is president and W. O. Stall, secretary.

Owing to a new schedule of rates issued by the Citizens' Telephone Company of Kokomo it is rumored that the advance may tempt the Bell company to go after the business in that field with new energy, although the Citizen's company has more telephones in use in Kokomo than has any other company in a city of equal population.

Thirteen independent telephone systems in Illinois and Indiana are to combine. Owners of Independent telephone systems in Dana, Sandaford, Libertyville and Terra Haute, Ind., and Vermillion, Scotland, Chrisman, Dudley, Brocton, Redmon, Horace, Grand View and Paris, Ill., have organized the Citizens' Mutual Telephone Company, with a capital stock of $50,000. The object of the organization is to obtain a franchise for the central office in Paris, Ill. In case this fails, the 13 systems will connect through a general exchange in Terre Haute.

The Citizens' Telephone Company of Columbus, of which Thomas Sheerin of Indianapolis, son of the late Simon P. Sheerin, is president, and M. F. Hosea of Columbus, manager, is making an effort to control the telephone situation in Bartholomew County. The Citizens' Telephone Company is, in reality, owned by the New Long-distance Company of Indianapolis, as the stock is practically all held there, and the local company is controlled from that point. Mr. Sheerin and Mr. Hosea, it is stated, are trying to effect a deal by which the local company will purchase the Hope telephone exchange. The Hope company is an independent line, with about 500 subscribers. The Citizens' company is also negotiating for the purchase of the exchanges at Grammer and Elizabethtown in the same county. The local company is extending its service into Jennings County, and in a short time the Jennings County people will be given free service. S.

Southeastern Telephone Developments

There is a proposition on foot by the Asheville Telephone Company which may result in the installation of practically a new system at Asheville, N. C., and the building of a modern exchange in that city. This movement grows out of recent action of the City Council giving the Asheville com-

pany 60 days in which to improve its system and rectify certain alleged deficiencies in the service locally. The new system contemplated will include the underground conduits and modern improvements suggested by the Asheville and Bell people.

The Bell Telephone Company has just completed a handsome three-story building in Greensboro, N. C., and has begun moving into its new quarters, cutting in a few telephones each day, until the entire system is transferred.

The Bell Telephone Company has recently put in long-distance connections at Newton, N. C., where the Piedmont Telephone Company controls numerous out-of-town lines and the local exchange.

The local telephone system at Woodruff, S. C., is being overhauled and a new switchboard installed.

L.

Ohio Telephone Notes.

Walter M. Harden of Orland, this state, has invented an attachment for party-line telephone boxes by which conversation can be limited to two subscribers, or, if a general conversation is desired or more than two are to hear or converse, all the boxes may be used. Up to a certain number, it is said, the instrument might be used as an automatic exchange.

The Cleveland Telephone Company has made a rate of $2 a month for unlimited residence service in competition with the Cuyahoga Telephone Company. The number on a circuit is limited to four.

Thieves stole several hundred pounds of copper wire from the Jennings Avenue extension of the Cleveland Telephone Company's line a few nights ago, and many telephones were out of service until it was replaced.

A new directory will be put out by the Cuyahoga Telephone Company of Cleveland shortly. The cover will be the one now being put out by the National-Interstate Telephone Association.

The Springfield-New Carlisle Telephone Company has been organized, and as soon as a franchise can be secured a new plant will be installed at New Carlisle. The plant will be modern in every respect and will be connected with the United States lines.

C. M. Myers of Ludlow is organizing the Miami Mutual Telephone Company. Subscribers will be stockholders at a cost of $10 at entrance and a $10 assessment each year. The cost will be the same whether for business or residence telephones.

Mayor Jeffrey of Columbus has formulated an ordinance to be presented to the City Council that will force all concerns using wires on poles to put them in underground conduits in the business section of the city. Two conduit systems may be built, one for the high-tension wires and the other for the remainder. The city must also put its wires underground. Companies may make such arrangements as they like about the joint use of conduits. Wires must be carried up the sides of buildings in a tube. The city has given up the idea of building a conduit and leasing portions of it to the various companies, for the reason that it is not in financial condition to do so.

C.

Telephone Assists the Lumberman.

With the increasing difficulty in discovering and working new lumbering districts comes as a partial offset improved modern methods. One of the latest conveniences used by the lumberman is the telephone, and it assists him greatly in his work. A traveler treading the forests of northern Maine, particularly that heavily wooded section lying north and east of Moosehead Lake and extending to and along the west branch of the Penobscot River, will be struck with wonder when he sees the extent to which the march of progress has left its tracks in the shape of the telephone. Passing through what is apparently virgin forest the traveler will come upon the bright wires attached to the little porcelain insulators and running from tree to tree. In much of these woods through which these telephone lines run there is no trace of man. The principal use of the telephone lines is to assist in the prevention of "jams" during the log-driving in the spring. The river has at dangerous shoal points dams provided with gates. In running the logs if a "jam" seems liable to take place on the shallows above the dams the information is quickly telephoned to the gate tender, who closes the gates and backs up the water till the logs are floated clear.

The telephone in addition to the above use is of aid to the fire warden in the discovery and extinguishing of fires in the valuable forests.

NEW COMPANIES.

The Ozark Mutual Telephone Company, recently incorporated, will extend a rural line of 12 miles to the country northeast of Girard, Kan.

The New Hope (Kan.) Telephone Company has been incorporated with a capital of $5,000 and will at once begin the construction of a plant.

The Eastern Utah Telephone Company will be organized soon at Price, Utah, with a capital stock of $60,000. Its lines will connect with those of the Rocky Mountain Bell Telephone Company.

GENERAL TELEPHONE NEWS.

H. T. Feasel has purchased the telephone business of W. W. Finney at Neosho Falls, Kan.

The city of Parsons, Kan., has granted a 20-year franchise to the Missouri and Kansas Telephone Company.

The Cherokee Telephone Company at Tallequah, I. T., has been absorbed by the Pioneer Telephone and Telegraph Company.

The Nebraska Telephone Company is rebuilding its plant in Central City, Neb., substituting a cable distribution for the overhead wires.

The Rocky Mountain Bell Telephone Company will expend about $20,000 during the year in improving its system at Cheyenne, Wyo.

The Missouri and Kansas Telephone Company has ordered all its wire chiefs to learn telegraphy, as all testing will be done by telegraph.

The county commissioners at Great Falls, Mont., have under consideration the petition of J. C. Furman of Augusta for a franchise for the operation of a telephone system.

A meeting of the telephone men of the second and third congressional districts was held recently in Chillicothe, Mo., to discuss toll rates, etc. A. Barnes of Hamilton, Mo., is the president of the district association.

Steps are being taken toward the organization of an Independent telephone company at Baker City, Ore. The new exchange building of the Bell telephone company at Billings, Mont., is also rapidly nearing completion.

Charles E. Sumher has purchased property on Burnside Street, Portland, Ore., for the Automatic Telephone Company at a cost of $30,000. It is understood that this will be used as a site for headquarters for the new telephone company.

The sale of the Oakland County Telephone Company of Pontiac, Mich., to the Michigan State Telephone Company is denied by the officers of the former company, who state that they are about to run three copper circuits into their office to take care of toll-line service between Pontiac and Detroit.

The contract for the construction of a telephone system in connection with the Fort Buford reclamation project in North Dakota and Montana has been awarded to E. A. Hess of Lyons at his bid of $15,939.45, being the lowest of the five bids submitted to the secretary of the interior. The system will consist of four telephone stations with about 70 miles of pole line.

P. Kerr Higgins, Los Angeles promoter of the Home Telephone Company, has applied for a telephone franchise in Alameda, Cal., guaranteeing to spend $80,000 within the next two years and to pay two per cent. of its earnings to the city after five years from the time the franchise is granted. One of the branches of the Home Telephone Company, recently incorporated, is expected to bid in the franchise when it is offered.

In the Western Electrician of August 12th, under the head of Ohio Telephone Notes, appeared an item stating that "It is reported that the Bell interests are negotiating with the Black River Telephone Company for the purchase of the plant at Lorain. The Bell company has had a franchise there for a year, but the Black River company has held the business against all odds." Officers of the Black River Telephone Company say that the plant is not for sale; they have not negotiated with the Bell company and have never received an offer from the Bell interests.

The city of Torreon, Mexico, is to be made the central point for an extensive system of long-distance telephone lines, which are to cover a large portion of Northern Mexico. The concession for this proposed system was obtained from the Mexican government about three years ago by John Woessner of Saltillo, Mexico. At present there are two Independent telephone systems in Torreon, each of them having a large list of subscribers. Both systems were recently improved in many particulars. Mr. Woessner already has built long-distance lines from Torreon to Gomez Palacio and Lero, and to the more distant city of Durango, and negotiations are now pending for an entrance into Monterey, 200 miles distant.

When the news that terms of peace had been agreed to came over the telephone to the hotel office in Portsmouth, N. H., last week Alexander Graham Bell was present, and is said to have related an incident which occurred 30 years ago. At that time Mr. Bell was teacher of English at the Boston University and was experimenting at the same time with his telephone. One of the pupils, named Isawa, asked if Japanese could be spoken through the new instrument, and on being informed that it could he brought two Japanese friends from Harvard to talk through the device. These gentlemen, according to the story, were Baron Komura and Baron Kaneko, Japanese peace envoys, who remembered the incident when Mr. Bell met them in Tokio eight years ago.

Methods of Getting New Lighting Business Where Natural Gas Competition Exists.

Getting new business and retaining the old where competition by natural gas exists is one of the ever-present problems of the electric central-station manager. This sort of competition is of course not felt by a large proportion of the central stations; still the territory in which natural gas plays an important part in lighting is considerable. Natural gas in such localities is often cheap to a degree that is alarming to those who have electricity to sell, still it may always be borne in mind that a good thing will sell upon its merits, and even if there be something a little cheaper but not so good the best will in the end win out.

How to obtain and hold business under these conditions is discussed in a paper prepared by Messrs. R. L. Johnston of Akron and Warren E. Russell of Massillon, Ohio, for the Ohio Electric Light Association convention held at Put-in-Bay in August. As pointed out by Mr. Johnston, the best method for obtaining new customers is to make up a list of the people who can afford to use electricity—people who can afford comfort and insist upon smoking 10-cent cigars notwithstanding the fact that there are nickel ones on the market—put to them some well-directed arguments; draw a few comparisons to show that notwithstanding the fact that gas costs them only 30 cents per thousand, it is short-sighted economy to use it, and it is certainly not for the man who can afford to use electric light to use gas with the accompanying risk and unpleasantness of dirt, smell and heat, let alone the inartistic appearance of the flaming gas jet and the fact that using electric light presents possibilities for decoration and improving the appearance of the home and store, and that it is well worth the difference in price to use electric light.

He has found the best method for retaining old business is to make old customers so well satisfied with the quality of the light, the reasonableness of the rates and the honesty and courteous treatment upon the part of all employes that they will proclaim to all their friends the satisfaction that they feel.

Mr. Russell said in part:

"In Massillon, a place of 15,000, we are on the lines of the East Ohio Gas Company. Our natural gas is furnished us out of the same mains which supply New Philadelphia, Canton, Akron and Cleveland.

"The wells are somewhere in West Virginia, more than 125 miles away. The price charged consumers is 30 cents per thousand cubic feet net; earlier the price was 20 cents per thousand. The gas company has not the right under its franchise to furnish gas for lighting purposes, but gas having been laid in a residence or other building for purposes of heat, if the owner sees fit to use it for light the gas company is liberal and does not stop him, and those like ourselves whose toes are figuratively stepped on can do nothing against such use. Our company owns the artificial gas plant in Massillon, and that part of our business has been idle since a time when its income got to a point where it about equalled the cost of operation.

"We are not discouraged over the progress which our company has made and is making in furnishing electric light in competition with natural gas. It forces us to have the best possible regulation, to carry on a constant campaign of education and to make new and renewed efforts. It has forced us to spread out more than we might otherwise have done, that is to say, we have built more new line over wider range of territory; we have even gone after some farm business, no motor business, but lighting. It is surprising how the country people do take to it, and once installed the farmer's wife and daughters will make any reasonable sacrifice to keep it."

"I advise the preparation of a card catalogue of prospective customers. Keep it up to date and send all the 'more likelys' something every month—or, better, twice a month. Our company cannot afford as yet to hire a solicitor, but I say it with a pardonable pride, that there is no one in Massillon who is in a position to have electric light if he wants it, who is not kept constantly reminded that we want his business and stand ready to serve him at any time.

"Get up circular letters about the fifteenth of each month and send them out. Mimeograph or typewriter carbon copies will get these up cheaply for you, and two cents or a cheap boy will deliver them. Send the circular letters to the ladies, and be sure that you address 'Mrs. Angelina Johnson Jones,' although the lady is only 'Mrs. John Jones.' This is small, but it counts; works all the corners! Let all your letters contain matter that is timely for the season, house-cleaning time, etc.; dwell on how cool electric light is for the summer; keep ever and always before the people the indisputable fact that electricity is always clean; that is your best trump with the particular and exacting housekeepers; even go to the honest length of pointing out how natural gas is absolutely ruinous to all the furnishings of the home or store, and that, adding to its cost the damage that it is sure to do, even the price is in favor of electric light; emphasize that it is cleaner and cheaper to use electric light

at 10 cents per kilowatt in residence and nine cents in business houses than to use natural gas at 30 cents per thousand; go into detail always in your letters in presenting your case."

"Now, a word about wiring! We do all the wiring that is done in Massillon; we also sell all the fixtures. I am not yet ready to say that I am an advocate of free wiring of residences to get business, but we may come to it. That is the practice in some towns in England where they have strong competition with artificial gas. I believe it is a good plan to give any householder who is responsible all the time that he will ask, within reason, to pay for wiring a house. One method for getting payment is to augment the light bill monthly by, say 25 per cent. or more, and allow this increase to be a partial payment credit for settlement of the wiring bill. This is attractive. In a town of 15,000, people for the most part think in dimes, whereas in larger ones the thought is in dollars.

"Incandescent lamps and renewals thereof is a ripe theme. We use Class A grade lamps and sell them at 25 cents each, or 20 cents each where six or more are taken. We do not give free renewals under any conditions. I believe that we are all coming to the giving of free renewals. It is my best information that under proper care it will add about one cent per kilowatt of current consumed to the cost of production. I do not know of anything that pleases customers more than free renewals. The gas companies will hardly come to the furnishing of free mantles, but I believe that those who have close competition with gas can gain a decided advantage by giving free renewals. The most approved method of furnishing free renewals seems to be to renew all lamps every three months, testing out those taken down and cleaning and putting up a second time all that have not dropped below 80 per cent. of their rated candlepower.

"For residence lighting I believe that all central-station people must agree that the best selection possible of Class A incandescent lamps is none too good. Where one does not give free renewals of burned-out lamps it is most important to instruct consumers in a thumb-measure method of test, that is to say, take a piece of white paper and hold it behind each bulb while it is burning, and if there is any black deposit at all inside the glass of the bulb, particularly around the tip, replace it with a new one. Not many will take down lamps this early, but if they do not, I need not tell here who gains and who loses primarily.

"Lamps are far cheaper than current at present rates. It is necessary to be ever ready to tell a customer to put up eight-candlepower lamps for 16-candlepower wherever they will answer; this never fails to please. As soon as you get home, if you haven't some already in use, order some electric flatirons and give them out on trial where they will do the most good. If you get a kind that do their work properly, you will soon be obliged to order more. The time is soon coming when there will be a 'flatiron peak' along through the middle of the day every Tuesday. At 10 cents per kilowatt in residences these irons of proper size consume about two cents worth of electricity per hour, and with ordinary care it is impossible to burn the finest fabric. When heating irons with gas not one-third of the amount consumed goes to heat the metal, not to mention vitiation of the air and the discomfort that is caused, especially in the summer, through heating the room to torrid temperature. One comparatively excellent feature of the electric iron is that it is always clean; it is peculiar that one of these irons will remain hot for upward of half an hour after the current is shut off.

"We have a few heating pads in use, and the users no longer have cold feet, and have discarded the hot-water bag altogether. It is safe to predict that the electric kitchen is coming, first, because it is economical, and, second, because it tends to make the cook's work easier and more attractive. Those of you who were in Denver in June will remember the statement by one member of the convention that after several years of trial in an older house, he is now building a new residence that has not a chimney on the kitchen, because all the cooking will be done by electricity; incidentally he mentioned that his family had been able to retain the service of an excellent Polish servant girl for five consecutive years because the electric kitchen simplified the work so much. This man stated that his house was wired with two systems, one for heat and the other for light.

"One hard feature that Canton, Massillon, etc., have had to combat is a four-burner gas arc light, each burner being fitted with a mantle, and each burner consuming about three cubic feet of gas per hour. The company that rents these lamps alone to customers at $1.25 per month, mantles, cleaning and trimming included, has no connection with the gas company. We 'go after' these in the summer, and it is a pretty stubborn fellow who has one indoors if we cannot induce him to replace it with a half arc on long time, say a three to five-year contract. By no means have we gotten rid of these gas arcs, but we 'keep a-knockin'' away."

CORRESPONDENCE.

Great Britain.

London, August 23.—The difficulties of dual control are still being experienced to a small extent in connection with the conversion of the Inner Circle to electric traction. It was agreed between the Metropolitan and Metropolitan District companies, in whose hands is the Inner Circle line, that the complete electrical service should replace the old steam regime on July 1st. The service was started, but the District company was unable to continue, owing, as the company put it, to the necessity for certain adjustments to be made in the rolling stock. Only a partial service has therefore been available, which is in the nature of a shuttle service sandwiched between the through steam trains. It is stated that the whole of the steam trains will be displaced by the middle of next month, and that in the meantime the number of electric trains on the shuttle service will be increased. In the rolling stock the two companies have adopted different methods, both in the exterior and mechanical arrangements. On the lines belonging to the two companies in question, greater progress is being made, presumably because the lines are in the one hand.

It was stated in some of the daily papers last week that a company is about to be formed in London with the object of placing 2,500 electric cabs upon the streets of London. If this is so it is to be hoped that a better fate will be met than that encountered by its predecessor a few years ago, which quickly went into liquidation. The engineer originator of that scheme is now an undischarged bankrupt.

Two further electric power companies are just opening their generating stations. One is the Yorkshire scheme which was authorized three or four years ago with a large district in Yorkshire, and which is now fast entering into agreements with local authorities, weaving factories, etc., for supply. The other is a Scotch scheme run by the Fife Electric Power Company, which was sanctioned more recently and has got to work more quickly.

Mention has often been made of the activity of the Local Government Board when asked to sanction loans for municipal enterprises. In the electrical industry it is becoming the subject of an outcry on the part of the municipalities, who apparently believe that any sums, no matter for what purpose, should be sanctioned without question. That the Local Government Board does not accept this view is evidenced by a decision given a few days ago in the case of a loan asked for, for a municipal electrical scheme, by an unusually small authority. The loan was refused and the advice tendered that the council's electric-lighting power should be transferred to a company. I believe this is the first time on record that such a decision has been given, but it is only right that some supervision should exist in regard to these matters.

It has been the invariable custom of the various steam-railway companies during the last two or three years to record losses of traffic due to the competition of electric tramways. With many of the railway companies this matter would appear to have reached an acute stage at present, for losses in traffic amounting to millions of passengers during the half year are common occurrences. The Liverpool overhead electric railway, for the first time in its history, is prevented from paying any dividend, owing to the competition of the corporation tramways. Throughout all the large towns the same result is being forced upon the railroad companies, while the losses of suburban passengers by the London railroad companies, due to the tramways, are reaching colossal figures.

It is reported that an electro-peat-coal plant has been erected in Ireland. G.

New York.

New York city, September 2.—Alexander E. Orr, president of the Board of Rapid Transit Commissioners, returned from Europe last Sunday morning on board the Celtic, and lost no time picking up the threads of local traction matters. He stated yesterday that the first contract for the new subways will be advertised before the end of the current year and that construction work may be begun in February, 1906.

Much progress has already been made in obtaining consents from property owners along some of the new subway routes, and where owners have not consented preparations have been made to appeal to the courts. Preliminary borings have been commenced, and although no effort has been made to push forward any particular route, yet it is likely that the earliest actual construction work will be on the Third, Seventh and Lexington Avenue schemes.

The French liner La Loraine, arriving here today, reported that last Thursday, when 800 miles east of New York, it received via the Kronprinz Wilhelm, the news of the peace agreement.

A contract for the installation of elevators in the New York custom house is likely to be advertised shortly. A contract for the interior furnishing of the building has this week been awarded to J. C. Robinson of Chicago.

A parlor car neatly and comfortably fitted is now in daily use on the subway for the use of the directorate and staff.

The New York, Westchester and Boston railroad was granted a franchise last night by the aldermen of Mount Vernon, N. Y., and this will enable the company to construct the continuation of its proposed line from the northerly termination of the New York subway. The Mount Vernonites insist upon a local five-cent fare and a minimum number of trains per day. The company undertakes to commence construction within 60 days and to complete the line within four years.

This week has seen the extension of the Long Island railroad electrical service on Atlantic Avenue, Brooklyn. The Long Island railroad is reported to have bought 17 acres of land near Wading River with the intention of demonstrating that unimproved land can be profitably used for various agricultural purposes.

The small municipal lighting plant which is to light the Williamsburg Bridge and is devised to consume street sweepings, will be in operation by about the first of October. The incinerating portion of the plant is ready and has been tested, but none of the electrical machinery has yet been put in.

The General Electric Company is reported to have equipped the plant of the Osaka Electric Light Company of Osaka, Japan, with complete generating apparatus, including six turbines. The capital of the Osaka company is $1,200,000 and the population of the city 800,000. D. W. W.

Southeastern States.

Charlotte, N. C., September 2.—Preliminary surveys have been made for developing the Shenandoah River near Luray, Va., and about 500 horsepower is found available. D. G. Strickler, F. G. Grave and others in Luray are interested in the development scheme.

The Southern Power Company will soon increase to 600 men the force engaged near Lancaster, S. C., on the power house and buildings at Catawba falls.

The officers of the Frederick (Md.) and Middleton electric railway have announced the sale of their eight-mile road to new owners, whose names are withheld for the present.

The Hatton Shoals Company has been given a charter by the state of South Carolina. R. S. Ligon is president.

The Hyatt Improvement Company of Columbia, S. C., proposes to build an electric street railway developing suburban property. F. S. Hyatt is among those interested.

The town of Concord, N. C., has contracted with the Murray Iron Works, Burlington, Iowa, for a 225-horsepower Corliss engine; with the Allis-Chalmers Company of Milwaukee for a 150-kilowatt alternator, and with the Adams-Bagnall Company of Cleveland for a 50-arc-light equipment.

The Raleigh (N. C.) electric railway has had its franchise extended to 50 years, and agrees to build two miles of new track within a year.

The trolley line from Southern Pines to Pinehurst, N. C., has been sold to the Page railroad, and will be discontinued.

The Board of Public Works of Fayetteville, N. C., now has in hand the enlargement of the electric-light plant, together with the improvement of several other public utilities.

The Southern Power Company of Charlotte, N. C., is having great success in making contracts to furnish electric energy to manufacturing plants, and the latest contract is with the Southern Cotton Oil Company at Charlotte for about 300 horsepower, beginning with the coming cotton season. The Southern Power Company is also erecting a $5,000 hotel at Rock Hill near its plants. The newest development, which is at Great Falls, on the Catawba River, will be completed in 18 months, according to estimate, and there will be available at that point 60,000 horsepower.

The first rail on the 30-mile interurban electric line from High Point to Winston-Salem, N. C., was laid on August 24th with impressive ceremonies.

T. D. Ladshaw of the firm of Ladshaw & Ladshaw, Spartanburg, S. C., is superintending the developing of a hydro-electric transmission plant on Meherrin River at Emporia, Va. From 3,000 to 5,000 horsepower will be generated and will be used for driving a cotton mill, city lighting, etc.

The Wilmington (N. C.) Seacoast railroad contemplates the building of about a mile of double tracks for its electric line in the city. Hugh MacRae is the head of the company. L.

Dominion of Canada.

Winnipeg, Man., September 2.—The Economic Power, Light, Heat and Supply Company of Toronto has been incorporated with a capital of $50,000 to deal in electric-light and power machinery. The head office is in Toronto and the incorporators are J. J. Palmer, H. N. Baird, E. T. Malone and others.

The West Kootenay Power and Light Company of British Columbia has been granted a charter to

construct an hydro-electric power plant on the north side of the Kootenay River near the Upper Bonnington Falls for developing a supply of power for electric-light and power purposes and to construct a dam above the Upper Bonnington Falls. The company proposes to construct a power plant capable of producing 20,000 horsepower. The generators will consist of three three-phase 60-cycle revolving-field generators giving a voltage of 1,100 volts at terminals of machines. This current will be passed through transformers and delivered to the transmission lines at 60,000 volts, and will be transmitted to any part of the district of West Kootenay within a radius of 50 miles from the city of Rossland. The current will be transmitted over a maximum distance of about 90 miles. The estimated cost is a little under $1.000.000, of which $100,000 must be subscribed before the company begins work, which must be finished within one year from August 17th. The company has placed an order for cable to cost $131,000. The cable is to be used to carry electric power from Bonnington Falls to Phœnix, Grand Forks, Greenwood and other points in the Boundary country. The company has seven camps employed in the construction of the line.

J. N. Nixon of the Winnipeg street railway has patented a device for use on street railways by which the motorman can open a switch without stopping his car by pressing his foot on a bolt which passes through the bottom of the car. The car having passed the switch closes automatically, leaving a clear line. It is simple and inexpensive.

The Suburban Electric Railway Company of Winnipeg and Headingly will extend its line this season from St. Charles to Headingly, an agreement having been concluded with the council of Assiniboia to that effect. The company has agreed to build and have the line in operation before the end of the present year to the village of Headingly, Man.

The Canadian Pacific officials have under consideration a proposition to supplant steam with electric energy as their motive power. They are now securing data for a comparison of cost and are investigating the available sites for waterpower, and find that ample energy can be developed along and at Kakabeka Falls, Keewatin, and along the Winnipeg River.

The Toronto and York Electrical Radial railway, after a long fight, has secured permission for an extension of the Toronto and Mimico branch of its line from Long Branch to the western boundary of Etobicoke; it also receives an extension of its franchise for 25 years from 1904. The original would run out in 1912.

Judge Morgan of the county of York, Ontario, has allowed the appeal of the Niagara and Toronto Power Company against the assessment of its towers, which are built to carry the wires for transmitting the electric current from Niagara Falls to the city of Toronto and intermediate points. H.

Ohio.

Cleveland, September 2.—According to reports in railway circles, the merger of the electric lines about Newcastle, Pa., and Youngstown, Ohio, as well as connecting lines and a number of lighting plants, was completed in New York a few days ago. The vote of the stockholders of the various corporations interested is said to have been almost unanimous. The Youngstown and Sharon, the Sharon and Newcastle and the Pennsylvania and Mahoning Valley are the companies interested so far as electric lines are concerned. Of the $10,000,000 capital stock, $4,000,000 will be preferred and the remainder common, while there will be $10,000,000 bonds, of which $3,000,000 will be issued at once for improvements and extensions. The remainder of the bonds will probably be sold to the stockholders.

Stockholders of the Central Market Street Railway Company of Columbus have arranged for an assessment of $2 a share to save the property from being sold under the hammer. The United States court will also be asked to allow the issue of receivers' certificates, in order that needed improvements and extensions may be made. The money raised from the assessment will be used in the adjustment of the receivership and protect the stockholders from loss. While only 2,500 shares of the stock are represented in this vote, it is thought that many others will come into this agreement. Guy Walker of New York will formulate, if possible, a reorganization plan.

Considerable talk is still indulged in regarding the supposed plan of the Widener-Elkins syndicate in securing the Appleyard lines and other properties in Ohio. Railroad men seem to recognize the fact that combinations will be formed and the roads gotten into larger systems sooner or later. L. J. Wolf, in an interview a few days ago, said he saw nothing to prevent electric-railway development to the point of long trains made up of sleepers and diners, and run over large systems, giving as much comfort in travel and attaining as great speed as the steam roads.

J. W. Holcombe of this city is said to be at the head of a syndicate that will build an electric railway from Bedford to Alliance by the way of Ravenna and Brady's Lake. The name of the company will be the Cleveland, Ravenna and Alliance Electric Railroad Company, and it is probable that some arrangements will be made by which the new company will use the Northern Ohio Traction line from Bedford to Cleveland. It is estimated that it will require about $1,750,000 to build the road. Work will begin on the road in the spring. It will be 57 miles long.

The Browne-Ryan Electric Company has remodeled the building at 108 East Long Street, Columbus, and will move into it within a few days. The new quarters are now well suited to the business.

Limited cars have been put on the Akron, Bedford and Cleveland branch of the Northern Ohio Traction Company. Connection is made at Akron for Canton and Massillon and some other points.

E. J. Bourke and C. C. Blake of Boston have been in Cleveland several days demonstrating a new semaphore system to prevent head-on collisions between cars. The train dispatcher, with this method, uses the telephone to order the semaphores turned. A number of signals will be set up in the city to show what they will do.

Reports are to the effect that the control of the Chillicothe Railway Company of Chillicothe has passed into the possession of President Vaughters of the Citizens' Bank.

Detectives from New York came here a few days ago with requisition papers for John Burns, one of the men arrested for attempting to swindle the local street-railway company by the accident game. He is also wanted at Philadelphia and other places on the charge of swindling the railway companies. The other two men, who now give their names as John Wilmot and Edward Pape, were sent to the workhouse, and are said to have confessed that they have worked the game in many other places.

A contract for the construction of a large power plant at Milford has been awarded by the Cincinnati, Milford and Loveland Traction Company. The plant complete will cost about $1,000,000, it is said.

The power house of the Toledo, Port Clinton and Lakeside Railway Company is almost completed, and one of the engines and a dynamo have been installed. Most of the wiring has also been completed.

George T. Bishop of this city, president of the Northern Texas Traction Company, denies the rumors that the company is to be reorganized. He says there is no reason why a reorganization should be made and that no plans have ever been considered.

G. A. Vaughters, president of the Citizens' Bank, has purchased the holdings of five stockholders of the Chillicothe Electric Light and Power Company, which gives him control.

Delinquent users of light current from the municipal plant at Ashtabula were cut off a few nights ago by Superintendent Fisk, and their homes left in darkness.

The Bullock Igniter Company of Cleveland, a few days ago, notified the secretary of state of an increase of capital stock from $10,300 to $50,000.

It is claimed that grasshoppers caused the wreck on the Springfield and South Charleston line a few days ago, which resulted in the death of a woman. The insects are plentiful, and the idea is that so many of them were mashed on the track that it became slick and the brakes did not act effectively.

Judge Tayler of the United States court has rendered an opinion to the effect that the Lake Erie, Bowling Green and Napoleon road may cross the Pennsylvania tracks in Wood County.

The line of the Avon Beach and Southern between Avon Beach and South Lorain will probably be in operation by November 1st.

The plan of refinancing the Eastern Ohio Traction Company is going along slowly. So far not enough of the stockholders have agreed to put the plan through.

Charles Thresher, Warren Bicknell and George A. Stanley are the syndicate managers who will build a new road from Youngstown to East Liverpool. They will advance the money to build the road, it is said, and securities will be issued later. It will cost about $1,500,000.

Bids for a franchise in Barberton have been opened, but no award made. The Barberton, Wadsworth and Western and Stephen Miller are the bidders.

Incorporation papers have been issued to the Independent Carbon Company of Cleveland, with a capital stock of $500,000. The incorporators are Gustav von den Steiner, G. W. Cotterell, W. B. Stewart, H. E. French and John P. Dempsey. This is the company that is to take over the property of the United States Carbon Company, evidently, which was purchased some time ago by M. B. Daly.

The Newark and Mount Vernon Traction Company has been incorporated with a nominal capital stock of $10,000 by C. S. Morse, F. A. Crane, Frank L. Beam, Dwight Sapp and A. J. Wilson.

Twenty-nine roads in Ohio and Indiana are now using the interchangeable mileage coupon books of the Ohio Interurban Railway Association. O. M. C.

Michigan.

Detroit, September 1.—The people of Augusta voted in a special election held this week not to install electric street lamps.

The Bay County stone road commissioners have granted a franchise along 20 miles of the Midland stone road, from the western limits of Bay City to the western county line, to unknown promoters of a projected electric railway. The line will run to Midland and Coleman and other points west.

The space-telegraph system recently installed on the Detroit and Cleveland steamer City of Detroit was given a test this week and messages were exchanged between the boat and the operating station at the Solvay Process Company's plant while the boat was in Lake Erie, 25 miles from the mouth of the Detroit River. Further tests will be made before the system is installed in all of the Detroit and Cleveland boats.

The Public Lighting Commission of Detroit has decided that it is not within its province to furnish light to private consumers, as the commissioners believe they were appointed to take charge of the public lighting of the city only. There has been a considerable agitation by some for the furnishing of electric light to individuals, as it has been shown that the public plant has been operated, so far as the lighting of the streets and public buildings are concerned, on a very economical basis.

It is said that W. A. Boland, who controls the Jackson and Ann Arbor line, has a plan for its reorganization and is in New York to complete arrangements to that end. The Boland line (so-called) extends from Jackson to Dexter, and if extended to Detroit would be a competitor of the Detroit, Ypsilanti, Ann Arbor and Jackson line, controlled by the Hawks-Angus syndicate.

P. A. Courtright of Marshall, who has recently completed the survey of an electric line from Jackson to Lansing, is now engaged in surveying the line for the Saginaw Bay and Southwestern, which will extend from Saginaw to St. Johns. C. G. W.

Indiana.

Indianapolis, September 2.—The Valparaiso Lighting Company of Valparaiso has filed articles of incorporation with a capital stock of $150,000. Manufacture and sale of light and heat is the purpose of the company. The directors are Clarence H. Geish, Charles B. Kelsey and Edward Clifford.

The Indianapolis Cold Storage Company has renewed its petition for a franchise to sell its surplus light and heat. The company desires to supply a small district in Indianapolis.

The Wabash and Southeastern Traction Company has asked the commissioners of Vigo County, at Terre Haute, for a franchise. This is the road which is proposed from Columbus to Terre Haute by way of Nashville and Bloomington.

Freight service between Indianapolis and Columbus will be started upon the arrival of two new freight cars which have been ordered by the Indianapolis, Columbus and Southern Traction Company. They will be 50 feet long. The company will erect a freight house in Columbus near the car barns.

A 25-year contract has been made between the Evansville and Eastern Traction Company and the Evansville Suburban and Newburg Traction Company by which the cars of the former will come into the city of Evansville from Newburg, Ind., a distance of 10 miles, over the tracks of the latter's road. Freight cars will be operated over the Eastern line.

A big traction system is planned at South Bend, and it is the intention to have nearly every city in Northern Indiana and Southern Michigan connected by a network of electric railways, which will compare favorably with the system in and around Indianapolis.

The Muncie, Hartford City and Fort Wayne Traction Company, one of the most important independent traction lines in the state, has passed into the hands of the Fort Wayne and Southwestern, representing the Philadelphia interests known as the Widener-Elkins syndicate. The two lines, both of which were building between Bluffton and Fort Wayne, will be joined at Ossian, and only one line, controlled by the Fort Wayne and Wabash Valley Company (to which the Fort Wayne and Southwestern is subsidiary) will be built between Bluffton and Fort Wayne. The town of Ossian is indignant over the sale, because it will place the interurban three-quarters of a mile west of the business street of the town. The Fort Wayne company also gets control of the line in operation between Bluffton and Muncie, 42 miles long.

The several traction lines centering in Muncie have let the contract for a handsome new terminal building to cost $100,000.

The Louisville, New Albany, West Baden and French Lick Railway Company has filed articles of incorporation with a capital stock of $10,000 for the purpose of controlling street-car lines in New Albany, Louisville, French Lick and West Baden, and to build an electric line from New Albany to French Lick. The directors include L. C. Davis, John F. Finley, George B. Dewess, B. H. Cravens, S. H. Braxton, Thomas Taggart and others.

According to a Cincinnati report, Indianapolis is

to be linked with Cincinnati by an electric railway. This line is planned by the management of the Cincinnati, Lawrenceburg and Aurora Traction Company.

Construction work on the Big Four railroad bridge between Jeffersonville, Ind., and Louisville, Ky., is about completed, and cars of the Louisville and Southern Indiana Traction Company will be crossing over the Ohio River by the middle of September. The rolling stock is already in use between Jeffersonville and New Albany, and only a few details remain to be attended to.

Washington and Hamilton townships, Brown County, have voted subsidies to the Indianapolis and Ohio Valley Traction Company, which purposes to build an electric railway from Indianapolis to Rockport, Spencer County, on the Ohio River. The subsidies aggregate $17,141.

Plans for an extensive improvement in the interurban service between Richmond and Indianapolis have been made by General Manager Murdock of the Indianapolis and Eastern Traction Company and the Richmond Street and Interurban Railway Company.

At present all of the Indianapolis and Eastern cars that can be spared from the regular service are being remodeled and repainted in the shops of the Indianapolis Street Railway Company. As soon as the improvements to the cars are finished a new limited service will be established. The limited trains will make the trip between Richmond and Indianapolis in two hours and 45 minutes, 45 minutes less than the time required by the local cars.

Kem Smith, division superintendent of the Fort Wayne and Wabash Valley Traction Company, has resigned his position and is succeeded by Frank Hardy of Marion, formerly chief dispatcher of the interurban system.

William Hart has resigned as freight agent for the Indianapolis Northern Traction Company at Peru and has been succeeded by M. P. Costin.

S. S.

Northwestern States.

Minneapolis, September 2.—The Phillips Light, Heat, Water and Power Company has applied for franchises at Phillips, Wis.

The Zinn Electric Light and Power Company of Oxford, Iowa, has bought out the Anamosa electric-light plant.

Two syndicates are talking of building an electric freight and passenger line from Lake Geneva to Jefferson, Wis., with a branch to Madison.

At an election recently at Fairmont, Minn., a proposition to issue bonds for enlarging the electric-light plant was voted down, and it was voted to sell the plant.

The Light and Power Company of Durand, Wis., has moved into a new building.

The village of Westfield, Wis., has voted to establish a municipal electric-light plant.

The Aberdeen (S. D.) Street Railway Company has been incorporated by S. H. Jumper and others, who propose to establish a street-railway system in that city.

The Northern Cooperage Company of Richville, Minn., will put in a private electric-light plant.

Phillips & Bartlett of Deadwood, S. D., have received the contract for the construction of the power house at Pluma, S. D., for the Consolidated Power and Light Company, at $22,000.

There is a movement on foot to establish a street railway at Sturgis, S. D.

R.

Rocky Mountain States.

Salt Lake City, Utah, August 30.—A company is to be organized at Ogden, Utah, within the next few weeks for the construction of a power plant on the Blackfoot River about 17 miles from Blackfoot, Idaho. E. W. Wade of Ogden is promoting the enterprise, which will involve an expenditure of about $100,000. The plant will supply electric power sufficient for Idaho Falls, Blackfoot and other Idaho cities.

The Boise and Interurban Railway Company has filed articles of incorporation at Boise, Idaho. It is the plan of this company, which is capitalized at $5,000,000, to construct an electric railway connecting the cities of Boise, Payette, Caldwell and Emmett. The directors are W. E. Pierce, J. A. Pinney, L. A. Cote, Aldred Eoff, M. B. Gwin and Edgar Wilson.

The Salt Lake and Ogden Railway Company has filed amended articles of incorporation, in which its capital stock is increased from $800,000 to $1,500,000. The company is about to begin the construction of an interurban electric railway between Salt Lake and Ogden, and an additional track in connection with the steam-railroad track now in use. Bonds of the company will be issued within the next few months.

L. B. Spencer of Ogden, Utah, has filed an application for a water right on Ogden River, his intention being to build a power plant for the purpose of furnishing both power and light to residents of Ogden.

The Helena Power Transmission Company has awarded the first of a series of contracts aggregating $1,500,000 for the construction of a dam across the Missouri River 12 miles from Helena, Mont., to the Wisconsin Bridge Company of Milwaukee. This contract is for the steel for the dam, which is to be completed by May 1st. It is the company's intention to commence transmitting electric power to Helena, Butte and Anaconda within 10 months. About 20,000 horsepower will be developed for use in smelters and mines and for lighting and electric railways.

An arrangement has been effected between the Utah Independent Telephone Company and the Western Union Telegraph Company by the terms of which the telephone company may use the poles of the Western Union between Salt Lake City, Utah, and Los Angeles, Cal. An alliance between the two companies is expected to be an event of the near future.

G.

Pacific Slope.

San Francisco, September 1.—The organization of an Electrical Club in San Francisco will be carried out on a large scale without delay. It is proposed to take in as members those interested in lines allied to the electrical trades. Gas, electric, hydraulic and mechanical engineers will be eligible. This will ensure a large membership of representative men.

The Nevada Consolidated Copper Company, with offices in the Schmiedel Building, San Francisco, has closed contracts with the Allis-Chalmers Company for a complete mining plant, including electrical machinery and the equipment for a smelter. Two 750-kilowatt three-phase generators will be direct connected to two Reynolds-Corliss engines.

The California Electrical Works of San Francisco has sent a shipment of transformers to Cleary City, Alaska, for the Tanama Electric Company. It included six 150-kilowatt 20,000-volt transformers, two 100-kilowatt transformers and 72 secondary transformers. A line of supplies was also furnished.

The Fort Wayne Electric Works has been incorporated in California by J. S. Anthony, E. W. Rice and others, with San Francisco as the prinpal place of business. The capital stock is $1,000,000.

The Electric Equipment Company has been incorporated in San Francisco by L. F. Foster, H. T. Bragdon and others with a capital stock of $30,000.

The Oro Water, Light and Power Company, which was recently incorporated with a capital stock of $3,500,000 by J. A. Krestschmer, R. C. Medcraft and others, will generate electric power near Oroville, Cal. Cory, Meredith & Allen, engineers, have issued specifications for the electric power plant which is to be installed. Thirty gold dredges using electric power are in operation in the territory to be covered by the company's transmission lines.

The Petaluma and Santa Rosa Railway Company has decided to extend its electric-railway system from Forestville to Trenton, Cal. Surveyors are again at work on the proposed extension of the road to Point Pedro on the Bay.

The Sonoma Valley Interurban Railway Company, incorporated with a capital stock of $300,000 by C. T. Ryland and his associates, proposes the construction of an electric road between Sonoma and Glen Ellen, Cal.

The new management of the Portland Consolidated Railway Company is expecting to make extensive improvements in its electric lines in and around Portland, Ore. It is reported that the purchase of part of the Lewis and Clark fair grounds is contemplated at the close of the fair for the purpose of maintaining a summer resort at Guild's Lake. The company has a large amount of money available for these purposes.

The Central California Traction Company has applied to the supervisors for a franchise to operate an interurban line from Stockton, Cal., to Lodi, Woodbridge and thence northward through New Hope and to the county line in the direction of Walnut Grove. H. H. Griffiths holds a franchise from Stockton to the Calaveras River, which he will transfer to the traction company shortly, so that it will have a complete franchise for its line northward.

The Mercantile Trust Company of San Francisco has purchased the Riverdale Power Company of Riverside, Cal.

The Columbia Oil Company of Bakersfield, Cal., is considering the establishment of an electric power plant in the near future. Electricity is to be generated by steam power, oil from Bakersfield being used for fuel. The idea is to build a pipe line from Bakersfield to convey the oil and generate the power at Porterville, Cal.

The construction of the electric railway from Marysville to Grass Valley and Auburn, Cal., is expected to begin in October. John Martin of the California Gas and Electric Corporation is interested in the company. Rights-of-way through Placer County have been promised.

Manager Perkins is superintending the construction of the new electric-light plant at Lakeport, Cal.

A.

PERSONAL.

W. M. Kelsey, master mechanic of the Western Ohio Traction Company, has resigned to take a position with the Union Traction Company of Indiana.

Alpha H. Kling of the Peru Electric Manufacturing Company of Peru, Ind., was in Chicago last Tuesday on business. Mr. Kling represents the advertising department of his company.

James W. Watson has been appointed assistant professor of electrical engineering at the University of Wisconsin to fill the vacancy made by the resignation of B. V. Swenson, who is now with the Indiana Union Traction Company. Mr. Watson is a graduate of the University of Wisconsin of the class of 1902 and has for the last year been instructor in electrical engineering. His appointment so early to an assistant professorship speaks well for his scholastic ability.

J. D. Callery, president of the Pittsburg Railways Company and also interested in several lighting companies in and about Pittsburg, Pa., won the $5,000 gold cup in the trotting race at the intercity matinee at Washington Park, Chicago, last week. Mr. Callery, who did his own driving, won two straight heats with his fine gray gelding, Doctor Strong, the time being 2:09. Other horses in the race were owned by F. G. Jones, H. K. Devereaux and C. K. G. Billings. Mr. Billings, however, did not enter Major Delmar and Lou Dillon, the fastest trotters on the turf.

W. Wyssling of Zurich, Switzerland, and Charles Wirth of Berne arrived in New York a few days ago, having been sent as experts by the Swiss government to the United States to study electric-railway methods. The government of Switzerland, as is known, has planned to apply electricity to all the government railroads and to operate these lines from waterpower plants, utilizing the mountain streams as a source of energy. Mr. Wyssling is secretary-general of the commission for the study of electricity as applied to railroads and is government commissioner in electric-railway studies. Mr. Wirth is government engineer.

B. J. Jones, who has been for eight years electrical engineer for Sargent & Lundy of Chicago, has been appointed manager of the electrical department of the Cincinnati Gas and Electric Company, to take effect October 1st. Sargent & Lundy are the consulting engineers for the Cincinnati Gas and Electric Company, and Mr. Jones is, therefore, thoroughly acquainted with its equipment. During the last eight years Mr. Jones has been employed largely in elevated-railway work, being immediately concerned with the engineering work on the South Side elevated road in Chicago. He also did much of the designing of equipment for the Indianapolis-Cincinnati single-phase road. For three years previous to his employment by Sargent & Lundy he was general superintendent of the South Chicago City railway.

While not officially announced at this writing, it is reported and generally accepted as true that Mr. B. H. Warren has resigned as president of the Allis-Chalmers Company. It is said that he will become the head of a new engineering and contracting company in New York. Mr. Warren became president of the Allis-Chalmers Company in March, 1904, previous to which time he was second vice-president of the Westinghouse Electric and Manufacturing Company of Pittsburg. He is a Bostonian and a graduate of the United States Naval Academy in the class of 1874. He was engaged in various engineering capacities up to 1896, when he became assistant general manager of the Westinghouse company. Mr. Warren is a member of the American Society of Mechanical Engineers, the Society of Naval Architects and Marine Engineers, the Society of Naval Engineers, the Engineers' Club and a number of other engineering organizations.

William E. Langdon of Ramsgate, England, died on August 12th at the age of 73 years. He was one of England's best-known telegraph engineers and also erected and controlled a number of electric-light plants. He began his electrical career at the age of 19, when the joined the Electric and International Telegraph Company. After that company was absorbed by the government he became telegrapb engineer for the London and South Wales Railway Company. From there he went to the Post Office as assistant divisional superintendent, and in 1878 reverted to railway signaling, becoming telegraph superintendent of the Midland Railway Company, which position he held until his retirement from active work in 1902. He wrote a book upon the "Application of Electricity to Railway Work," besides many papers in his line of work. His connection with the Institution of Electrical Engineers was long and intimate, and he was also a member of its forerunner, the Society of Telegraph Engineers. He acted as both president and secretary of the Institution.

William Randolph Strickland has resigned from the New York Central railroad and is now associated with J. G. White & Co. of New York, as assistant to the secretary. Mr. Strickland is a grad-

uate of the Massachusetts Institute of Technology, and during the Spanish war served at the Mare Island navy yard as assistant engineer. While on the U. S. S. Bennington as assistant engineer he had charge of the operation, maintenance and repair of all the machinery about the ship. After the war Mr. Strickland was employed by the Blake Pump Company and Buckeye Engine Company as draftsman, and also in designing special electric cranes and controllers for the Case Manufacturing Company in the capacity of assistant and also as chief engineer. He made the hydraulic calculations for the North Fork power-house scheme at Denver, Colo., in 1900. After he had completed this work he joined the staff of the Colorado Fuel and Iron Company as engineer of location on a standard-gauge line over M'Clure Pass. He also located several electric and steam narrow-gauge lines in Colorado. In 1902 Mr. Strickland was appointed designing engineer for the Lannius Machine Company, and in that capacity laid out its combined amalgamator, concentrator and arrestor. In 1903 he was appointed location engineer on the New York Central railroad and supervised the extension from Cherry Tree to Possum Glory, as well as several of its double-tracking and grade-revision schemes. For the last year Mr. Strickland has been assistant engineer in the maintenance-of-way department of the railroad company, handling correspondence from all divisions in regard to the repair and construction of bridges and buildings. Mr. Strickland's headquarters will be at the main offices of J. G. White & Co. in New York.

ELECTRIC LIGHTING.

The City Council of Clinton, Tenn., has granted a franchise to William B. Crawford of Oliver Springs to erect an electric-light and water plant.

Sealed bids for lighting the streets of Knoxville, Tenn., for three or five years will be received by the Board of Public Works at the city hall until September 11th.

The Western Electric Company and the Fort Wayne Electric Works were the successful bidders for furnishing the city of Chicago 1,000 arc lamps, with regulators and transformers. City Electrician Carroll awarded the contract for a lump sum of $18,028 to the above bidders, each of which will furnish 500 lamps, five transformers and five regulators. Details of the bids were given in the Western Electrician of August 26th.

The Solvay Process Company has lighted the village of Delray, Mich., since its incorporation, its contract expiring next April. The Solvay company owns not only the dynamo but also the wires, poles and lamps throughout the village. Delray is to be taken into Detroit and the Edison Illuminating Company has secured a contract with the Solvay company for illuminating when the contract which compels it to light the village expires.

President W. H. Blood of the National Electric Light Association has appointed the following named gentlemen as the committee on standard rules for electrical construction and operation: Ernest H. Davis (chairman), Captain William Brophy, Louis A. Ferguson, Alex Dow and Samuel Scovil. The chairman, Mr. Davis, is past president of the association and took an active interest in the work of the committee last year. All of the other gentlemen have been in close touch with this question for some time, so the association will be represented by men who are thoroughly conversant with the subject.

ELECTRIC RAILWAYS

The erection of iron columns for the first elevated railway in Philadelphia has been commenced. The uprights weigh about five tons each and are placed on concrete foundations which extend 13 feet into the ground. The road will be known as the Market Street Elevated.

Hugh A. Holmes announced recently in Kansas City that construction work will soon be begun on an electric railway to run from Kansas City, Mo., to Iola, Kan., with branches to the principal towns near the line. About 75 miles of the 110 miles of right-of-way has already been secured.

Thomas Taggart and others are interested in a proposed electric railway from New Albany, Ind., to French Lick Springs, to be built by the Louisville, New Albany, West Baden and French Lick Railway Company, which was incorporated a few days ago. The line will be about 50 miles long.

In reply to the Chicago City Railway Company's bill for an injunction the city of Chicago has filed a demurrer with the United States Circuit Court. The bill for injunction filed by the railway company on July 26th sought to restrain the city from putting into effect its plan for the municipal operation of street railways by granting franchises to other corporations or otherwise interfering with the company in the operation of its 119 routes under the 99-year act and other ordinances which have not yet expired. The principal contention set up in the city's brief demurrer is that the United States courts have no jurisdiction in the matter, as the controversy involves the construction of municipal ordinances and not of any federal law.

PUBLICATIONS.

Queen & Co. of Philadelphia have issued a new folder describing a new line of testing instruments for measuring resistance. The instruments are used extensively by telephone, telegraph and electric-light companies, and electrical manufacturers and dealers. The instruments are clearly described and illustrated in the folder.

The Robert Instrument Company of Detroit, Mich., has issued a small pamphlet describing its combination volt-ammeter, which is of convenient pocket size and a valuable device for electric automobile and launch owners for testing the voltage and current of batteries. It contains no hair springs or intricate movements liable to frequent disarrangement.

In a bulletin issued by the National Battery Company of Buffalo, N. Y., is given a description of an installation of unit accumulators made for the Syracuse and Suburban Railroad Company of Syracuse, N. Y. A good general description of the plant is given in the bulletin, dwelling more particularly on that part which relates to the battery plant. The bulletin is well illustrated and thoroughly interesting.

The Richardson Engineering Company of Hartford, Conn., has issued a new table (No. 100) which is very convenient for buyers in ordering gas or gasoline-engine belted equipments. The table contains six columns which list, respectively, the catalogue number, horsepower of engine, number of 16-candlepower lights normal, number of 16-candlepower lights maximum, price complete of plant and price complete of plant installed.

An unusually attractive catalogue, and one which will bear careful reading, is that of the Wallace Barnes Company of Bristol, Conn., manufacturer of small springs of every description; the company also deals in wire and cold-rolled steel. Springs of various sorts enter largely into the construction of electrical apparatus and instruments, and the company is well prepared to take care of this line of trade. The catalogue contains many valuable tables.

Volume 7 of the Transactions of the American Electrochemical Society has been issued and is in every respect well up to the high standard set by the previous editions. It contains as a frontispiece an excellent portrait of Mr. Wilder D. Bancroft, the president of the society. This volume contains the transactions of the society at its seventh general meeting, held in Boston and Cambridge on April 25th to 27th of this year. All the proceedings of the convention, committee reports, papers and discussions, etc., are set down in full, and the book is well illustrated with pictures and diagrams which go with the various papers. Everything is carefully indexed. The secretary of the society, to whom credit should be given for the general excellence of the book, is S. S. Sadtler of 30 South Tenth Street, Philadelphia.

The architects' edition of the American Metal Stamping Company's bulletin on light-balancing selective diffuser ceilings is very creditable, especially from an artistic point of view. The employment of these ceilings in connection with General Electric arc lamps, gives assurance of a steady and diffused light, adding at the same time an ornament to the room. The bulletin contains a treatise on the subject of color and distribution of artificial lights; also full descriptions of the various styles of ceilings, and a large number of handsome half-tone illustrations taken from night photographs, where the only source of light was from the arc lamps, with their associated ceilings. These pictures were taken in department stores, and show to what advantage the light-balancing system may be used for such work. The American Metal Stamping Company is located at Germantown, Philadelphia, Pa.

The Blanchfield Publishing Company of San Francisco is sending out the 1905 (initial) issue of the Western Electrical Directory. The directory covers the western states, including California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, Wyoming, Texas; also Alaska, Hawaii, British Columbia, Yukon Territory, Alberta, Saskatchewan, Assiniboia and a portion of Mexico. In it are noted the names of companies or individuals operating electric-light and power plants, electric railways; also names of companies, if any, which have been absorbed or succeeded. The capital stock is noted, names of officers, superintendents, purchasing agents, electricians, etc.; location and equipment of generating stations and sub-stations and main offices, mileage and number of cars operated by railway companies, and general information. Electrical contractors and dealers are also listed, together with consulting and contracting engineers.

TRADE NEWS.

The bureau of supplies and accounts of the Navy Department will receive sealed proposals until October 3d for furnishing and installing ready for use a complete storage-battery installation on board the U. S. S. Adder at the Norfolk navy yard. Applicants for proposals should call for schedule 121, which can be obtained of the bureau or at the navy pay office in Norfolk, Va.

The Navy Department, through the bureau of supplies and accounts, is inviting sealed proposals until September 19th for furnishing eastern navy yards with the following: Schedule 108, electric cable; schedule 109, incandescent lamps, circuit-breakers, panels, ammeters, dry cells, compound and electrical supplies; schedule 111, motors and miscellaneous electrical supplies. Blank proposals may be obtained at the navy pay office in New York or of the bureau at Washington.

BUSINESS.

Dixon's Graphite paint for all classes of steel work has fully demonstrated its economical advantage as a protective coating, being easy to apply and having good covering power and wearing qualities. It is manufactured by the Joseph Dixon Crucible Company of Jersey City, N. J.

The Pittsburg Transformer Company of Pittsburg, Pa., says that "Pittsburg transformers are the best transformers made." It takes seven words to say it, says the company, but it took seven years of hard work to make the transformers what they are. In efficiency, close regulation, cool running and durable construction these transformers may be relied upon.

C. O. Schneider & Co. of 84 East Adams Street, Chicago, announce that their Firefly flasher continues to increase in popularity wherever a flasher is required to operate lamps up to a total of 48 candlepower. It is now about a year since this useful little device has been placed on the market and that it is entirely practical and reliable the manufacturers state has been demonstrated by flashers that have been in continuous operation during this time with no attention whatever.

The firm of J. G. White & Co. will be represented at the convention of the American Street Railway Association, to be held in Philadelphia, September 25th to 29th, by Mr. W. E. Harrington, operating manager of the operating department; Mr. W. E. Goldsborough, business manager of the engineering department, and Mr. William Pestell, assistant mechanical engineer, in charge of matters relating to rolling stock and equipment of the street railway and engineering department of the company.

Much success has attended the efforts of A. F. Hamacek, 2014 Kenmore Avenue, Chicago, in placing on the market his automatic series arc cut-out. It is stated that, among a large number of these devices placed in various parts of the country, after a thorough test, not one has been returned as not doing all that was claimed for it. Besides acting as a lightning arrester and ground cut-out this cut-out protects series arc lamps against burning out and will enable a break to be located immediately, thus doing away with rebate bills.

John H. Fowler of John H. Fowler & Co., Chicago, has just returned from a month's trip in Idaho, where he has secured several large stocks of idaho cedar poles. The firm believes that it has on hand the largest stock of well-assorted western poles on the market. It is in shape to handle large orders promptly and give customers good satisfaction as to quality and promptness of delivery. The firm has opened a branch office in the Exchange Building in Spokane, Wash., in charge of Mr. C. W. Gregory, whose duty it will be to look after the buying, shipping and yarding of the stocks in the West.

The Westinghouse Electric and Manufacturing Company of Pittsburg manufactures much of the smaller electrical apparatus which it is possible that some buyers are not aware that it carries. Included in this list are class A and class B incandescent lamps; a complete line of miniature lamps; the new mill type lamp; a street series lamp, especially adapted for use in connection with the Westinghouse shunt-box system; a Lumino lamp which is full of desirable features; a reflector lamp; a complete line of colored lamps, and a new street-railway series lamp. The company states that it has secured the largest lamp contract ever let in Chicago from the White City Construction Company. It also furnishes renewals for the Meridian and Zenith lamps.

The Green Fuel Economizer Company of Matteawan, N. Y., has just completed the erection of a large shop designed to provide for its rapidly increasing business. This company not only supplies special exhausters, with bearings removed from the action of the flue gases, for mechanical draft in connection with the widely used Green fuel economizer, but also builds fans, blowers and exhausters for every purpose. New designs have been worked out for all types of Green-Matteawan fans with the special object of reducing the power required for driving. The Green Fuel Economizer Company does not contract for the engineering of plants, or for the installation of heating and ventilating plants in competition with the heating and ventilating contractors, but freely offers the advantages of its engineering skill and 60 years' experience in the construction and operation of air-moving plants.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) August 29, 1905.

798,062. Insulated Handle. Arthur E. Hobson and John G. Brown, Meriden, Conn.; said Brown assignor to said Hobson. Application filed June 28, 1904.

An insulated handle for electrical tools is described.

798,082. Automatic Controller for Electric Circuits. August Sundh; Yonkers, N. Y., assignor to the Otis Elevator Company, East Orange, N. J. Application filed February 7, 1903.

In an automatic switch are a pivoted switch lever, two electromagnets for swinging it on its pivot in relatively opposite directions and a pivoted three-arm lever having two of its arms respectively connected to the armatures of the magnets and having a pin carried on the third arm and engaging the switch lever for moving it.

798,097. Trolley Stand. Boniface A. Grassberger, Richmond, Va. Application filed December 12, 1904.

Combined with a pivoted support carrying an air cylinder is a trolley-pole arm pivoted to the support between its vertical axis and the cylinder. A piston, slidable on the cylinder, is operatively connected with the arm at a point above its pivot.

798,123. Telephone Switchboard. Joseph L. Wright, Cleveland, Ohio. Application filed July 28, 1904.

The switchboard is provided with line terminals and a number of pairs of conducting strips. Jacks having contact with the terminals and movable contact with the several pairs of strips are associated with plugs engageable with the jacks to move them, the plugs being arranged in pairs, each pair having a member of different length from a member of any other pair.

798,124. Automatic Safety Cut-off for Elevators. Leon J. Adams, Providence, R. I. Application filed May 20, 1903.

Combined with a fixed electric terminal are a pivoted member, a terminal carried by the pivoted member, means operated by the elevator door for actuating the pivoted member to bring the terminals into contact, a latch for holding the terminals in contact and means for releasing the latch.

798,143. Electric Alarm Clock. Joseph McCarthy, St. Louis, Mo. Application filed May 5, 1904.

Details are described.

798,152. Galvanoscope. James T. Armstrong and Axel Orling, London, England. Application filed May 19, 1902.

In an electrocapillary apparatus are a tube containing an electric conducting fluid with means for imparting an electric charge to the fluid to reduce the capillary force and to allow the fluid to flow out of the tube.

798,161. Controller for Electric Circuits. Eugene R. Carichoff, East Orange, N. J., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 30, 1904.

Embodied in the apparatus are a number of switches, a magnet winding, armatures for the winding adapted to be placed under strain when the winding is energized, operative connections between the armatures and the switches and means for automatically regulating the movement of the armatures to move the switches in succession independently of the exciting current of the magnet winding.

798,162. Control System. Eugene R. Carichoff, East Orange, N. J., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 30, 1904.

Combined with several switches are a magnet winding, a number of armatures on each side of the winding, operative connections between each of the armatures and one of the switches and means for controlling the movement of the armatures.

798,167. Measuring Instrument. Frank Conrad, Edgewood Park, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed September 22, 1904.

In a measuring instrument are combined a rotatable member having an indicating pointer, a stationary part, an arbor having a disk fixed thereon, a worm wheel loosely surrounding the arbor and resting upon the disk, a spring washer interposed between the stationary part and the worm wheel, and a worm meshing with the worm wheel.

798,168. Spring Abutment for Measuring Instruments. Frank Conrad, Edgewood Park, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed September 22, 1904.

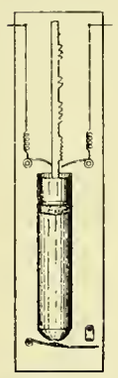
Mechanical details are described.

798,173. Gear Casing for Electric-railway Motors. Henry R. Edgecomb, Edgewood Park, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed August 17, 1904.

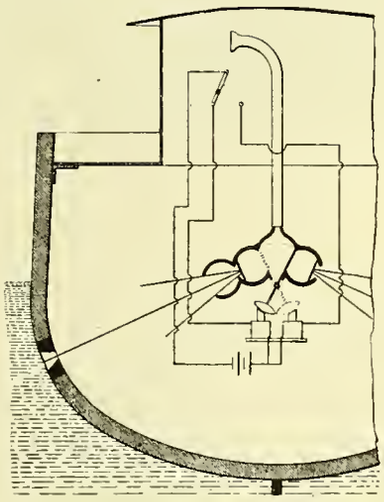
An electric motor has a field magnet frame comprising two parts hinged together for independent movement. A gear case is formed in two parts, which may be removed independently of each other.

798,190. Controller for Electric Motors. George Laird and John P. Todd, Manchester, England, assignors to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed July 22, 1904.

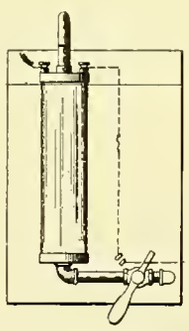
In the controller are a main drum and a reversing-switch drum, and a single operating lever having means for so adjusting its connection with the reversing-switch drum that a one-way movement of the lever may effect rotation of the drum in either direction.



NO. 798,197.—FIRE ALARM.



NO. 798,202.—SUBMARINE SIGNALLING DEVICE.



NO. 798,300.—ELECTRICAL WATER HEATER

798,153. Apparatus for Wireless Telegraphy and Transmissions Across Space. Alessandro Artom, Turin, Italy. Application filed April 19, 1904.

Sending mechanism comprises a closed loop containing one element of a pair of transformers. A self-induction is situated in one part of the loop between the transformers and a capacity in the opposite part of the loop between the transformers. Two discharge conductors are connected to the loop at opposite symmetrical points, a condenser being between one of the terminals and the loop. Insulated aerial conductors cross each other at right angles, each aerial connected to the second element of a transformer and grounded.

798,156. Cooling Apparatus for Electric Generators. Benson Bidwell, Chicago, Ill., assignor to Wilmer S. Snow, Chicago, Ill. Application filed November 25, 1904.

A refrigerating apparatus for the dynamo comprises a cooling tank, cooling coils passing through the tank and a cylinder having connection with the cooling coils.

798,160. Control System. Eugene R. Carichoff, East Orange, N. J., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 4, 1903.

Associated with normally open switches are means for simultaneously placing the switches under strain tending to cause them to close, means for automatically regulating the closing of the switches in succession and means for rendering the strain-producing means inoperative, thereby allowing the switches to open automatically.

798,196. Conduit for Electric Wires. Robert W. Lyle, New York, N. Y. Application filed February 24, 1903.

A conduit section is provided exteriorly with longitudinal grooves extending from end to end and having filled into the middle portion of the grooves cement or other material which divides the groove into relatively short open end sections.

798,197. Fire Alarm. Henry A. Marshman, Albany, N. Y. Application filed April 22, 1905.

A tube with a small hole in the end is filled with sand. The hole is covered by a device which automatically opens when the heat becomes dangerous. A plunger in the tube follows the movement of the sand downward, and in its downward course intermittently makes and breaks an electric alarm circuit. (See cut.)

798,202. Sound-receiving Means for Submarine Signaling. Josiah B. Millet, Boston, Edward C. Wood, Somerville, and Horace B. Gale, Natick, Mass., assignors to the Submarine Signal Company of Waterville, Maine, Boston, Mass. Application filed November 21, 1903.

Apparatus for receiving sound signals transmitted through water consists of sound-transmitting diaphragms in contact with the water upon opposite sides of the ship, sound-receiving diaphragms inside the ship and vibratory connections between the transmitting diaphragms and the receiving diaphragms. (See cut.)

798,222. Ventilating Device for Cores of Electrical Machines. Robert Siegfried, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed January 3, 1905.

A core-ventilating device comprises a plate having lips projecting laterally therefrom and bars of U-shape cross-section clamped to the lips.

798,227. Electric-railway Motor. Norman W. Storer, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed August 6, 1904.

Combined with a field-magnet frame in two parts which are hinged together at one side are means located at the same side for supporting the motor, which may be secured to either the upper or lower part of the field-magnet frame. Axle caps are secured to both parts of the field-magnet frame at the opposite side.

798,235. Insulator. William R. Twiggs, Sandusky, Ohio. Application filed May 9, 1904.

The insulator comprises a body portion having a depression formed in the top, diametrically disposed downwardly inclined slots radiating from the depression and adapted to receive a line wire and removable locking members disposed within the slots for engagement with the wire.

798,236. Electric Annunciator. Hans Usener, Kiel, Germany. Application filed January 4, 1905.

In an electric-telegraph apparatus are a magnet producing a magnetic field and two rigidly interconnected coils having magnetic axes inclined to one another revolubly mounted in the field and forming with the latter a receiver. An electric circuit comprising an electric generator and a resistance, means for maintaining the one end of each coil and one point of the resistance at substantially the same potential and means for electrically connecting the other parts of the two coils with various parts of the resistance are other features of the device.

798,237. Controller for Alternating-current Motors. Hermon L. Van Valkenburg, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed September 2, 1904.

Resistances have their middle points respectively connected to the source. Subdivided autotransformer windings are connected between the terminals and the resistances, a translating device or devices having one terminal connected to the middle of one of the resistances. Means connect the other terminal to the various points of subdivision of the autotransformer windings.

798,252. Anti-hummer for Telephone Wires. Benjamin P. Bartlett, Norway, Kan. Application filed October 19, 1904.

An insulated body having its ends notched in planes at an angle to each other carries wires having loops at their ends, each engaging the notches in a single plane. The body has a passage therethrough and a wire passes through and is connected to the first-named wires.

798,260. Method of Insulating Electrical Conductors. William H. Bristol, New York, N. Y. Application filed December 3, 1904.

The method of electrically insulating conductors consists in forming an intimate mixture of a powdered fire-resisting material, electrically non-conductive, with a solution of silicate of soda, wrapping asbestos about the conductors, applying the mixture in the form of a paste or paint so as to embed the conductors therein and finally heating to dry and harden the material.

798,270. Pressure-operated Electric Switch. Edward H. Dewson, Edgewood Park, Pa., assignor to the Standard Traction Brake Company. Application filed November 2, 1901.

A pressure-operated switch comprises an abutment exposed to fluid pressure, a cylinder and piston, a slide valve separate from but actuated by the abutment and adapted to admit fluid under pressure to and exhaust it from the cylinder, a switch operated by the piston for opening an electric circuit and a spring for returning the piston and closing the switch.

798,279. Brush or Collector for Dynamo-electric Machinery. Josef H. Hallberg, Cincinnati, Ohio. Application filed February 15, 1904.

A collecting member has a cavity in which one end of a flexible terminal member is situated. Means within the cavity force the members into an intimate and extended contact.

798,290. Electrically Actuated Reciprocating Tool. Alonzo W. McArthur, Lynn, Mass., and John G. Crawford, Chicago, Ill. Application filed August 26, 1901. Renewed January 21, 1905.

An electrically actuated reciprocating tool is provided with a plunger, an intermittingly energized coil for moving the plunger in one direction and a separate continuously energized coil for moving the plunger in the opposite direction.

798,300. Electrical Water Heater. Eli E. Sager, Vancouver, Canada. Application filed February 14, 1905.

In an electrical water heater is a casing composed of insulating material and having conducting ends. Supply and discharge pipes are connected with the ends of the casing and an electric resistance coil extends between the conducting ends of the casing and in direct contact with the fluid. Means cause the fluid to flow from one end of the casing to the other end in spiral streams following the direction of the winding of the resistance coil. (See cut.)

798,314. Electrode of Electrolytic Apparatus. George J. Atkins, Tottenham, England. Application filed November 22, 1904.

In electrolytic apparatus where a trough-like vessel is lined with carbon which forms the anode, the improved anode consists of cylindrical segments of carbon, cylindrical segments of sheet-metal conductors and cylindrical segments of conducting water-tight material. Separate trough-like vessels support the segments, frames support the vessels and screw bolts hold the parts together, the segments forming a hollow cylindrical anode the two parts of which can be separated.

798,326. Field-coil Protector. Herbert E. Dubois, Springfield, Mass. Application filed December 23, 1904.

A field frame is provided with a pole piece and a field coil. An independent pan surrounds the pole piece and is adapted to receive the field coil, the pan being provided with walls rising around the outside and inside of the field coil, the inside walls being of less height than the outside walls.

798,335. System of Gun Control. John L. Hall, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 28, 1904.

Electrical means for training the gun both horizontally and vertically, control apparatus controlled from a point remote from the gun and means controlled from the remote point for firing the gun are described in the patent.

798,336. High-potential Switch. Edward S. Halsey, Palmetto, Fla., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 30, 1904.

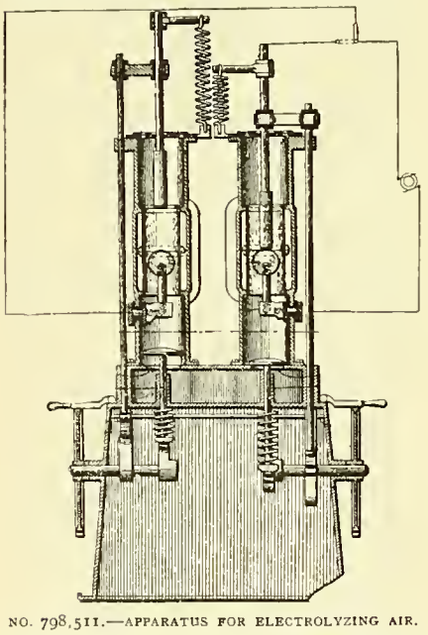
Combined with a high-potential line are a main contact disk, an auxiliary contact disk spaced therefrom to form an air gap, a contact blade movable from the main disk to the auxiliary disk to establish an arc between and a reactance device connected to the auxiliary disk to decrease the current carried by the arc.

798,339. Electric Vibrator. Henry J. Heeney, Boston, Mass., assignor to the Holtzer-Cabot Electric Company. Application filed November 22, 1904.

In a two-gong vibrator are a base or support, a gong mounted at each end thereof, a casing mounted on the support midway between the gongs, a striker pivotally supported in the lower wall of the casing, an armature contained in the casing and connected with the striker, electromagnets to act upon the armature and circuit controllers also contained within the casing and operated by the striker.

798,342. System of Motor Control. George H. Hill, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 30, 1903.

A number of actuating coils control the contacts in the motor circuit. Actuating and maintaining circuits are provided for these contacts and an automatic switch interrupts the actuating circuit actuated by the current flowing through the actuating circuit and maintained in its actuated position by the current in the motor circuit.



NO. 798,511.—APPARATUS FOR ELECTROLYZING AIR.

798,365. Insulation of Electric Conductors. George H. Rupley, Schenectady, N. Y., assignor to the General Electric Company, Schnectady, N. Y. Application filed January 30, 1905.

The process of insulating metallic plates consists in dissolving a saponified vegetable oil in volatile solvent, coating the plates with the solution, igniting the volatile matter and hardening the coating by a further application of heat.

798,368. Third-rail Contact Shoe. Samuel B. Stewart, Jr., Schenectady, N. Y., assignor to General Electric Company, Schenectady, N. Y. Application filed May 5, 1904.

A collector shoe for a third-rail electric railway comprises a supporting frame in which the shoe is mounted so as to have a vertical movement and a horizontal movement relative to the frame and springs acting under compression to maintain the shoe in contact with the rail and also acting under compression to take up the longitudinal thrust of the shoe due to encountering irregularities in the rail.

798,374. Electric Switch. Harold E. White, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 22, 1904.

Combined with a switch capable of independent rotary and reciprocating movement are a second switch capable of rotary movement, a handle arranged to reciprocate the first switch and to rotate the second switch and independent means rotating for the first switch.

798,375. Controller. Harold E. White, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed April 7, 1904.

In a motor controller are a cylindrical member carrying a contact segment, a movable contact finger adapted to engage therewith and means operated by the rotation of the cylinder to move the finger into and out of engaging position.

798,383. Vacuum Tube. William S. Andrews, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed May 10, 1900.

A vacuum adjuster for Roentgen-ray tubes consists of a shunt circuit including in the path of the current a volatile salt within the vacuum inclosure and a spark gap within a closed receptacle.

798,389. Reel for Mine Locomotives. Harris Booker, California, Pa. Application filed April 4, 1905.

A reel for winding up the cable of an electric mine locomotive is described.

798,394. Trolley. Frederic C. Cottrell, Taunton, Mass. Application filed April 26, 1905.

The trolley is provided with a harp having slots in its sides, casings having lugs which are pivoted in the slots, rollers having shanks mounted in the casings and a roller mounted in the harp.

798,397. Service Switch. Frank C. De Reamer, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 19, 1904.

Combined with a box having insulated contact clips mounted therein and adapted to receive a fuse is a hinged member having a fuse-engaging part flexibly mounted thereon.

798,410. Controller. George H. Hill, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed May 2, 1904.

A relatively movable member having contact segments is associated with relatively fixed contact fingers adapted ot engage the segments. A separate normally de-energized blow-out magnet is mounted on the movable member for each contact segment.

798,414. System of Electrical Distribution. Albert S. Hubbard, Greenwich, Conn., assignor to the Gould Storage Battery Company, New York, N. Y. Application filed June 24, 1903.

Combined with a generator, storage battery, booster and work circuit are a field winding for controlling the booster electromotive force and automatic means for cutting a resistance into circuit with this field winding upon increase of current in the field winding.

798,427. Controller Attachment for Supplementary Circuits. William Linterne, Westpark, Ohio, assignor to the Nichols-Lintern Company, Cleveland, Ohio. Application filed November 7, 1904.

Conducting means for an electric circuit co-operate with a controller handle, a push button in the handle and operative means whereby an inward thrust of the push button closes the circuit.

798,439. Trolley-wire Finder. Peter McDonald, Harrison, N. J. Application filed October 8, 1903.

Spiral ridges on the elongated hub of the trolley wheel serve to direct the wire to its proper channel.

798,452. Electrical Signaling System. Joseph P. Sauer, Wheaton, and Samuel E. Johnson, Lombard, Ill. Application filed September 19, 1904.

In a circuit controller for railway-signal systems are an electric circuit, a magnet, an armature therefor, relatively fixed and movable contact devices, the latter moving with the armature and adapted to be moved into and out out of engagement with the former and means for mechanically moving the armature into contact with the magnet to be electrically held thereby.

798,457. Self-galvanic Massage Apparatus. Sven R. E. Schmidt, St. George, Staten Island, N. Y., assignor to John O. Peterson, Brooklyn, N. Y. Application filed January 7, 1905.

Details are described.

798,481. Electrocapillary Apparatus. James T. Armstrong and Axel Orling, London, England. Original application filed May 19, 1902. Divided and this application filed February 2, 1904.

In a relay-closing device are a body of heavy non-conducting fluid combined with a body of relatively light conducting fluid resting thereon, means actuated electrocapillary action for delivering mercury into the lighter fluid and relay contacts located in the heavier fluid and actuated by the falling mercury.

798,482. Electrocapillary Apparatus. James T. Armstrong and Axel Orling, London, England. Application filed February 2, 1904.

Combined with two bodies of different fluids in contact at the point of discharge are means for containing and supporting them, means for sending an electric current through them to effect a change in their electrocapillary condition and permitting one of the fluids to fall and means governed by the fall of the fluid for maintaining unchanged its level in the reservoir.

798,483. Electrocapillary Apparatus. James T. Armstrong and Axel Orling, London, England. Original application filed May 19, 1902. Divided and this application filed February 2, 1904.

Electrocapillary apparatus comprises a balanced tube or receptacle containing two fluids with means for sending a current of electricity through them to disturb the equilibrium by changing the capillary condition of the fluids.

798,484. Method of Actuating Electrocapillary Apparatus. James T. Armstrong and Axel Orling, London, England. Original application filed May 19, 1902. Divided and this application filed February 2, 1904.

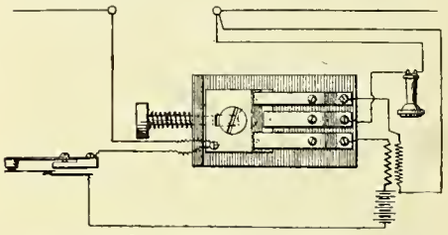
The method of actuating electrocapillary apparatus consisting of the following steps: First, inclosing a fluid electric conductor within a capillary tube; second, keeping the tube supplied with the fluid electric conductor; third, arranging a dissimilar-fluid electric conductor in contact with the first-named fluid at the discharge end of the tube and finally applying an electric charge to the contacting surfaces of the two fluids, whereby the balance of opposed natural forces is disturbed.

798,511. Apparatus for Electrolyzing Air. August Johnson, Moline, Ill., assignor to the Barnard & Leas Manufacturing Company, Moline, Ill. Application filed January 5, 1905.

In an apparatus for electrolyzing gaseous fluids are a generating chamber, normally separated electrodes therein adapted to maintain a continuous arc, a valved outlet from the chamber and means for holding the valve open while the electrodes are separated, and for closing the valve when the electrodes are brought into contact. (See cut.)

798,546. Electrical Signal Circuit. Eugene W. Vogel, Chicago, Ill., assignor by mesne assignments to the Railroad Supply Company. Application filed July 10, 1901.

In a signaling system are combined a signal circuit, a signal mechanism located therein, controlling means for opening and closing the signal circuit, a normally closed track circuit adapted when closed and opened to actuate the controlling means to respectively open and close the signal circuit and a second track circuit governing the first track circuit.



NO. 798,555.—TELEPHONE CUT-OUT.

798,555. Switch or Cut-out for Telephones and Circuits. Charles Adams-Randall, New York, N. Y. Application filed September 17, 1904.

A switch or cut-out for telephone circuits consists of an insulating base, a slidable conducting member on the base having an insulating medium therein and a series of yielding conducting devices, a part of the conducting devices being normally in contact with the insulating medium and the remaining portion engaging the member and the devices connected up to the several telephonic and line circuits. (See cut.)

798,561. Common-battery Lock-out Telephone. Mark P. Boone, Peru, Ind. Application filed April 11, 1905.

One claim reads as follows: A lock-out telephone system for party lines, comprising a common battery having one of its poles grounded at the central office, two line wires connected respectively to the tip and sleeve contacts of the central-office jack, two equal impedance coils connecting the tip and sleeve contacts respectively with opposite sides of the battery, and a subscriber's instrument having two normally open talking contacts, a receiver hook, means for causing the weight of the receiver to hold the talking contacts open, one of the talking contacts being connected through the transmitter and induction coil of the receiver to one of the line wires, and the other talking contact being connected to the other line wire and arranged to divide the current flowing to the ground side of the battery at central office, one part going to the ground side of battery through an impedance coil and the other part going to the ground at subscribers' stations, a locking electromagnet arranged in circuit between the latter line wire and the ground of each subscriber, and an armature with detent for holding the talking contacts open, whenever the circuit of the electromagnet is grounded substantially as described.

798,580. Magnetic Brake. George W. Gilmore, Alliance, Ohio, assignor to the Alliance Machine Company, Alliance, Ohio. Application filed November 23, 1904.

A braking device includes a wheel, a shoe placed to bear thereon and movable toward and from the axis of revolution of the wheel, a magnet for operating the shoe and including in its magnetic circuit a portion of the shoe structure and an adjustable core for the magnet.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on September 4, 1905:

388,836. Electric Bell. M. G. Crane, Newton, Mass.
388,859. Electrical Cash and Parcel Carrier. G. F. Green, Kalamazoo, Mich.
388,869. Electric Signal. H. T. Hill, Manchester, N. H.
388,876. Magnetic Annunciator. W. Humans, Cambridge, Mass.
388,922. Telegraph Exchange System. R. J. Sheehy, New York, N. Y.
388,955. Electrical Railway Conductor. L. Daft, Plainfield, N. J.
388,960. Manufacture of Secondary-battery Plates. J. O. Ellinger, New York, N. Y.
389,011. Dynamo-electric Machine. A. L. Riker, New York, N. Y.
389,029. Regulator for Dynamo-electric Machines. A. G. Waterhouse, Hartford, Conn.
389,030. Regulation of Dynamo-electric Machines. A. G. Waterhouse, Hartford, Conn.
389,062. Telegraphy. P. B. Delany, New York, N. Y.
389,080. Electromagnetic Bell. W. Humans, Cambridge, Mass.
389,096. Automatic Thermo-electric Cut-off for Water Service Supply Pipes. E. A. Newman, Washington, D. C.
389,122. Device for Actuating Street or Station Indicators. W. A. Turner, San Francisco, Cal.
389,142. Printing Telegraph. B. A. Fiske, U. S. Navy.
389,140. Galvanic Battery. A. A. Eaton, Brooklyn, N. Y.
389,151. Electrical Gas Lighter and Extinguisher. G. L. Logan, Olmstead, Ky.
389,184. Commutator for Electric Generators. Otto Zech, Detroit, Mich.

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LIBRARY OF ELECTRICAL ENGR.

Electrically Operated Lift Bridge at Duisburg, Germany.

By Dr. Alfred Gradenwitz.

The ease of adaptation and safety of operation of electric motors, besides their simplicity, are mainly responsible for the important place they now fill in connection with the operation of hoisting machinery, winches, etc. Modern harbors, canals and other hydraulic constructions, with their electric crane plants and all sorts of transporting devices, sluices and bridges, afford a striking illustration of this assertion.

The plant described in the following was installed by the Siemens-Schuckert Works and is the electrically driven lever drawbridge at the Schwanenthor, in Duisburg, Germany. As seen from Fig. 1, part of the double bridge situated between the two central piers is so designed as to be swung upward on the passage of vessels. Fig. 2 shows the bridge in its lowered position. The motion of either lowering or lifting the pairs of flaps may be accomplished within 20 seconds, and is effected by two separate winches, which are operated in each case by two motors of 12 horsepower maximum capacity. Fig. 3 (next page) shows one winch. The electric current is led to the motors by means of inverting switches, which are so connected to the motors that each of them will throw current into one motor. The switch levers may, however, as well be coupled together, so that by motion of one hand lever two inverting switches, and accordngly two motors, may be thrown into circuit simultaneously. Under ordinary conditions, that is to say, with small wind intensities, each motor operates two flaps, this duty requiring an expenditure of about three horsepower, as given by the motor with 840 revolutions per minute. As the wind pressure increases the number of turns of the motor will decrease in proportion, while its output increases at the same time, owing to its being wound in series. In order to obtain with still stronger winds the lifting or lowering motion within 20 seconds, as prescribed, the second motor is made to engage with its winding machinery while the two coupled halves of the inverting switches are coupled together so that the two motors may operate two flaps. With especially strong winds the work done by two motors is not sufficient for the operation of the two flaps simultaneously. In this case each flap is lifted and lowered separately by the two motors. The number of turns of the motors will decrease down to about 450 a minute with the maximum resistance encountered, when the output of the motor increases up to 12 horsepower.

In order to bridge over the central joints of a pair of flaps there are arranged bolts to connect

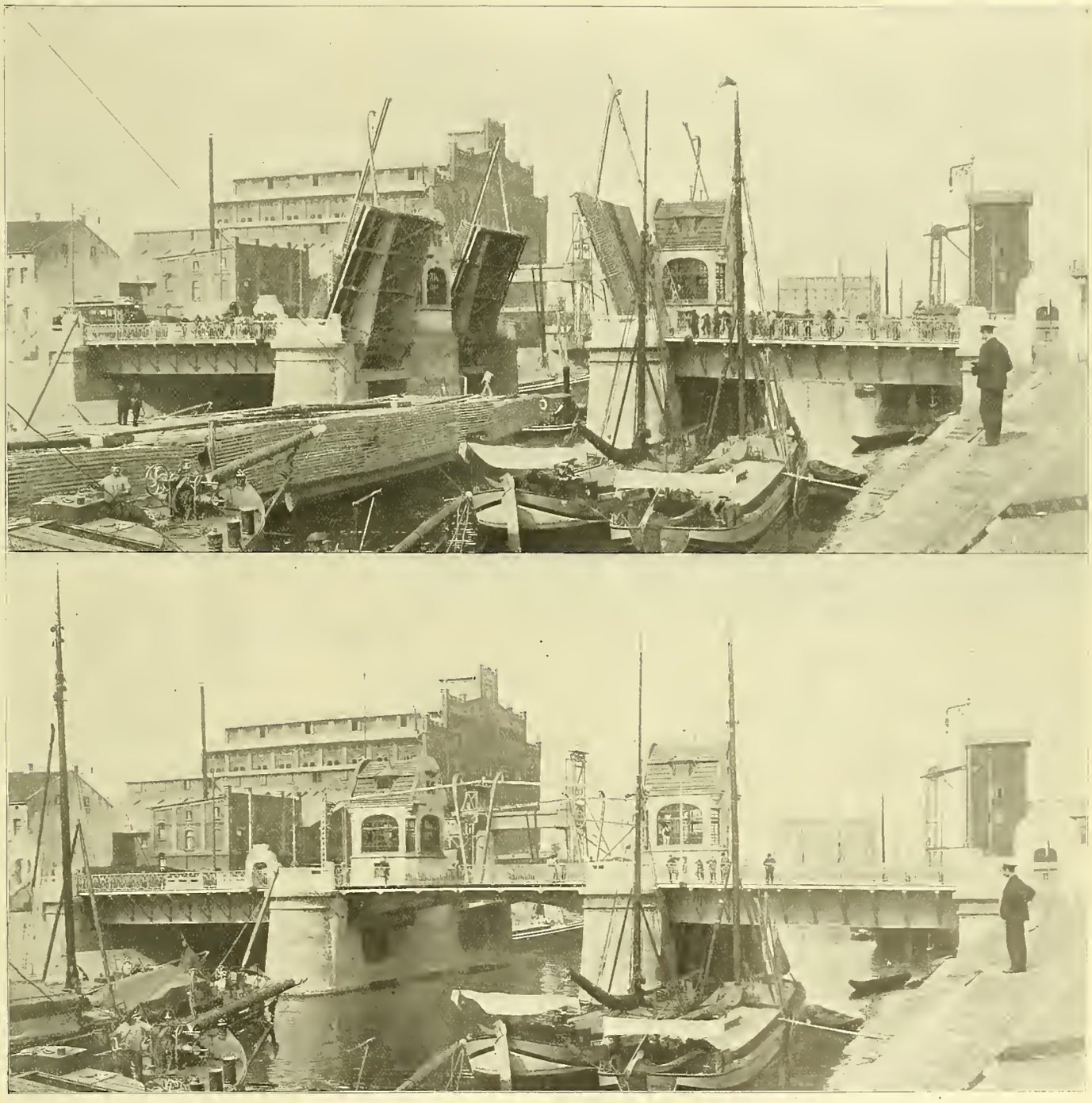


Fig. 1. Bridge Raised Showing Double Arrangement.
Fig. 2. Bridge in Lowered Position.

ELECTRICALLY OPERATED LIFT BRIDGE AT DUISBURG, GERMANY.

the flaps located diagonally in front of each other; these are operated from the guard's cabin. In order to prevent the guard lifting the flaps of the bridge on one side of the bridge before the bridge bolts have been withdrawn by the guard on the other side of the bridge the electric starting apparatus on one side is so connected to the lever of the bridge bolts as to make a starting on the other side possible only after the guard has released the bridge bolts. In order to brake or stop the motion of the flaps, each winch has been equipped with a braking pulley and two braking bands lined with wood blocks, these brakes being operated by automatic braking magnets.

The motors are of the enclosed type and are series wound for intermittent operation and 440-volt direct current. They derive their current from the municipal three-wire mains at 440 volts, with the central conductor earthed, being inserted between the external conductors. The apparatus for the

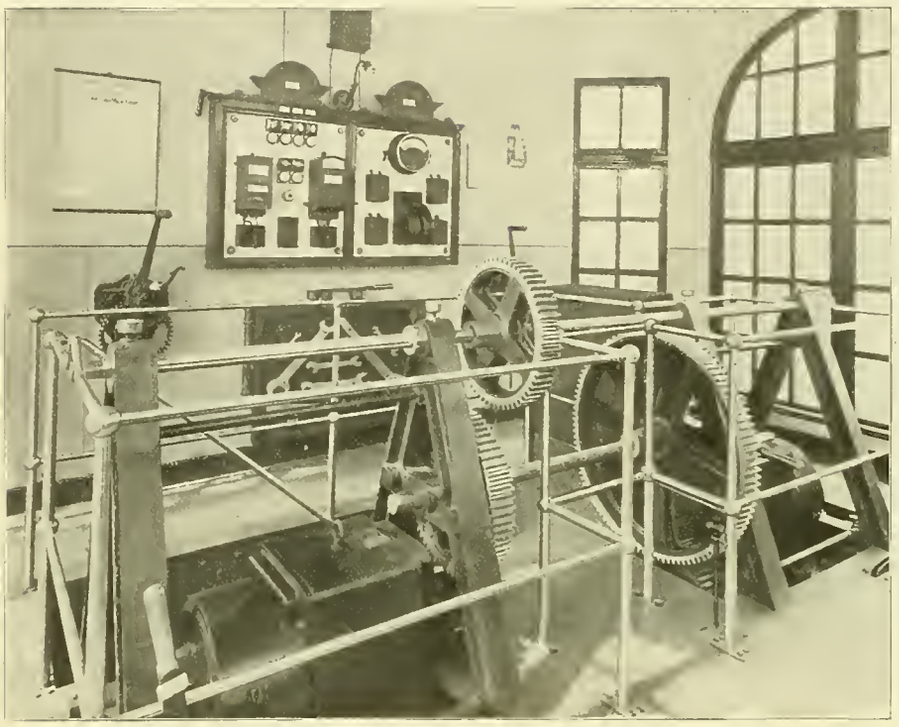


FIG. 3. ELECTRIC MOTORS AND GEARING FOR OPERATING GERMAN LIFT BRIDGE.

forward and backward running of the motors is fitted with a lateral horizontal lever and with resistance boxes attached immediately to them. The cylinders are connected up for full reversion and have contact devices each for two braking magnets connected in parallel.

Hydro-electric Power Development Near the City of Mexico.

The Mexican-American Power Company, composed chiefly of Philadelphia men, is to begin work on one of the largest electric projects ever undertaken in Mexico. The project involves the erection of a series of electric power plants near the City of Mexico and the building of transmission lines for the purpose of providing electric power in that city and in a number of towns adjacent to the power plants. The amount to be invested is estimated at $10,000,000 gold, and it is stated that $1,500,000 in cash has already been paid in, and that all preliminary plans are completed for the immediate construction of the plants.

The main plant will be located on the Malinaltenango River at the foot of Snow Mountain near Toluca. The other plants will be erected on the Meyiec and Tizates rivers. According to the reports of engineers who have investigated the water supply and fall of these rivers the three plants will be able to generate not ess than 90,000 horsepower. The initial plant will have a capacity of 10,000 horsepower. The falls in these rivers are so great that it will not be necessary to construct dams or long canals. By digging a short canal the water from the Malinaltenango River will be dropped into a basin, a distance of 820 feet, and thus afford the necessary power for the electric generating plant.

The concession under which this electric power enterprise is to be established is one of the most valuable ever granted in Mexico. It was obtained by Ricardo Marin from the federal government in 1888 at a time when the great value of such industries was not fully realized. It embraces a blanket franchise covering the whole of the City of Mexico for electric power and lights. Mr. Marin transferred the concession to William Mackenzie, a prominent railroad man of Mexico, and the latter after several years of constant effort has succeeded in interesting American capital in carrying out the project on the large scale originally proposed.

It is stated that aluminum wires will be used for transmitting the electric energy. The generating plants will be situated at an altitude of about 10,000 feet. In addition to the proposed transmission line to the City of Mexico other lines will be built to Toluca, El Ora and a number of other towns and mining centers. It is said by those interested in the enterprise that the price of light and power in the City of Mexico will be reduced fully 50 per cent. when they enter competition for the business.

Joel H. de Victor of Philadelphia, Pa., is president of the company and A. S. Harvey of Philadelphia is vice-president.

Illinois State Electric Association.

The Illinois State Electric Association will hold its next annual meeting in Peoria, Ill., October 5th and 6th, next. The first business session will be called at 10 o'clock a. m. on the first day. Headquarters will be established at the National Hotel, where the business of the association will be held and where arrangements have been made for the display of new and improved electrical appliances. Several valuable papers are being prepared bearing on various interesting subjects; important questions will be brought up for discussion, and the entertainment committee has agreed to see that the members and visiting representatives of electrical manufacturing houses are kept busy. A profitable and enjoyable convention is assured, and it is expected that the attendance will be the largest in the history of the organization.

The present officers of the association are: President, E. B. Hillman of Quincy; vice-presidents, N. Cavarno of Kewanee, R. H. Abbott of Petersburg, J. H. Carothers of Pontiac and E. S. Hughes of Olney; secretary, D. Davis of Litchfield; treasurer, C. A. Vallette of Edwardsville; executive committee, W. B. McKinley of Champaign, J. N. C. Shumway of Taylorville, Frank J. Baker of Chicago, H. E. Chubbuck of La Salle, and S. S. Davis of Rock Island.

It was rumored in Dallas, Texas, last week that a big company was being formed by eastern and western capitalists for the purpose of taking over all the street-railway lines in Fort Worth, Dallas, Houston, Galveston and several other Texas cities, and merging them into one corporation.

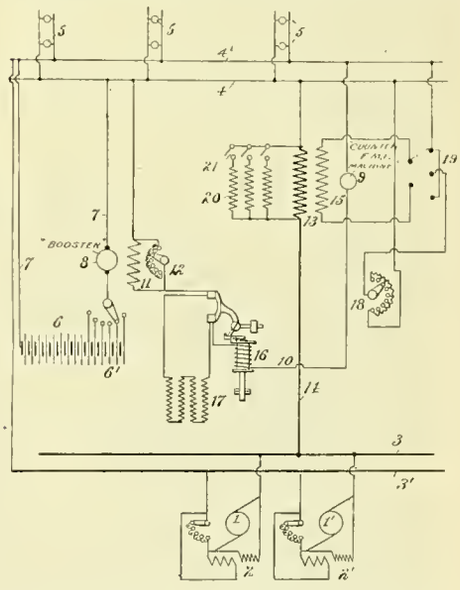
Controller for Storage-battery Boosters.

Systems embodying the use of a storage battery and booster are open to improvement in the direction of regulating apparatus for the control of the booster. A patent recently issued to Albert S. Hubbard of Greenwich, Conn., and assigned to the Gould Storage Battery Company of New York has the object in view of providing means whereby the winding controlling the booster electromotive force may, with safety, be energized by the resultant potential differences that act oppositely on the winding.

Referring to the accompanying diagram, the generators are indicated as connected to bus bars (3) (3') from which the current is taken to supply mains for a lighting or power circuit. The storage battery is provided with regulating or "end" cells (6') and is connected across the mains in a circuit (7), which includes the armature (8) of the booster. The booster armature is driven at desired speed by suitable connection from any convenient source of power. The booster field (11) is energized by the difference between or algebraic sum of the different potentials which act oppositely thereon. In the invention here shown the booster field coils are connected in a circuit of a counter-electromotive-force generator (9), the armature of which is connected across the mains (4) (4'), so that the field winding is energized by a current which is due to the difference between the voltage of the mains and that of the counter-electromotive-force machine.

The field of the counter-electromotive-force generator is provided with a coil (13), which is so connected as to be traversed by the current supplied by the generators, being included, for example, in the connection (14) between a dynamo busbar (3) and the corresponding side (4) of the mains or work circuit. The effect of this field may be varied by means of any suitable devices, such as by shunts and their switches. Other field-regulating devices for the machine (9) may be provided—as, for instance, a coil (15) in a circuit connected, as shown, in parallel with the mains, so that the system may readily be adjusted for different generator loads by manipulating rheostat (18) and pole changer (19) included in the circuit.

In the operation of the system it will be seen that the field winding (11) is energized by a voltage equal to the difference between the potential



CONTROLLER FOR STORAGE-BATTERY BOOSTERS.

difference of the mains (4) (4') and that of the machine (9). In order that the field winding (11) may be protected from abnormal increase of current, which obviously may occur through any derangement of the system that would materially affect or cut out either of the sources of potential difference affecting this circuit there are provided means for increasing the resistance of the booster field circuit which act automatically when the electrical condition of the booster field-winding circuit permits an abnormal increase of current. This is effected, preferably, by the resistance (17) in series with the field winding (11) and the circuit-breaker (16), connected in a short circuit around the resistance. Normally, as shown, the current to the booster field winding passes through

the circuit-breaker and the actuating coil. When, however, the current increases to the desired limit the circuit-breaker (16) opens and the resistance (17) acts to reduce it to a safe quantity. It will be observed that this insertion of resistance in addition to preventing any actual burning out of the field winding (11) has the advantage of preventing dangerous derangements of the system due to abnormal changes of booster voltage. In the specific regulating apparatus shown the resistance also protects the counter-electromotive-force generator (9).

Proposed McCall's Ferry Power Plant on the Susquehanna River.

By O. P. Waters.

Picturesque McCall's Ferry, on the Susquehanna River, 17 miles from Columbia and about 25 miles from York, Pa., will soon be transformed from its wild, romantic scenery to an active hydro-electric center, from which will go out current to furnish motive power to industries, railways, and give light to thousands of those who live within a radius of 100 miles. This historic place has furnished inciments for more than 150 years, but the project now under consideration of harnessing the river will doubtless be the greatest of them all.

Fig. 1. McCall's Ferry, the Narrowest Part of the Susquehanna.

Fig. 2. The Site of the Dam and Power Plant.

PROPOSED M'CALL'S FERRY POWER PLANT ON THE SUSQUEHANNA RIVER.

Before permanent settlements were made by the whites west of the Susquehanna, there were cross-country routes made by traders and missionaries leading from north to south and from east to west. They generally followed Indian trails, and one of these was what is now called the "McCall's Ferry Road." At this point the river is narrowest, and Fig. 1 is a view of the river at this place. This doubtless gave thought to the establishment of a permanent crossing, and the narrow part has since been used for that purpose more than a century and a half.

The first active ferry is thought to have been conducted by a man by the name of Nelson in the year 1740. In 1748 it was known as "White's Ferry." Old records in the York County Court House show that 145 acres of land along the river, and including the ferry, was transferred to Joseph Hadley, who conducted the ferry for several years. It then lay idle for a few years, when it passed, in 1757, into the possession of George Stevenson, who was then the recorder of York County and a leading politician. After that the property had various owners until it was sold to Elias Frey, in 1875. The property reverted to Frey's two children, Samuel D. and Robert T., who held it until recently, when it was transferred, with all its rights and franchises, to the McCall's Ferry Water and Power Company. A handsome price is known to have been paid for the property.

When sold by the Frey brothers the property comprised 1¾ miles, extending north and south on the York County side of the river and 2½ miles on the Lancaster County side. The ferry is surrounded by magnificent mountain and river scenery, and is near the base of an estimated fall of 117 feet, extending from Turkey Hill, a distance of 13 miles. The new company has since purchased all the lands contiguous on both side of the river for about eight miles. Five years have been spent in acquiring this territory.

The harnessing of the river about 3,000 feet below McCall's Ferry, which has been under consideration for a number of years, and which seemed only speculative, is now an assured fact. The final step was taken in New York on May 25th, when the Hillside Water and Power Company and the Susquehanna Water and Power Company were merged into what is known as McCall's Ferry Water and Power Company, with Cary T. Hutchinson of New York, who has spent several years in getting the property together, at its head. The project has been financed by Bertram, Storrs & Griscom of New York, in conjunction with Harvey Fiske & Sons of New York, Lee, Higginson & Co. of Boston, and other prominent banking interests.

The company will have the benefit of the services of an eminent board of engineers, including William Barclay Parsons, Cary T. Hutchinson, F. O. Blackwell, Hugh L. Cooper, Charles T. Main, with Boyd Ely as resident engineer, and R. H. Anderson as chief assistant. These two latter gentlemen are on the ground nearly all the time. They have made all the surveys, and are now ready to begin practical operations.

Late in August the McCalls Ferry Water and Power Company, in conformity with its intention, went on record in the office of the recorder of deeds with a mortgage intended to secure the flotation of $1,000,000 worth of bonds, the proceeds of which will be applied to the creation of the immense plant at that place for the manufacture of electric power. The mortgage covers all properties which have for several years past been acquired by several competing interests in York and Lancaster counties, Pa., and in Cecil and Harford counties, Md. It also covers 2,478 shares of capital stock of the Susquehanna Canal and Power Company, 400 shares of the capital stock of the Conowingo Land Company of Cecil County, Md., 75 shares of the capital stock held by the proprietors of the Susquehanna Canal and many grants of flowage rights of the owners of properties abutting on the river.

All those who have been acquiring properties and rights for power purposes have assigned and combined in the one corporation. The Knickerbocker Trust Company of New York city is the trustee named in the mortgage, and will act for the bondholders. The mortgage bears the date of June 15, 1905, and was executed on behalf of the power company by John A. Keppleman, vice-president, and by W. H. Baunum, secretary. The bonds are payable in 30 years and bear five per cent. interest.

Two other instruments have been recorded, one by the Susquehanna Canal and Power Company, and the other by the Tide Water and Susquehanna River Railroad Company, which convey to the McCall's Ferry Water and Power Company the right to the construction, maintenance and operation of a dam or dams at any point upon the river, and also to the flooding of its rights-of-way and releasing all damages caused by such flooding.

The company will build a dam across the river about 3,000 feet below McCall's Ferry. The river at this point is shown in Fig. 2, and is divided by what is known as Fry's Island. On the Lancaster County side of the island are what is known as the Deeps. Here the water is deep and still, and it is at that point where the power plant will be located.

A dam will be built from the towpath of the old Susquehanna and Tide Water canal across the river to the island and to the plant, a distance of about 2,600 feet. It will be constructed of concrete, and will be 80 feet thick at the bottom and 25 feet at the top.

The massive foundations and wheel-pits will be constructed also of concrete, as will be the building, except the upper portion, which may be built of brick. It will be 600 feet long, 75 feet wide and about 90 feet high. Fifteen wheels, with vertical turbine shafts, will be installed until others are needed, and about 100,000 horsepower of electricity will be generated.

The plant differs materially from the York Haven company's plant, inasmuch as there will be no large race to conduct the water into the wheel-pits. The water will enter the wheels directly from the river.

A great fall of water is one of the features about the plant. The fall extends far up the river to Turkey Hill. From that point, a distance of 13 miles, there is a gradual fall until it reaches the first lock on the canal below the ferry. This is estimated to be about 117 feet.

No disposition has yet been made for the distribution and sale of the current, but it is generally supposed that it will be carried to Baltimore and Philadelphia and intermediate towns along the way. Baltimore is about 50 miles distant, and it is said that Philadelphia is not more than 60 miles, if a direct route is taken.

Heavy pole lines will be erected to carry the current, and a transformer house will be built. These matters are only secondary, as the company will have but little trouble in disposing of its product when it is once put on the market. Baltimore alone will use a large amount of the current.

The development of the McCall's Ferry Water and Power Company's plant will be the means of rejuvenating and bringing additional activity to this section of the country. Already the farmers are beginning to look forward to an advance in the price of their land. A more active spirit seems to be permeating the entire community thereabouts.

The work of constructing the dam and power plant has been given to Sanderson & Potter of New York. The first work will be begun within the next 60 days, when many laborers will be taken to the ferry by the company.

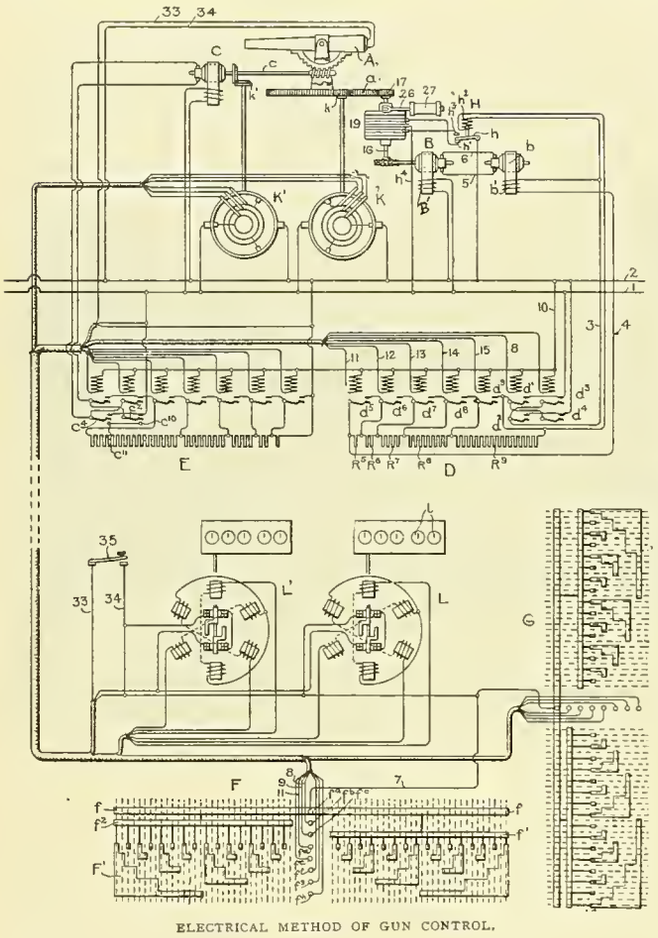
As the plans now are, the dam will be 32 feet in height and will run at an angle across the river. It will contain about 375,000 cubic yards of concrete masonry. Edward Johnson will be the supervising engineer in charge of all the work.

Electric-railway Development in Berlin.

The capacity of power stations which furnish electrical energy for the operation of the street railways in Berlin is, according to a pamphlet prepared by Mr. Bork of the Imperial Railway Administration at Berlin, 70,000 horsepower, of which 30,000 horsepower is required only during the period of largest demand. The amount of trackage is 434 miles and the number of cars in service 2,700, of which 1,600 are motor cars. The number of passengers carried in 1904 by the various transportation companies was as follows: Electric tramways, 395,000,000; city railway, 110,000,000; omnibuses, 94,000,000; elevated electric railway, 33,000,000. During the last 10 years the passenger traffic on the tramways has increased from 157,000,000 to 390,000,000.

Electrical Method of Gun Control.

In the operation of heavy ordnance it is the usual practice to determine at a range-finding station the range of the ship or other object at which it is desired to fire and to telephone or otherwise communicate the range to the control stations adjacent the gun. Not only must the range be communicated to the control stations from the distant range-finding stations, but the orders for firing any particular gun or guns must also be transmitted from the battery commander's station to the man in charge of each gun. It is evident that in the confusion of actual warfare there is danger of misunderstanding telephonic or other communications, necessitating, perhaps, serious delays or causing orders to be executed improperly. The guns must be directed to fire from points within the zone of operation of opposing guns, and where the number of guns is large it is difficult to control them perfectly so as to secure the most rapid and efficient operation and co-operation of all of the guns.



ELECTRICAL METHOD OF GUN CONTROL.

An ingenious system for aiming and firing heavy guns has been patented by John L. Hall of Schenectady, N. Y., and assigned by him to the General Electric Company.

In one of its aspects the invention consists in controlling one or more guns from a distant point, such as a range-finding station or the battery commander's station, which may be situated entirely out of the danger zone, thereby enabling individual guns to be directed and discharged at will and permitting perfect co-operation between the several guns.

The arrangement of parts of the system of control are such that a wide range of resistance changes may be obtained through the use of a small number of main switches or contactors.

In the third of its aspects the invention relates to a control system in which the object or machinery to be moved is accurately brought to rest in the desired position upon the interruption of the motor current.

Referring to the accompanying illustration, which is a diagrammatic representation of one form of the invention, (A) represents a gun of any suitable type mounted upon its carriage, a motor (B) is adapted to rotate the carriage, and (C) is a motor arranged to elevate or depress the muzzle of the gun. Instead of controlling the motors from adjacent points the controlling mechanism is located at a distant safe point.

The control systems for the motors illustrated are as follows: (D) is a controller for the motor (B), and controls this motor indirectly through the generator (b); (E) is a controller for motor (C) and, as illustrated, controls this motor directly. The motor controllers (D) and (E) are connected, respectively, to the master controllers (F) and (G) at the distant station. The motor controller (D) consists of a set of contactors, which constitute a reversing switch for reversing the direction in which the current flows through the field of the generator, together with a series of switches or contactors, which control sections of resistances (R^5) to (R^9).

A pair of leads connects the brushes of the motor (B) and generator (b), while the field (B') of the motor is connected directly across the main lines (1) and (2). The direction of current flow through the field of motor (B) therefore remains constant, and the direction of rotation of the motor is governed by the direction of current flow through the field (b') of the generator, the speed of the motor being determined by the amount of resistance included in series with the field of the generator.

The master controller (F) consists, preferably, of a rotatable cylinder provided with a series of contacts which are adapted to engage in a predetermined order with a series of stationary fingers or brushes. The master controller is shown diagrammatically in a developed form, as is usual in constructions of this type, the angular contacts (F') representing metallic segments on the cylinder and the circles (f^a) (f^b) indicating the fixed fingers or brushes past which the contacts (F') are carried. Two sets of contacts (F') are shown, these being arranged on opposite sides of the "off" point of the cylinder for the purpose of causing the motor (B) to turn in one direction or the other, according as the master controller is moved to one side or the other of its "off" position.

When the master controller is turned to the right, bringing contact (f^c) into engagement with segment (f') a circuit is completed through the actuating coil of contactors (d^3) and (d^4), closing them and permitting current to flow from line wire (1) to contactor (d^3), lead (3), field (b'), lead (4), resistance sections (R^5) to (R^9), contactor (d^9), to line wire (2). The generator now supplies current to the motor armature; but since the field of the generator is weak the current will be impressed at a very low potential. If the master controller is turned in the opposite direction the flow of current between the generator and motor is in the reverse direction from that which flows when the master controller is turned in the opposite direction.

By means of the controller just described the motor may be started at a low speed and may be accelerated at a slow and uniform rate peculiarly adapted to moving a heavy mass, such as a gun and its carriage, from a position of rest, the acceleration of the motor being such that its speed increases only with sufficient rapidity to enable the motor to apply its power most efficiently. The motor may be slowed down gradually as the gun approaches the proper azimuth by gradually cutting in resistance, so that the gun may be moved and brought to rest again with smoothness and precision. Moreover, the parts of the controller are few in number, making the controller compact and of such simplicity that it may be safely used in situations where it is not desirable to have complex apparatus of this character.

In order that the operator of the controller may be able to properly position the gun there is provided indicating mechanism consisting of a commutating device (K), suitably connected to the gun carriage, as by means of a shaft and a pinion (k), together with a synchronous motor (L), adjacent to master controller, the synchronous motor being preferably geared to an instrument having a series of dials for accurately indicating the position of the gun carriage in degrees, minutes, seconds and fractions of seconds.

The motor controller (E) is similar to the controller (D), but controls the resistance in series with the armature of the motor (C) instead of controlling the action of a generator, as in the arrangement previously described in connection with motor (B).

A firing circuit may extend from the gun to the distant station, where the circuit is normally kept open by means of a push-button switch. After the gun has been properly trained pressure upon the push-button serves to fire the gun.

Difficulty is usually experienced in stopping the gun at the exact point desired on account of the momentum of the massive structure, which invariably carries the gun past the proper point no matter how slowly the gun may be brought into position. One of the features of this invention consists in means for accurately positioning the gun upon the desired azimuth without the exercise of extreme care, and to this end there is associated with the gun carriage a yielding stop and clutch mechanism which clutches the gun carriage to the stop at the instant the motor current is interrupted, the stop being provided with powerful springs or similar means which initially yield as they absorb the momentum of the gun and carriage, but which return the gun and carriage to the position which they occupied at the instant of clutching the stop.

In order to operate effectively the clutch mechanism a relay (H) has been provided, which comprises a movable arm (h) permanently connected to line wire (2) and adapted normally to engage with one terminal (h') of the clutch-energizing coil (21), together with an electromagnet (h^2), adapted when energized to move the arm (h) into engagement with one terminal (h^3) of the coil (22) of the clutch. The electromagnet (h^2) is preferably arranged in shunt with the field (b^1) of the generator, so that upon the instant the circuit of the generator field is broken the electromagnet becomes de-energized and permits the arm (h) to drop into engagement with the terminal of clutch coil (21), and since the opposite terminal of the coil is connected to line wire (1) the coil will be energized, clutching the gun carriage to the fixed stop.

Annual Report of the Brooklyn Rapid Transit Company.

The annual report of the Brooklyn Rapid Transit Company has been made public and shows a net gain in operating receipts of $534,855. President Winter states that the physical condition of the company's property has improved and that an additional $200,600 has been spent during the year ended June 30th on way and structure. For equipment there was an additional expenditure of nearly $450,000, chiefly on account of standardizing and fireproofing the elevated cars. One hundred new elevated motor cars and 87 convertible surface cars have been acquired, the latter seating 48 passengers, and being driven by motors aggregating 440 horsepower. Speaking more specifically of the electric equipment, Mr. Winter says in part:

"The new Williamsburg power station building is approaching completion. One 7,500-kilowatt turbine unit and one 5,500-kilowatt unit will be installed about the end of this year, and a third unit of 7,500-kilowatt capacity during the summer of 1906. This station is designed for an ultimate capacity of 100,000 kilowatts or 130,000 horsepower. The capacity of each of the following sub-stations has been increased by the addition of one 1,000-kilowatt rotary with static transformers and switchboard: Tompkins Avenue, Brooklyn Bridge, Essex, Coney Island and Parkville.

"A new station has been erected on Myrtle Avenue and is nearly ready for use. This station will be equipped at once with four 1,000-kilowatt rotaries and the necessary transformers and switchboards. It has a reserve capacity for two additional units. There have been constructed during the year 87,000 lineal feet of subway conduits, ranging from six to 24 ducts, with capacity for 900,000 lineal feet of cable, and 143,000 feet of high-tension and 85,000 feet of low-tension cables have been installed."

The total earnings from operation for the year ended June 30th amounted to $16,333,445, an increase of $1,578,286 over the last previous year. The gross earnings from passengers amounted to $15,649,401, an increase of $1,219,955, and from freight, mail and express $219,641, an increase of $92,380. The total operating expenses were $9,803,870 against $8,760,439 the previous year. Some of the items included under operating expenses, together with the figures for the years ended with June, 1905, and June, 1904, respectively, are as follows: Maintenance of way and structure, $816,276;

$615,669; maintenance of equipment, $1,625,623, $1,206,326; operation of power plant, $1,356,621, $1,501,746; operation of cars—trainmen's wages—$2,768,860, $2,673,863; operation of cars—other expenses—$1,213,708, $1,129,711: freight, mail and express, $139,515, $45,893. The net earnings from operation were $6,529,574, an increase of $534,855.

New Cars for the Chicago City Railway.

To improve the character of its service the Chicago City Railway Company recently ordered 200 new cars to be built especially to meet the conditions in Chicago, and according to plans prepared by President Thomas E. Mitten of the company. Some of the cars have arrived and are in operation on the Indiana Avenue line, where they are giving excellent satisfaction. The cars are equally serviceable for summer and winter use, being provided with extra storm windows for winter service. Of the accompanying pictures Fig. 1 is a view of the exterior of one of the cars arranged for winter use, while Fig. 2 shows the interior as used in the summer.

The new cars are not quite as long as the largest ones previously ordered and seat a few less passengers, but the new features make them more comfortable. Over all the cars measure 45 feet nine inches long by nine feet wide. Inside they are eight feet 2½ inches wide and the body over the end panels is 32 feet five inches. There are seven cross seats on each side and longitudinal seats in each corner, the latter with ample room for four passengers. The aisle is of unusual width, 28 inches, and the cross seats are 33 inches from center to center, instead of the usual 30 inches, giving more knee room, so that the passenger next the aisle need not rise to let his neighbor get out.

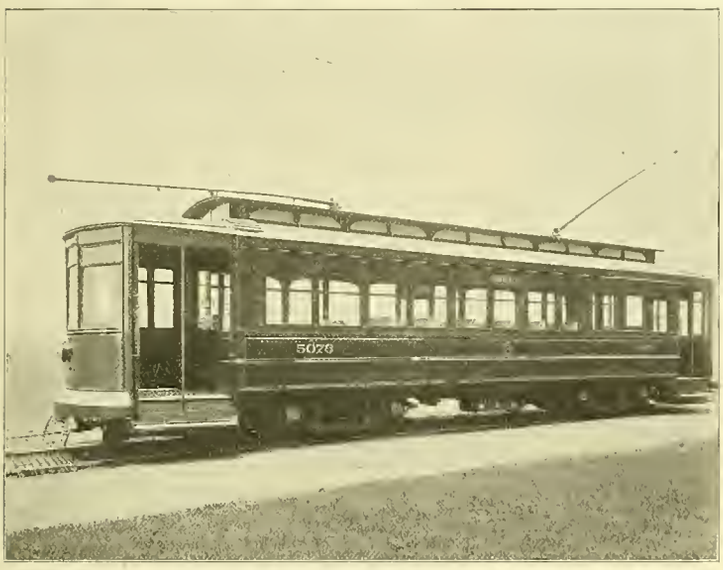


Fig. 1. Exterior View of Car Arranged for Winter.

Fig. 2. Interior View of Car as Used in Summer.

NEW CARS FOR THE CHICAGO CITY RAILWAY.

A special feature is the wide end doors and what may be called a double entrance at each end, which is provided by an iron rod placed perpendicularly through the center of the entrance with a hand rail on each side, as shown in Fig. 1.

There are no straps in the cars; instead handrails are provided on the cross seats for the standing passengers. The idea of this is to accustom those standing to move to the center of the car and thus avoid congestion at the ends. Some objection has been made to the absence of straps, but as it is the plan of the company to reduce standing to a minimum by adding more cars during rush hours, Mr. Mitten believes the patrons will soon welcome the change.

The new cars are equipped with four motors each, two on each truck. The motors are of a new type, called the G. E. 80, being practically the same (40 horsepower) as the G. E. 67, except that the commutator is larger, and some other changes have been made, notably an increase in the size of all bolts to a standard of 1⅛ inches. These motors open from the bottom, a point to which much thought was given. In view of the fact that pit-work is being abandoned as far as possible by some companies, and there has been a marked tendency in some quarters during the last few years to do all work on motors from above and to demand a motor which opens from above rather than from below, the merits of such motors were duly considered, and visits were made to some of the principal cities where motors are being handled in this way. It was finally concluded, however, that under Chicago City railway conditions there is no material advantages in having a motor which will open from above and not from below, and there are some decided advantages in having it open from below. Armatures and fields can be removed and replaced through the pit at any car house without taking the car to the general repair shop if the motor opens from below.

On a large system, such as that of the Chicago City Railway Company, it was not considered advisable to select a type of motor which would make it necessary to take a car many miles to the general repair shops in order to remove armatures and fields. As to convenience of handling when making a general overhauling of a car equipment it was considered practically as easy to lift a motor out of the trucks with the crane at the general repair shops and turn it over so as to get the armature out as it would be to take it out of the trucks and remove the armature if the motor opened from above; the only difference being that the motor must be turned over by the crane, which is the work of but a few seconds.

The car wiring has been given very careful attention by H. B. Fleming, chief engineer of the company, and is considered probably the finest piece of work of the kind ever put on a street-railway car. It follows the practice recently adopted on a number of elevated roads of putting all wires under the car in iron-pipe conduit. The motor wires between controllers are bunched into three cables. One of these cables contains the wires for motors 1 and 2, which motors are placed on one truck. The second cable contains wires for motors 3 and 4 placed on the other truck. The third cable contains wires going to the resistance grids. The compressor wiring is run in separate iron-pipe conduit. The iron-pipe conduit for the main cables runs along the center longitudinal sills of the car. Each cable conduit has all wires of different color, so there is no confusion of leads.

Where the taps are taken off from the cable to the motor leads a split cast-iron junction box containing the joints is bolted on the conduit. These taps are led to a connection box, which is an innovation in car wiring, and is intended to make it possible quickly to disconnect the motor leads without the inconvenience of disconnecting joints and removing joint insulation, as has been necessary heretofore when taking trucks from under a car. The taps from the cable are led into the connection box, where they terminate in switch jaws. Lugs soldered on to the terminals of the motor leads are made of such shape as to fit into these switch jaws, and when the lid of the connection box is fastened on they are secured firmly in place.

The controller at each end of the car is connected to the trolley lead through an automatic circuit-breaker and a new type of fuse box. While the automatic circuit-breaker can ordinarily be depended on, it is felt that a fuse should be provided to save the equipment when the circuit-breaker sticks. This fuse box is arranged to take a copper-strip fuse, the arrangement for clamping being powerful and simple, so that the fuse requires no special terminals, being simply a length of copper ribbon. The K 28 controller is used. Just under the controller is a cast-iron box in which the iron-pipe conduits terminate, through which the wires are led up to the controller by a bell mouth, but in such a way as to prevent water from the platform getting into the controller wires.

Auxiliary circuits are provided which constitute the lighting, heating compressor and signal wiring. In addition to placing a kick coil in series with the main motor circuit, as is the usual practice, a kick coil has also been introduced in series with the auxiliary circuits for heating, light and air-compressor motors in order to prevent damage from lightning.

Straight air brakes are used, supplied with a new type of Christensen AA 4 compressor, which has a capacity of 16 cubic feet of free air a minute. Two air-storage tanks are placed under the car. The governor for the air compressor is put under one of the longitudinal seats. In each corner of the car, under the longitudinal seat, is a sandbox with a Nichols-Lintern air-sanding device. The valve for operating the air sander was devised by the company's engineers. It is placed directly above the stem of the air-brake valve so that the motorman can operate the sander with his thumb while applying the brakes, making a very convenient arrangement. The hand brake provided for emergencies is the Peacock type, with which the car can be readily controlled should the air fail.

The car bodies were built at the works of the J. G. Brill Company at Philadelphia and St. Louis, the trucks by the McGuire-Cummings Manufacturing Company, the air-braking apparatus by the National Electric Company, the Peacock brake by the National Brake Company, the seats by the Hale & Kilburn Manufacturing Company, and the illuminated signs by the Hunter Illuminated Car Sign Company. The cars cost complete about $5,500 each.

Improvement in Everett-Moore Properties.

The Citizens' Savings and Trust Company of Cleveland, Ohio, as receiver of the Lake Shore Electric Railway Company of Cleveland, has made a report to the United States Circuit Court in which it is shown that the debts, amounting to $968,262.74, have been paid, and, in addition, $800,000 in earnings were turned over to the court for the benefit of the company. The receiver asks to be discharged, as its work has been completed. The appointment was made when the Everett-Moore syndicate became embarrassed, and was meant to be temporary in the beginning. The road is now in better condition than it ever has been, but at the same time it is probable that the owners will make some important improvements when they again come into possession. There is some talk of double-tracking the line, and a lot of new cars will be purchased. All the Everett-Moore properties that were not sold will be back into the old hands within a short time and the owners will, it is said, put them in the best of shape. Though delayed in the consummation of many plans, these men are again ready to push their business to success.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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DATES AHEAD.

Colorado Electric Light, Power and Railway Association (annual convention), Glenwood Springs, Colo., September 18th, 19th and 20th.

American Electrochemical Society (general meeting), Bethlehem, Pa., September 18th, 19th and 20th.

American Electrotherapeutic Association (annual meeting), Academy of Medicine, New York city, September 19th, 20th and 21st.

American Street Railway Association (annual convention), Bellevue-Stratford Hotel, Philadelphia, September 25th to 29th.

Illinois State Electric Association (annual meeting), National Hotel, Peoria, Ill., October 5th and 6th.

Railway Signal Association (annual meeting), Niagara Falls, N. Y., October 10th.

RUSSIA, out of gratitude, it is assumed, for the work of President Roosevelt in striving mightily, and successfully, for peace, has abolished the retaliatory duties upon manufactures of the United States, especially machinery of every character. The news conveyed by Mr. Witte, the senior Russian envoy, was a surprise to the president, whose aims for peace had no ulterior political motive. When Mr. Witte and Baron Rosen met the president at Sagamore Hill before the dinner tendered to them at the president's summer home, after the peace treaty had been signed, the former stepped forward and presented the following communication:

Some years ago, in consequence of a misunderstanding in the interpretation of the most-favored-nation clause, there were established in Russia on several articles of American production custom duties on a higher scale than those levied on the same articles when imported from other countries. His majesty, the emperor of Russia, has commanded me to inform the president of the United States that he has been pleased to order the discontinuance of the levying of such higher duties on American products in order that henceforth the American manufacturers shall pay the same duties as importers from other countries.

This will be pleasing news to American electrical manufacturers as well as to others engaged in the export trade. Russia does not go extensively into electrical manufactures, and its needs in this line are supplied mainly by Germany, although there has been some demand for American electric-railway and telephone material. Not a little electrical apparatus, too, made in the United States is believed to have found its way into the czar's dominion via Germany, and probably without being credited to the land of its origin. But Russia is going to take account of itself, as one result of the war, unless all signs fail, and there will surely be an increased demand for electrical material of all kinds. Germany is very favorably situated for supplying European Russia with all manner of manufactured goods, but nevertheless the American electrical product is superior in many lines, and there is little doubt that with proper effort and energy a respectable market for American electrical machinery and appliances could be worked up in Russia. The manufacturers in this country were just beginning to think of making a more systematic and intelligent effort to this end several years ago, when the sugar-bounty quarrel came up, and Russia established the retaliatory duties on American machinery. Now that this barrier is removed by a curious and unforeseen chain of events, the makers of electrical appliances should seriously ask themselves the question, "What of Russia?"

Russia has had a rude awakening; it is looking around and taking notice. One thing it cannot fail to observe is that its awakener, Japan, has equipped itself with the latest products of civilization to a large extent. The Russians are not so dense that they will refuse to profit by this lesson. Neither is the country so devastated that it has no cash or credit left to buy modern improvements. The electric railway, the electric light, mining and agricultural machinery, apparatus for power transmission, electric motors for factories, the telegraph, the telephone—all these agencies and many others are needed. Where can they be obtained of such excellent quality and yet of such reasonable price as in the United States? And if we benefit by selling these things, how much more will Russia benefit in receiving them.

IT MAY BE that the last meeting of the American Street Railway Association will be the one held in Philadelphia on September 27th and 28th, and that it will be then and there succeeded by the American Street and Interurban Railway Association, for which a proposed constitution and a set of by-laws have been prepared by the executive committee of the association. For several years the work of the association has been admitted to have been unsatisfactory. This is not the fault of any one man or any particular set of men, but because, through lack of active interest on the part of the busy men composing it, the organization has been permitted to drift along in somewhat haphazard fashion, holding a convention once a year, but not accomplishing much real work, or at any rate only feebly attempting to meet the amount of useful work in sight. For several years the association has been "under conviction of sin;" it hasn't been satisfied with itself. Last year at the St. Louis convention the executive committee was directed to work out a plan of reform, and this proposal has taken shape in the proposed constitution and by-laws, which will come up for final action at the Philadelphia convention. Some of the members—busy men of large affairs—think, according to President W. Caryl Ely, that the results outlined by the new constitution and by-laws embody the only method of saving the American Street Railway Association and its affiliated organizations from utter confusion and uselessness. But it should be stated that the affiliated associations, at any rate—the Mechanical association and the Accountants' association—deserve a better fate.

In the proposed constitution the name of the association is changed to include the words "and Interurban." This makes for bulkiness, but is otherwise acceptable.

It is provided that the headquarters of the association shall be located in New York. Heretofore, for a number of years, the secretary's office has been in this city. The idea of having headquarters is all right, but why not establish them in centrally located Chicago? Why not locate the distributing plant at the center of distribution? We shall be surprised if the western members do not object to the proposed headquarters at the eastern verge of the country.

Members are to be of two classes—active members, consisting of operating companies or individual owners, and associates. The associates shall have no vote, shall not hold office, "nor shall they have the privileges of the floor unless permitted by the association." Evidently, the associates are not expected to cut much of a figure.

The proposed by-laws provide, among other things, that the secretary shall "collect and file for the benefit of the members information and statistics regarding matters relating to the purposes of the association." This is a good provision.

"The entire charge and management of the affairs of the association shall be in the hands of an executive committee, which shall consist of the president, the vice-presidents and one member appointed by each of the affiliated associations." This seems to make a largely honorary office of the presidency; any other member of the executive committee has as much power as the president.

Regular annual meetings are to be held between September 15th and December 15th. Special meetings may be held upon the order of the executive committee. At any meeting executive sessions may be held. These sessions are to be open only to active members.

A committee on subjects shall suggest topics for the work of the main and affiliated societies. This is a good proposal.

Affiliated associations are to be granted charters by the main association, are to be represented on the executive committee and may receive financial assistance.

Annual dues for active members are to range from $25 to $600, according to the gross receipts of the company. Associate members shall pay in advance an annual fee of $5.

One advantage of the proposed reorganization, as stated by President Ely, is the establishment of an information bureau, although we can find no specific reference to it in the by-laws. Affiliated associations, we are informed, will be allowed to draft their own constitution and by-laws, subject to the approval of the parent organization.

The plan of reorganization is an interesting one. It has many good features, and the American Street Railway Association needs reorganizing. But not all of the proposed changes are of equal value. Some are unwise; some are unnecessary. The proposed constitution and by-laws should be given careful study by all members before the convention meets. They should then be taken up, section by section, debated and voted on. The executive committee has done well to provide a basis for the actions of the association, but the association should deliberate well before determining the fundamental law upon which its future usefulness is to depend.

Alumino-thermics.

Through its committee on science and the arts, the Franklin Institute recently investigated the system of "alumino-thermics" devised by Dr. Hans Goldschmidt of Essen, Germany. The sub-committee consisted of Dr. H. F. Keller, chairman; A. E. Outerbridge, Jr., H. G. Morris, James Christie and G. H. Clamer. This sub-committee made some interesting observations in its report, from which the following is taken:

The heat-producing material now known as thermit is now manufactured by Dr. Goldschmidt at his Essen works on a considerable scale. It consists of an intimate mixture of finely divided aluminum and oxide of iron (or other metallic oxide), the ingredients being present in chemical proportions:

$$2\,Al + Fe_2O_3 = 2\,Fe + Al_2O_3.$$

When this thermit is ignited in one spot the reaction proceeds with marvelous rapidity through the entire mass without any further supply of external heat. Owing to the high temperature of ignition of thermit the reaction started either with a bit of burning magnesium ribbon, or better, by the aid of a special ignition powder, consisting of peroxide of barium and aluminum powder.

The extraordinary thermal effects of the reacting mass (its temperature is said to approach 5,400° F.) are due to the sudden disengagement of a vast quantity of heat in a relatively small volume of material. The only products are metallic iron and oxide of aluminum, which retain practically the entire heat of the reaction, and, being liquid, separate into two layers, the metal below and the alumina slag on top.

The principal use of thermit is in joining metal pieces, especially of iron and steel.

Thermit welding has been successfully applied during the last four years in a great number of cases, for some purposes on an extensive scale. Conspicuous among these uses of thermit is the welding of street-railway rails at the joints for the construction of continuous track. Many thousands of such welds have been made in England and Germany, and while the method has not so far found introduction on a large scale in this country, it has been adopted and employed for repairs of the more costly and complex parts of tracks, such as crossings, switches, etc., with excellent results, as one of the members of the sub-committee can attest from personal experience. Special mention should be made also of an advantage in thermit welding in that it dispenses with all bulky equipment, for it requires only a few simple appliances in addition to the thermit itself. Of the latter the Goldschmidt works now supply "welding portions," each containing the quantity required for one weld. In the case of rail ends the weld is made by bringing the molten iron resulting from the reduction of the thermit in direct contact with the rails, so that it will adhere to the parts to be joined, and thus unite them.

Another method of thermit welding, applicable to wrought-iron pipes and angle iron, depends entirely upon the heat obtainable from thermit, the reduced iron not being allowed to adhere to the welded parts. To this end it is only necessary to apply the molten thermit mass in such a way that the slag (alumina) first comes in contact with the cool surface of the articles so as to form a protecting layer, and thus prevent the metal which follows from adhering. While the ends of the pieces are brought to the welding temperature the weld is produced by application of pressure, but without disturbing or changing the section of the welded parts.

Thermit welding has also proved most valuable as a means to repair in breakdowns of machinery. Many cases have been reported where otherwise exceedingly difficult, if not impossible, repairs were made by its means, and so far as the sub-committee is able to ascertain, with remarkably uniform success. It is to be noted in this connection that the repairs which have been made by the aid of thermit include smaller operations, such as replacing a tooth in a steel wheel, as well as the welding of very large pieces, like the stern-posts and crankshafts of transatlantic steamships.

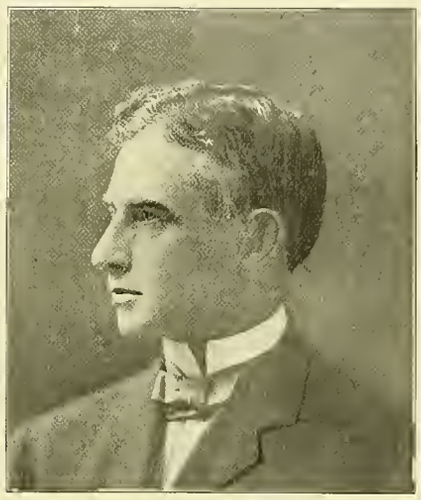
Still another ingenious application of the thermit reaction is in preventing the formation of cavities in large steel castings. A box of specially prepared, so-called anti-piping thermit, attached to an iron rod is pushed into the ingot just as the crust is beginning to form. The heat produced is sufficient to keep the metal liquid where the piping occurs and allows more liquid metal to be poured in to fill the cavity.

It is the opinion of the sub-committee that the invention of thermit and its application in welding and casting metals constitutes a great step in advance in the production and utilization of high temperatures. While it is recognized that Dr. Goldschmidt was not the first one either to observe or to apply the heat liberated in this reduction of metallic oxides with aluminum, he must be credited with having developed the manufacture of thermit, with the practical application of the enormous heat energy stored in this product, and with extraordinary perseverance and resourcefulness in bringing these inventions to commercial success and thereby creating a new industry.

Walter H. Whiteside, President of Allis-Chalmers Company.

As a result of the annual election of the Allis-Chalmers Company on September 7th Walter H. Whiteside was elected to fill the office of president, made vacant by the resignation of B. H. Warren. Henry Woodland was elected treasurer to succeed W. J. Chalmers. Mr. Whiteside was previously vice-president and general manager, and had been connected with the company only about a year, beginning first with the office of general manager of sales of all departments, including the Bullock company.

Mr. Whiteside is a man of broad training, and although young in years he is old in experience. In 1881 he entered the employment of the Hercules Powder Company of Wilmington, Del., and it was he who introduced the high-explosive products of this company into the Lake Superior region. Four years later he became connected with the Cleve-



WALTER H WHITESIDE.

land Electrical Manufacturing Company of Cleveland, Ohio, remaining with that concern about 12 years.

In 1896 Mr. Whiteside was appointed manager of engine sales for the Gates Iron Works of Chicago, and in 1898 the Westinghouse Electric and Manufacturing Company made him manager of its Washington office. While connected with this office he distinguished himself by his work in connection with the installation of electrical power in the dry docks of the Navy Department, especially in the docks at Portsmouth, League Island and Boston. To him was largely due the credit for effecting the change in voltage standardization from 80 to 125 volts in the electric-light and power installations on board the vessels of the United States Navy. His best work, however, in a commercial sense, was in the building up of that very successful branch of the Westinghouse organization known as the Detail and Supply Department. Into this department he injected a new life and vigor of administration that brought an admirable reaping of profitable results, and won for him recognition as a man of marked executive ability. In 1903 Mr. Westinghouse appointed him general manager of the Sawyer-Man Electric Company, in addition to his other duties.

In the summer of 1904 Mr. Whiteside severed his connections with the Westinghouse company and became, as before stated, general manager of sales of the Allis-Chalmers Company, becoming later vice-president and general manager and now, finally, the president of the company. He is a man of force and also of delightful personality, and there is probably no man in the commercial end of the great industrial companies who is better known than he. Everyone who has had dealings with him has entire confidence in him.

Proposed Elevated and Subway Railway for the City of Mexico.

News comes from the City of Mexico that S. F. Neff, formerly superintendent of the street-railway system in that city, is associated with a number of Americans and Mexicans in the project of building a system of elevated and subway electric railways for the City of Mexico. Application for a concession for the proposed system has been made to the Mexican government and is now under consideration. Preliminary plans for the proposed improvements have been made and submitted to the government. It is estimated that the cost of constructing the lines will be about $5,000,000. A commission of government engineers is investigating the project with the view of deciding as to its feasibility.

Chicago Street-railway Situation.

The settlement of the traction problem in Chicago may yet be accomplished on the lines of the tentative ordinance drawn during the closing months of the Harrison administration. At least if the action of the local transportation committee of the City Council is to indicate the probable attitude of the council toward the "contract plan" of Mayor Dunne for building a municipal street-railway system according to plans developed by A. B. Dupont, which have been described in the Western Electrician. At a meeting of the committee on local transportation early this week, at which an ordinance embodying the features of the mayor's "contract plan" was being considered, that body by a vote of 8 to 4, the chairman not voting, passed the following resolution:

"Resolved, That the further consideration of this ordinance [the one for the mayor's contract plan] be deferred until after the existing companies shall be heard and until such proposals as they submit shall be considered fully, and that this committee adjourn to Friday at 2 p. m."

The friends of the mayor's plan at once offered an amendment which read: "It is hereby intended that such companies shall make no propositions other than those looking to an immediate sale of their rights and properties to the city," but this was also defeated by the same vote of 8 to 4. It is understood that the committee favors the contract plan only as a last resort in case the traction companies prove too obstinate in affecting a settlement on the tentative ordinance plan which proposed a waiver on the part of the companies of all franchise rights, including the rights claimed under the provisions of the 99-year act, in return for a franchise of about 13 years' duration covering the lines on which the franchises have about expired as well as those which the company holds effective until 1956. The next meeting of the committee, which will be held after this issue has gone to press, and at which the companies will be asked to make a statement as to what they can or will do, may produce the first indication as to which plan will be worked upon in an attempt to settle the franchise dispute and give the people the improved transportation facilities they need.

It is interesting to note that regardless of the mayor's determination to grant no further franchises to the existing companies, and in the face of the uncertainties of the whole situation, the Chicago City Railway Company is spending considerable money in the way of improving its service, only last week the first installment of an order of 200 new cars, costing about $5,500 each, having been put into service. These cars embody the most modern features, as will be seen in a special article on the subject elsewhere in this issue.

The mayor's legal advisers made a report in which they agreed that the plan for constructing and operating a 264-mile municipal street railway was legal and possible. Some minor difficulties might arise, according to the opinion, but "none of these questions, however, would be even embarrassing if the corporation was made by its articles of incorporation a trustee of the city, and the ordinance prescribed how its money should be expended." The opinion suggests that "this corporation could be incorporated as one 'not for profit,' and would thus become a quasi-public corporation and as much a department of the city government as the library or school board." However, the local transportation committee is not satisfied with the plan and it wants to know just who will constitute the "contracting company," how the money is to be raised and a more detailed estimate of the probable earnings of the municipal system. Further, the opponents of the contract plan say that if they finally turn to this plan it must embody a system covering the entire city. They argue that some of the wards in urgent need of transportation facilities have plenty of streets in which there are no franchise disputes, but are, nevertheless, left out of the Dunne-Dupont system.

Bion J. Arnold has submitted a report to the transportation committee of the council in which he says that Mr. Dupont's traction system of 264 miles could be built for the estimated $25,000,000, providing the line is built as cheaply as possible. He said, however, that it was the minimum figure, and in order to get the cost of the line inside of it it would be necessary to abandon the underground trolley entirely and substitute lighter rails and girders and inferior cars. He also added if waste were to be avoided it would be necessary to add $2,000,000 for a power house capable of taking care of the future, otherwise it would mean expensive additions whenever extensions were made.

Central-station Heating Plants.

An illustrated talk upon the subject of central-station heating was given by Mr. W. H. Schott before the Robert Fulton Association on April 22, 1905. The subject is an important one in view of the increasing favor which is being shown toward this method of heating, and the speaker made clear many of the details of construction and operation of such plants. A central-station heating plant, in order to work economically and give satisfactory results, requires the greatest attention to be paid to its design, as the plant generally operates in connection with a power plant, so that flexibility and economy are very essential features.

The design shown in Fig. 1 represents a modern combination plant. It will be noted that this is a typical layout, where the engines in place are used for driving generators; their exhaust in turn being used in surface condensers to heat water. The water is circulated by the use of pumps, and after the latent heat of the exhaust steam has been absorbed, it is then forced through boilers, fired direct, to bring the water to the proper temperature, provided the exhaust steam is insufficient, and then goes to the buildings which are to be heated. In other words, the engine plant is operated in series, each part of the apparatus performing its part of the work, the condensers transmitting the latent heat from the steam to the water, and any deficiency being made up by the direct burning of coal under the boiler.

In numerous tests tests, it has been demonstrated that 55 pounds of coal burned under the boiler will deliver a number of heat units to the circulating water equal to that which 100 pounds of coal will deliver, when used for the purpose of generating steam, and then turning the steam into the condensers.

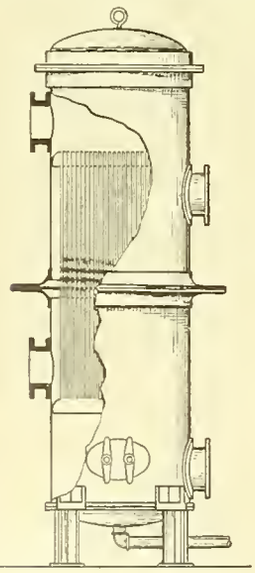


FIG. 2. TYPICAL CONDENSER USED IN CENTRAL-STATION HEATING.

During the time a boiler is being utilized as a circulator, it merely becomes an economizer, due to the low temperature of the circulating water. The absorbing power of the boiler is very high.

TABLE I.

RADIATION SUPPLIED BY 100-HORSEPOWER BOILER CAPACITY AT VARIABLE TEMPERATURES.

Water.					Steam.				
Temperature.		Radiation per 100 H. P.			Temperature and Amount.			Radiation per 100 H. P.	
Outside Temperature.	Water Temperature.	Water Tube Boiler.	Fire Tube Boiler.	Exhaust Surface Condenser.	Outside Temperature.	Steam Per foot Per hour.	Steam per season of 5,000 hours.	Water Tube Boiler.	Fire Tube Boiler.
50°	140°	43,000	37,300	22,600	50°	.117	505	20,250	18,000
40°	150°	36,500	31,000	19,200	40°	.138	600	16,400	14,850
30°	160°	31,900	27,200	16,770	30°	.16	800	14,000	12,600
20°	180°	25,000	21,500	14,700	20°	.20	1,000	11,250	10,000
10°	190°	22,300	19,000	13,000	10°	.225	1,125	9,900	9,000
0°	200°	20,000	17,400	11,500	0°	.25	1,250	9,000	8,100
—10°	210°	18,400	15,500	10,500	—10°	.265	1,325	8,400	7,560
—20°	220°	16,500	14,300	9,600	—20°	.303	1,515	7,500	6,750
—30°	230°	15,000	13,000	8,600	—30°	.333	1,665	6,750	6,000

The usual gauge board of a station has on it a complete set of direct-reading instruments, as well as a complete set of recording instruments. The idea of recording instruments is to have a record of the outside temperature, the temperature of the supply water, the temperature of the return water, together with the steam pressures, in order to at all times check the operation of the plant in question.

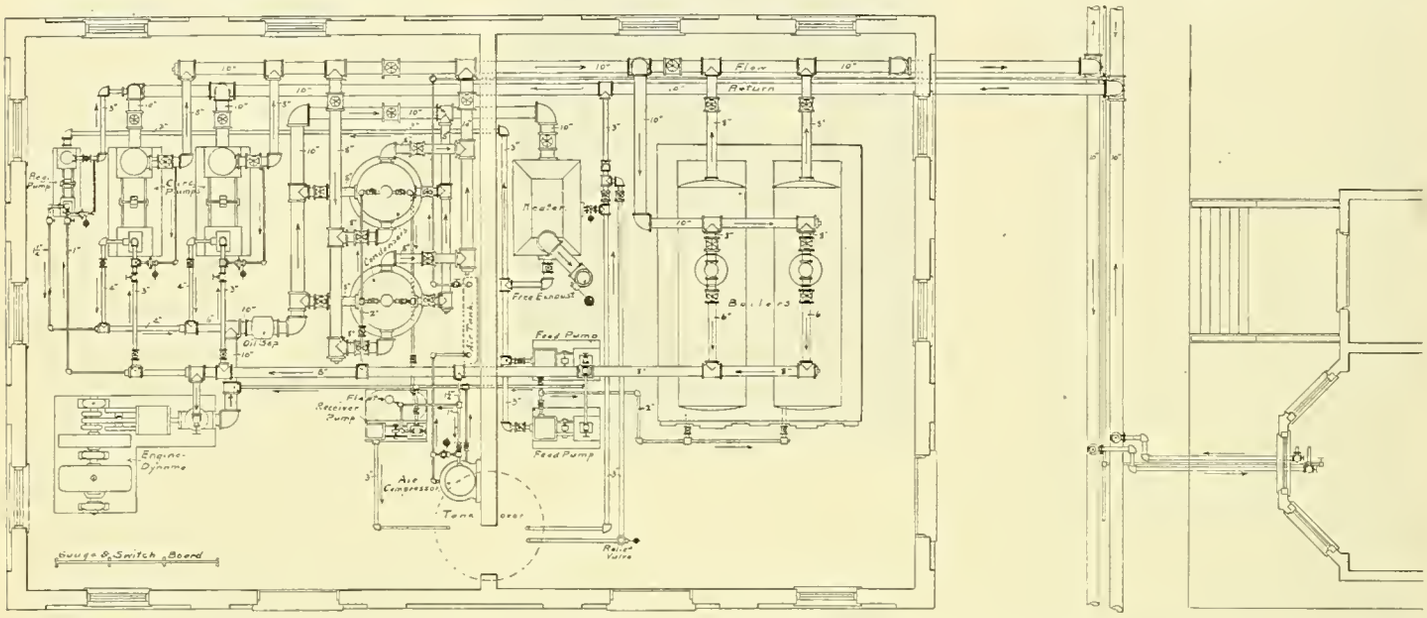


FIG. 1. CENTRAL-STATION HEATING PLANTS.—LAYOUT OF MODERN COMBINATION PLANT.

Fig. 2 is a design of a typical type of condenser used in central-station work. The machine in question has a steel shell, with a water chamber, top and bottom, the tubes being expanded in solid. The expansion and contraction is taken care of by a diaphragm in the center of the shell. The upper and lower chambers are water chambers, with manholes of the Eclipse pattern, which permit ready access for inspection or cleaning-out purposes.

One type of expansion joint used is known as the "slip" type, the body being made up of cast-iron. The sleeve is made up of either brass or gun metal, the packing being metallic, and as to form, is governed entirely by pressures and as to whether steam or water or other liquids are to be taken care of.

A diaphragm valve is placed upon the service pipe where it enters the building. The valve is controlled by a constant pressure of compressed air, admitted to it through a thermostat.

The results of a considerable number of tests were recounted by Mr. Schott, and some of these results are given in the tables which follow.

Table I. shows what can be done with 100 horsepower under varying conditions. In a steam plant, assuming the outside temperature to be 50° F., 100 horsepower would supply heat to 43,000 square feet of water radiation; the same in a fire-tube boiler would supply 37,300 square feet of water radiation. Applying the same to a steam plant, the water-tube boiler would take care of 25,000 square feet of surface, while the fire-tube boiler would only take care of 18,200 square feet. Taking the same capacity and assuming 10 degrees below zero as the outside temperature in a water plant, 100 horsepower would only take care of, with a water-tube boiler, 18,400 square feet, while the same capacity, with a fire-tube boiler, would only take care of 15,500 square feet, and under steam conditions 8,400 square feet in the first against 7,560 square feet in the second.

Table II. shows the given coal consumptions at various temperatures, the same being based upon a heating season of 5,280 hours, using slack coal, with a B. T. U. value of 10,500 heat units; the plant designed for 60 per cent. efficiency and temperature of buildings to be maintained at 70 degrees.

With zero temperature in a water plant, the standard temperature of the surface would be 190 degrees. At this temperature each square foot would transmit 221 heat units, or require 5,304 heat units per day. Upon this basis it would require 1,168,880 heat units per season, 0.035 pound of coal per hour, 0.842 pound of coal per day, or 185.32 pounds per season.

Fig. 3 is a graphical chart worked out for the purpose of obtaining coefficients, so as to arrive at the increase or decrease in radiation required when the temperature of the surface is changed. This is based upon having 170 degrees as a standard.

Taking curve 1, which applies to direct water radiation, three-column, 38 inches standard height, to maintain 70 degrees the question will arise as to how many heat units would the same surface

TABLE II.

COAL CONSUMPTION AT VARIOUS TEMPERATURES.

Mean Temperature of Water.	Outside Temperature.	Heat Units per Hour.	Heat Units per Day.	Heat Units per Season.	Pounds Coal per Hour.	Pounds Coal per Day.	Pounds Coal per Season
220°	—30°	306	7,344	1,615,680	.047	1.128	248.16
212°	—22°	280	6,720	1,478,400	.044	1.056	232.32
210°	—20°	275	6,600	1,452,000	.0437	1.049	230.74
200°	—10°	246	5,904	1,298,880	.0390	.936	205.92
190°	0°	221	5,304	1,168,880	.0351	.842	185.32
180°	10°	195	4,680	1,029,600	.0310	.744	163.68
170°	20°	170	4,080	897,600	.0270	.648	142.56
160°	30°	146	3,504	770,880	.0232	.556	122.32
155°	35°	136	3,264	719,180	.0216	.518	114.05
150°	40°	124	2,976	654,720	.0197	.472	103.84
140°	45°	102	2,448	538,560	.0162	.388	85.36
130°	50°	82	1,968	432,960	.013	.312	68.64
120°	55°	66	1,584	355,480	.0104	.249	54.78
110°	60°	51	1,224	269,280	.0081	.194	42.68
100°	65°	44	1,056	232,320	.0070	.168	36.96

TABLE III.

CENTRAL-STATION COEFFICIENTS.

Kind of Surface.	Temperature of Room.							
	55°	60°	65°	70°	75°	80°	85°	90°
Siogle glass, loose	.58	.64	.69	.73	.77	.81	.85	.90
Single glass, tight	.48	.53	.57	.60	.64	.68	.72	.75
Vault light glass	.57	.63	.68	.72	.76	.80	.84	.89
Siogle skylight	.42	.455	.485	.52	.55	.585	.62	.65
Douhle skylight	.24	.26	.28	.30	.32	.34	.36	.38
Good Door, ½ glass	.26	.28	.30	.32	.34	.36	.38	.40
Double glass, storm windows	.225	.24	.26	.28	.295	.315	.33	.35
Average Frame, N. and W	.175	.19	.20	.22	.23	.24	.255	.27
Average Frame, S. and E	.16	.175	.185	.20	.21	.225	.24	.25
8-inch Brick wall or well, N. and W	.16	.175	.185	.20	.21	.225	.24	.25
Constructed Frame, S. and E	.155	.16	.17	.18	.19	.20	.215	.225
Back Plastered Frame, N. and W	.13	.14	.15	.16	.17	.18	.19	.20
Back Plastered Frame, S. aod E	.11	.12	.13	.14	.15	.155	.165	.175
12-inch Brick wall, N. and W	.11	.12	.13	.14	.15	.16	.17	.18
12-inch Brick wall, S. and E	.09	.10	.11	.12	.13	.14	.15	.16
16-inch Brick wall, N. aod W	.09	.10	.11	.12	.13	.14	.15	.16
16-inch Brick wall, S. and E	.07	.08	.09	.10	.11	.12	.13	.14
Ordinary Floor or Ceiliog	.04	.0425	.045	.048	.05	.053	.057	.06
Fireproof Floor or Ceiling	.02	.0225	.025	.0275	.03	.0325	.034	.035

throw off at any other temperature. For instance, how much would it throw off at 200 degrees? By taking the vertical column 200 and following it until it intersects curve 1, the coefficient is found to be 1.5, or, each square foot would then, at 200 degrees, throw off 255 degrees per square foot per hour, instead of 170.

Oftentimes, in considering a central-station layout, compound engines are found which have been operating under vacuum conditions. To change these engines, from condensing to non-condensing, it is necessary to increase the steam consumption per indicated horsepower per hour. All of such increased consumption is directly chargeable to the heating department, and must be known in order to determine, from a boiler standpoint, just what surface must be provided for.

Assuming a compound engine of standard make, at a 26-inch vacuum, consuming 16 pounds of steam per indicated horsepower, to operate this same engine with a condenser at atmospheric pressure, it is found that this would increase the steam requirements per indicated horsepower per hour six

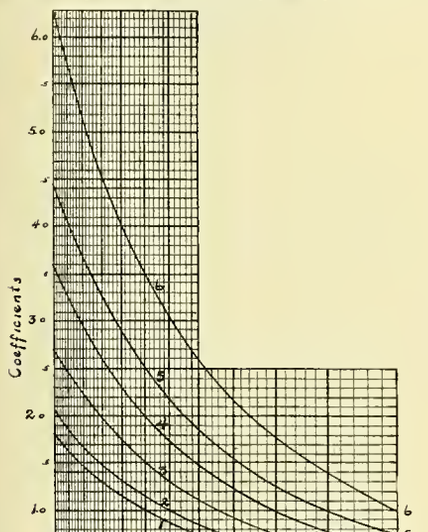


FIG. 3. CHART FOR OBTAINING RADIATION COEFFICIENTS

pounds, or there would be 22 pounds per hour as the steam consumption instead of 16.

If the engine is a simple engine, at 26-inch vacuum and it is consuming 25 pounds of steam per hour, then at atmospheric pressure, or zero, it will will consume 30 pounds.

Table III. is used for arriving at the requirements for cubic contents, based on six pounds of water per foot of radiation per hour.

Death of Mr. Peter Kreidler.

Mr. Peter Kreidler, an old and respected resident of Steuben County, N. Y., and father of Mr. W. A. Kreidler of Chicago, president of the Electrician Publishing Company and editor and publisher of the Western Electrician, died suddenly at his home in South Dansville, N. Y., on September 11th, at the ripe age of 76 years. Mr. Kreidler had been an active, strong, rugged man all his life, and although he was known to have some heart trouble, it was not of a kind to cause fear of sudden death, and therefore the unexpected news of his passing away came as a great shock to the family and friends.

Mr. Kreidler was born in Mount Morris, Livingston County, N. Y., August 15, 1829, but had lived practically all his life in Steuben County. He was a prosperous farmer and stock raiser and brought into the county the first Delaine sheep of the present improved breed. He was a consistent member of the Methodist Episcopal Church and lived a pure, just and honorable life. His neighbors liked him and trusted him, although many of them differed from him in politics, for he was a stanch Democrat, and for 20 years he was a justice of the peace. No man in the community was more highly respected for manly integrity and true worth of character.

The immediate surviving relatives are a widow, Mrs. Ellen R. Kreidler, who would have celebrated her golden wedding if Mr. Kreidler had lived another month, and four children—William A. Kreidler of Chicago, Allen S. and Woolsey Lynn Kreidler, engaged in the carriage business in Olean, N. Y., and Mrs. Grace B. Carney of South Dansville, N. Y.

Irrigation Discussed by British Association.

The engineering section of the British Association held a session at Johannesburg at which the principal speaker was Sir C. Scott Moncrieff, president of the section. He took for his subject the development of irrigation, and traced its growth from the most primitive means up to the methods of modern times.

Pumps and windmills were the primitive water-raising contrivances of the East. Egypt has of late been more in touch with western civilization, and since its cotton and sugar-cane crops yielded from $30 to $40, or even $50 per acre, the well-to-do farmer can easily afford a centrifugal pump worked by steam power. Where wind can be counted on, the windmill is a very useful and cheap means of raising water. In the dry western states of America wind power is largely used for pumping. It has been found that this power is of little use if its velocity is not at least six miles per hour. With a reservoir five to 15 acres may be kept irrigated by a windmill. Without a reservoir three acres is as much as should be counted on. Windmills attached to wells from 30 to 150 feet deep cost from $145 to $340.

In the state of California there are said to be 8,097 artesian wells, of a mean depth of 210 feet, discharging 0.12 cubic foot per second, and of an original cost on an average of $243. In Algeria the French have bored more than 800 artesian wells, with a mean depth of 142 feet, and they are said to irrigate 50,000 acres scattered over a large area. In Queensland artesian wells were largely used for the water supply of cattle stations, but not for irrigation. In India about 13,000,000 of acres, or 30 per cent. of the whole annual irrigation, is effected by wells.

By one who has not given the subject attention surprise is often expressed at the large volume of water that has to be stored to supply an acre of land. In the case of rice irrigation in India it is found that the storage of a million cubic feet does not suffice for more than from six to eight acres. For the irrigation of wheat about one-third this quantity is enough. It would never pay to excavate on a level plain a hollow large enough to hold a million cubic feet of water. It is invariaby done by throwing a dam across the bed of a river or a valley and ponding up the water behind it. Many points have to be considered—the length of dam necessary, its height, the material of which it is to be constructed, the area and the value of the land that must be submerged, the area of the land that may be watered. The limits of the height of a dam are from about 150 to 15 feet. If the slope of a valley is great it might be that the volume which could be ponded up with a dam of even 150 feet would be inconsiderable, and the cost might be prohibitive. On the other hand, if the country is very flat, it might be found that a dam of only 20 feet high would require to be of quite an inordinate length, and compensation for the area of land to be submerged might become a very large item in the estimate. The advantage of a deep reservoir is very great, for the evaporation is in proportion to the area of the surface. In India, from time immemorial, it has been the practice to store water for irrigation, and there are many thousands of reservoirs, from the great artificial lakes holding as much as 5,000 or 6,000 millions of cubic feet, down to the humble village tank holding not a million. There are few in which the dam exceeds 80 feet in height, and such are nearly always built of masonry or concrete. If possible the outlet sluices should be arranged to serve at the same time as scouring sluices to carry off the deposit that accumulates at the bottom of the reservoir.

In Egypt proper, extended northward from a point in the Nile about 780 miles above Cairo, is a long valley, never eight miles wide, sometimes not half a mile. East and west of this lies a country broken into hills and valleys at such a level that the Nile flood has never reached it. A few miles north of Cairo the river bifurcates. In the Nile valley the river banks are higher than the more distant lands. From an early period embankments were formed along each side of the river, high enough not to be topped by the highest flood. At right angles to these river embankments others were constructed. It was easy then, when the Nile was low, to cut short deep canals in the river banks, which filled as the river rose and carried the precious mud-charged water into the great flats. There the water remained for a month or more, some three or four feet deep, depositing its mud. In this manner was Egypt irrigated up to about a century ago. The high river banks which the flood could not cover were irrigated directly from the river. With the last century, however, appeared a very striking figure in Egyptian history, Muhammed Ali Pasha, who soon recognized that with this flood system of irrigation only one cereal crop was raised in the year, and that cotton and sugar cane would fetch far higher prices if greater developed; but they could only be grown at a season when the Nile was low, and they must be watered at all seasons.

With the English occupation in 1883 came some English engineers from India, who, supported by the strong arm of Lord Cromer, soon changed the situation. The first object of their attention was the barrage at the head of the delta, which was made thoroughly sound in six years and capable of holding up 15 feet of water. Three great canals were taken from above it for irrigating purposes. In Upper Egypt, with one very important exception (the Ibrahimieh Canal, which was a perennial one), the early flood system of irrigation, yielding one crop a year, prevailed until very recently, but it was immensely improved after the British occupation, and there was not much more left to do, unless the volume of water at disposal could be increased.

In average years the volume of water flowing past Cairo in September is from 35 to 40 times the volume in June. Far the greater part of this flood flowed out to the sea useless. A site for a great dam was discovered at Assuan, 600 miles south of Cairo, where a dyke of granite rock crossed the valley of the river, occasioning the First Cataract. On this ridge a great wall of granite 6,400 feet long was thrown across the valley, 23 feet thick at the crest and 82 feet at the base. Its height above the rock bed of the river was 130 feet. This great wall or dam holds up a depth of 60 feet of water, which forms a lake of more than 100 miles in length up the Nile Valley, containing 38,000 million cubic feet of water. The dam is pierced with 180 sluices, or openings, through which the whole Nile flood, about 360,000 cubic feet per second, is discharged. A flight of four locks, each 260 by 30 feet, allows free navigation past the dam. The chief use of the great Assuan reservoir is to enable perennial irrigation, such as existed in Lower Egypt, to be substituted in Upper Egypt for the basin system of watering the land only through the Nile flood; that is, to enable two crops to be grown instead of one every year; and to enable cotton and sugar cane to take the place of wheat and barley. But a great deal more had to be done in order to obtain the full beneficial result of the work. About 450,000 acres of basin irrigation are now being adapted to perennial irrigation.

American Electrochemical Society.

The American Electrochemical Society will hold its eighth general meeting at Bethlehem, Pa., September 18th, 19th and 20th. The Eagle Hotel will be the headquarters and the sessions will be held at Lehigh University. The programme contains a large number of important papers bearing upon the development of electrochemistry from an engineering and industrial standpoint. Among these papers are the following: "New Gin Furnace for the Electrical Manufacture of Steel," by G. Gin; "An Electrolytic Process for Refining Silver," by A. G. Betts; "The Electric Smelting of Zinc," by O. W. Brown and W. F. Oesterle; "Report on the Electrochemical Exhibits at the Louisiana Purchase Exposition, 1904," by C. F. Burgess; "Some Tendencies in the Design of Electric Incandescent Lamps," by E. F. Roeber, and "Insulating Paints," by M. Toch.

Series Alternating-current System of Arc Lighting.

The Fort Wayne Electric Work has recently developed a complete system of series arc-lighting circuits which may be readily operated upon a constant-potential supply. Although the many advantages of the alternating-current system for series arc lighting are well known, and although systems of this nature have been in operation for some time, the further advantages of a simple system which requires but slight attention, and which is sufficiently flexible to operate in parallel with an incandescent system if desired, will at once be manifest. The system here described consists of a regulator for maintaining a constant current, a specially designed high-tension switchboard, a constant-

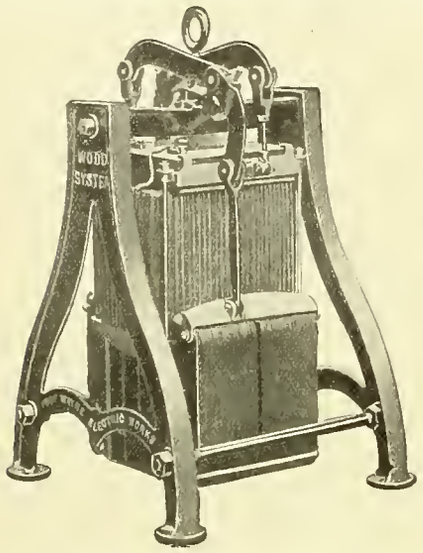


FIG. 1. REGULATOR FOR SERIES ALTERNATING-CURRENT ARC SYSTEM.

potential transformer and a series of arc lamps. In addition, both sides of the line are equipped with a lightning arrester peculiarly adapted to circuits of this nature.

Fig. 1 represents the type SA regulator which has been designed for this system. Its operation depends upon the automatic introduction of impedance into the lamp circuit whenever any decrease in the resistance of the latter would tend to cause an excessive current to flow therein. This impedance is introduced by the combined movements of a laminated iron core and impedance coil into such a position as to cause a greater magnetic flux to be cut by the current in the coils. This increase in the amount of flux cut by the line current produces a choking effect, reducing the latter to its normal value. If, for any reason, the line current be decreased, the exact opposite effect takes place within the regulator, and the current is automatically increased to its normal value.

The mechanical parts of the regulator are so well counterbalanced that the motion of the heavy core is small as compared with that of the coil. This reduces the inertia and guarantees an immediate and more sensitive adjustment of the current. This design also permits the core and the coils to counterbalance each other, and does away with the use of the counterweight, thereby simplifying the design and reducing the necessary attendance.

The regulator, being very compact in form, requires a floor space of but 22 by 28 inches in the 75-light capacity, and may be located upon the floor of the power station in any convenient position. No attention is required at the regulator, the starting operation being entirely controlled from the switchboard specially designed for this purpose.

The switchboard furnished with this system consists of a single panel of blue Vermont marble, equipped with ammeter, reactance, fuses, and all necessary switches for the starting and operation of the system. It can be furnished with or without a wattmeter sub-base equipped with an integrating wattmeter.

By reference to Fig. 2, the peculiar design will be noted, by means of which the system may be quickly started from the switchboard without paying any attention to the regulator and without causing any excessive rush of current through either the regulator or the lamps in so doing. The ability to thus start without any disturbance upon the line is one of the greatest advantages of the Fort Wayne system.

The starting switch, which is located in the center of the panel, should always be closed last. In the closing of this switch three separate stages exist, as follows:

At the first stage in the closing of the switch, a reactance, which is mounted upon the back of the switchboard, is introduced into the regulator circuit, so that no rush of current will take place when the regulator is thrown upon the line. If it were not for the introduction of this reactance, the regulator, which is in its no-load position, introducing but very little impedance in the circuit, would permit an excessive current to flow. With the introduction of the reactance, however, the current is choked down to its normal value until the regulator comes to its full-load position, in which position it introduces a sufficient impedance of its own to reduce the current to its normal value.

The second stage in the closing of the starting switch short-circuits the reactance, thus throwing the regulator, which has now reached its full-load position, directly across the constant-potential bus bars. During both these stages the line leading to the arc lamps is short-circuited.

When the starting switch is entirely closed the short-circuit across the line, which previously existed, is removed, thus permitting the line of arc lamps to operate in series with the regulator upon normal current. By thus connecting the lamps into the circuit after normal current has already been maintained, no disturbance is caused in the mechanism of the lamps.

Although the systems for 12 and 25 lights will operate satisfactorily without the use of a constant-potential transformer upon circuits of 1,100 and 2,200 volts, respectively, it is advisable to use a transformer in all cases, although it may be of a one to one ratio, introduced merely for insulation purposes. This is especially desirable where both arc and incandescent systems are operated from one set of bus-bars, in order to entirely insulate the arc system from that which supplies the incandescent lamps.

The constant-potential transformer supplied with this system may step up or step down the bus-bar voltage, or may in some cases maintain the same voltage upon both primary and secondary in cases where it is introduced for insulation purposes only. The secondary of this transformer is provided with a number of taps, by the use of which the output of the station may be varied as more arc lamps are needed upon the circuit, maintaining at all times practically full-load efficiency and power factor. The advantage of this will be at once apparent. If a regulator and transformer be purchased of sufficient capacity to meet the needs of a growing system, the latter may be connected at first, so as to supply only a small portion of its total output, and, as the number of arc lamps increases, the taps upon the transformer may be so connected as to meet this demand with no further cost of installation. This may be done with practically no sacrifice of efficiency when operating the circuits of small capacity.

The alternating-current series arc lamps which

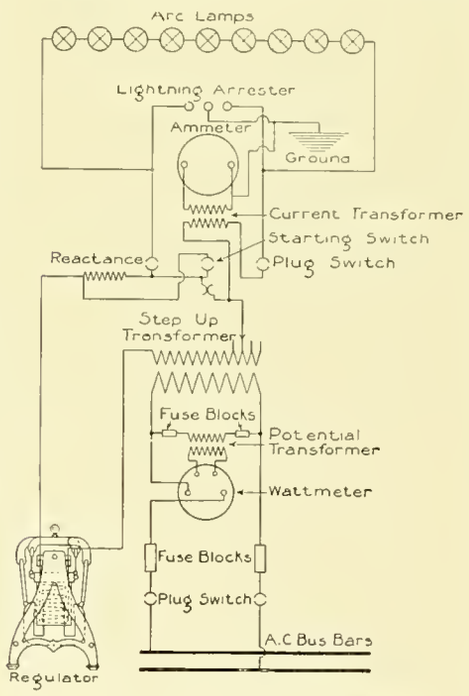


FIG. 2. DIAGRAM OF CONNECTIONS OF SERIES ALTERNATING-CURRENT ARC SYSTEM.

have been designed to operate in connection with this system are of the same high grade and long life which is characteristic of the direct-current product. They will be found to operate with extremely low temperatures for periods of time up to 125 hours with but one trimming, when adjusted for normal current of 6.6 amperes.

The disadvantages which so often occur in alternating-current arc lamps have been reduced to a minimum in this design, great care being taken to prevent vibration and the consequent hum which frequently exists in lamps operated upon alternating-current circuits.

The system has been designed for either 60 or 140 cycles and has been found to operate with entire satisfaction upon both of these frequencies. The 140-cycle lamp has been especially designed for high-frequency service and cannot be operated upon a 60-cycle circuit. Although the use of the 60-cycle system is advised wherever possible, owing to the fact that it is at present the tendency for central stations to reduce the frequency of their systems, the central-station managers who already have 140-cycle circuits in use will find that this system will operate with satisfaction. Bulletin No. 1070, issued by the Fort Wayne company, explains the installation and operation of the entire system in detail.

New Automatic Numbering Machine.

The new automatic number machine illustrated herewith embodies the highest achievements in the art of numbering-machine construction. In its design there have been many departures from the usual plan. Originality marks its conception, and ingenuity of no mean order is responsible for its development.

Wherever the numerical system of records is employed, a hand-numbering machine becomes an absolute necessity, and in most instances several of them are found to be very desirable.

123456

FAC SIMILE IMPRESSION

NEW AUTOMATIC NUMBERING MACHINE.

Instead of the customary iron or brass frames and brass cases, all metal parts in this machine are made of steel, contributing rigidity and strength with minimum weight. The device is produced upon the American system of interchangeability, in large quantities, by an expensive plant of special tools and machinery.

It is only necessary to move the indicator until the word representing the class of numbering desired appears in the window of the front plate. When set, "consecutive" the number advances from 1 to 999,999, changing all the wheels automatically. When set "duplicate" each number is printed twice and is then advanced consecutively. When set "repeat" the automatic mechanism is detached and the number is repeated continuously.

Only the standard size and style of figures shown under the illustration are furnished in the stock machines. These are deeply cut and finely engraved and proportioned. Being well spaced, they are absolutely legible, and will be found large enough for practically all purposes while condensed to occupy but a small space. Other styles and sizes will be made to order at an extra charge.

The wheels and ratchets are divided into equal tenths, thus assuring accuracy of movement. "Dropciphers," with their springs and pins, have been eliminated and the wheels themselves are made depressible to provide the necessary spaces preceding the unit wheel.

The plunger, which is made of Bessemer steel, is shielded from view when in its normal position, and will never present the unsightly appearance of the oiled brass plunger with the nickel partly peeled off, nor will the hands be soiled by contact with it. All machines of this model are made with six wheels with a numerical capacity from from 1 to 999,999, and may be reset to commence at any desired number.

The frame is substantial, being made of drawn steel, one-fourth inch thick, and is beautifully finished and blued. Weighing only 14 ounces, it is capable of being operated noiselessly and with remarkable speed and accuracy.

The figures are automatically inked before each impression, from a thick felt pad. The pad-holder may be instantly removed from the machine for reinking. An accurate gauge plate assures printing precisely upon a line.

This machine is made under the latest patents of Edwin G. Bates, and is manufactured by the Bates Machine Company, with general offices located at 346 Broadway, New York, and branches at 315 Dearborn Street, Chicago, 63 and 64 Chancery Lane, London, W. C., and 2 Cooper Street, Manchester, England.

Power House Management.[1]

By G. M. Campbell.

Power-house management is getting the best results in the way of power output at the lowest cost. To accomplish this it is necessary that a systematic record be kept of all expenses and of the output of power, for it is mainly by careful comparison of such figures that costs can be reduced and output increased for the same outlay. In scanning the record of expenses it would not be sufficient to consider prices in the abstract, material must also be taken account of, for example—a high-grade cylinder oil at 65 cents a gallon would undoubtedly be cheaper for many purposes than a poor grade at 35 cents. Again, it is often poor economy to be too careful about the amount of supplies used; the wear and tear on the machinery by use of insufficient supplies may far exceed the saving in supplies.

For the best results the plant should be designed with the object of economy and efficiency in view; boilers, engines, pumps, etc., should be chosen with particular reference to the conditions under which they will work, and everything should be so installed that it is capable of being easily repaired, i. e., there should be working space around all apparatus, and pipe lines, valves, etc., should be easy of access. All large power houses are equipped with cranes, the smaller plants are not always so equipped, but they should be, and if a crane is not part of the original installation it should be added.

It is generally assumed that a low-water rate condensing plant is more economical than a non-condensing one where the rate is higher, but such is not always the case. If all the heat in the exhaust steam can be made use of, then relatively inefficient but low-cost engines would, when interest and depreciation as well as the coal pile are considered, be the cheapest to install and maintain. If steam from the boilers is eventually discarded as water and at the same time the feed water enters the boiler at or near 212 degrees, what more could be desired or obtained? I have in mind a non-condensing plant of 2,000 boiler horsepower, which in winter uses every ounce of exhaust steam and in summer a very large percentage of it. That plant is working very economically, though the engines and pumps installed have a high water rate.

In general, do not worry and scheme to simply repair troubles, but remove the cause. If you are burning out tubes in your boilers and keeping gangs of men putting in tubes or cleaning the scale out of old ones, do not scour the market to find the best flue scraper or where a man can be got for $3 to take the place of a man you are paying $3.25, but remove the trouble and install a plant that will soften the water. It is an easy matter, usually, to prove the saving; if the management refuses to spend the initial sum, hammer away with facts about costs until they will spend it. One firm in this vicinity put in 200 tubes in two months at an average cost in place of $7.50 per tube, a total of $1,500 for two months. A water-softening plant of the proper size would cost about $8,000 and would pay for itself in two or three years.

The question of stokers should be carefully gone into and it will usually be found that there will be an undoubted saving in maintenance and improvement in service, especially in large plants. On quite small plants it is not necessarily advisable to install stokers.

Another and important item is the personnel of the force; the men as well as the machinery should work at high efficiency and good and intelligent men should be obtained, even if the price is somewhat higher than that demanded by inferior men. It would be easy to obtain common labor at $1.50 for an eight-hour day as firemen, but if by paying $1.90 or $2 for the same service a superior workman can be obtained, the difference will be more than made up by the decreased use of coal and better service. In general, the organization consists of the head of the department controlling the various power houses, if there are more than one, or the power house and the general power distribution. Under him is a superintendent for each power house and others for outside work. If the plants are large there may be a night as well as a day superintendent. Under the superintendent there would be, in large plants, a head to the engine room, another to the boiler room, etc. There should be distinct seniority of rank so that when the superintendent is absent there is no doubt about who is in control. If men work at high efficiency their hours should not be too long. Power houses have of necessity to run 24 hours a day, and therefore either two or three tricks must be used. If a man works 12 hours a day, takes three-quarters of an hour going to and returning from his home, another half hour for breakfast and supper and eight hours for sleep, he will not die of ennui in endeavoring to fill in the balance of the day. I am strongly in favor of three tricks of eight hours instead of two tricks of 12 hours. It is extremely difficult to get men of proper force of character to work on 12-hour tricks, but relatively easy to get men for eight-hour tricks, even though the wages be less. In one of our power houses we were at first running 12-hour tricks and paying the enginemen $3.25, and were unable to keep them for any length of time. We later changed to eight-hour tricks, paying the enginemen $2.80 and one of the old men came back. When good men are obtained, treat them well so that they would rather work for you than for anybody else. If a man is sick on the three-trick force, have his work taken care of by the other two men, with no deduction of pay or only partial deduction. This is an excellent practice where reliable men are hired, but is apt to be taken advantage of by the shiftless.

One of the best devices for the control of a power plant is the automatic recording instrument recording steam pressure, voltage current, wattage, temperature on heating systems, pump speeds, etc. The most important in an ordinary power house are the steam-pressure chart and voltage chart; the former records conditions in the boiler room, the latter conditions in the engine room. The pressure line cannot be good unless the water level and fires are attended to, nor can the voltage line be correct if the switchboard is neglected. It is excellent practice to require that a written explanation of any irregularity in these charts be pinned to the chart, and an engineer or fireman with a too frequent repetition of bad charts should be discharged.

Another important point in connection with power-house management is the avoidance of shutdowns. There is nothing more annoying to the public than a shutdown of the power plant of an electric railroad, and there is nothing more costly to a producing firm than the shutdown of the plant. Cost of making repairs is a secondary consideration, the first is continuity of service. Pipe lines should be so put in that any section in the power house could be cut out for repairs without shutting down the plant. A fairly large supply of duplicate parts should be kept on hand. All machines should be inspected at frequent intervals. If an engine has run for a year or more without repairing the superintendent should rather have a nervous than a satisfied feeling concerning it.

A few points in connection with the compact and efficient power plant for the McKees Rocks shops of the Pittsburg and Lake Erie Railroad Company may be of some interest. This plant is thoroughly up to date in almost every respect. It embodies a great many of the best features in power-plant design. The building is 77 by 100 by 50 feet high from the basement floor. Most of the pumps are in the basement. The main floor is divided by a brick partition wall into engine room and boiler room. The boilers are six Babcock & Wilcox, 264 horsepower each, nominal rating. They are, however, worked much above this rating. A load of 1,800 brake horsepower has been carried for several hours on four boilers. It was calculated that five boilers would at any time be sufficient to take care of the load, leaving one for spare. In connection with these boilers I may say that we had a great amount of trouble at first from burning out tubes, 56 tubes requiring to be replaced in three months. When the water-softening plant was installed and in good working order the trouble ceased and now the tubes remain almost as clean as the day they were installed. The coal and ashes are handled by machinery, the coal is dumped from hopper cars through a grating to a hopper beneath, whence it is hoisted by endless chain or conveyor to the top of the building; it is there dumped on a horizontal conveyor which deposits it at points desired in the storage bins, when it flows by gravity to the stoker hopper. The ashes are handled from the basement by the same machinery and are dumped into a storage bin directly over the track, thence into hopper cars beneath. Coal capacity is 100 tons, ash capacity 2,000 cubic feet.

The engines installed are four 14 by 24 by 14 Westinghouse compound engines, 280 revolutions per minute, about 250 horsepower.

Generators are direct-connected Westinghouse, 150 kilowatts capacity, 240 volts.

The switchboard is an 18-panel board consisting of four-generator panels, one-load panel, five incandescent light and constant-speed motor panels, three arc-light panels and five variable-speed motor panels.

There are 15 pumps which cover every purpose and are of various capacities, from a 50-gallon test-pressure pump to a 1,000-gallon cold-water supply pump. Five of the pumps are motor-driven centrifugal or turbine pumps.

The two air compressors are each capable of compressing 1,000 cubic feet of free air per minute to 100 pounds pressure.

There are also what are termed balancers or motor-generators to split the 240-volt circuit into two 120-volt circuits for the arc lighting and six voltages from 40 to 240 for the variable-speed motors.

This power plant takes care of the heating of the whole system of buildings, some of the buildings being half a mile from the power house. The heating is performed by circulating hot water through large heating coils in the various buildings from which the heat is extracted by the air forced over them by fans. The temperature in all the buildings is controlled in the power house by raising or lowering the temperature of the water, which can be done at will. The water is heated in the power house in large heaters by means of exhaust steam supplemented by live steam, and is circulated through the system by two centrifugal pumps. It is expected that the heating load in 10-degree weather will, when all the buildings are up, be about 40,000,000 British thermal units per hour, 40 per cent. of this being taken care of by the exhaust steam.

The steam pressure carried is 150 pounds; voltage, 250 volts direct current; water pressure, general service, 80 pounds; fire service, 100 pounds; hot-water supply, 125 pounds; test pressure, anything up to 400 pounds. About 4,000,000 gallons a week is used, and as 95 per cent. of this is double pumped the pumps handle about 8,000,000 gallons a week.

Several of the automatic recording instruments referred to are in use in this plant.

The operating force at the power house consists of a superintendent who has charge of the men on three tricks, each trick consisting of one engineer, one oiler and one fireman; in addition there are during the daytime two extra helpers. This is a very small force of men and the good results can only be accomplished on account of the large number of labor-saving devices installed and the care and forethought expended on the original design. The plant is not yet worked to the limit, as several new buildings have yet to go up, but from present appearances it would seem that it will accomplish what it was designed for. The plant is sometimes criticised on account of the small electric units used, but the load varies very greatly. On summer nights one generator is sufficient to carry the load, while on dark days in winter all four generators are in service.

In proportioning the cost everything is based pro rata on the actual steam consumption, the steam consumption in most cases being based on result of tests.

An extract from the 1904 yearly report is as follows:

	Total.	Monthly Average.
Steam pressure, pounds		148.3
Coal consumption cars, total	265	22.08
Pounds, total	22,724,400	1,893,700
Pounds per hour		2,592.1
Ashes, cars loaded	42	3.5*
Water evaporated galloos, total	20,910,000	1,742,500
Pounds per hour		19,373.2
Pounds per hour per lb. of coal:		
Actual		7.475
From and at 212°		8.662
Boiler horsepower developed		645.8

*Ashes were 13 per cent. by weight of the coal.

Expenses.

			Per Cent.
Wages	$10,274.95	$ 856.25	50.27
Supplies	1,861.43	155.11	9.11
Machine repairs	1,483.54	123.63	7.26
Coal	6,817.62	568.14	33.36
Total	$20,437.54	$1,703.13	100.00

General Distribution.

Heating	$ 3,208.01	$ 267.34	17.00
Compressed air	5,464.66	455.39	26.31
Lighting	2,255.20	187.93	11.10
Pumping	4,779.69	398.31	22.78
Machine tools, etc	3,602.66	300.22	17.32
Locomotive filling	1,127.32	93.94	5.49
Total	$20,437.54	$1,703.13	100.00

Rates.

Cost in cents, per hour.	Maintenance.	†Total.
Boiler horsepower developed	0.367	0.756
Kilowatt hour	0.628	1.282
Horsepower hour, electric	0.469	0.96
1,000 cubic feet free air, compressed	1.695	3.474

†Based on cost of plant of $165,000, 5 per cent. interest and 8 per cent. depreciation.

Railway Signal Association.

Members of the Railway Signal Association met in the Great Northern Hotel, Chicago, on September 12th, when the report of the committee on "Definitions and Nomenclature" was considered. The results of the day's discussion will be submitted at the annual meeting of the association to be held at Niagara Falls on October 10th. Various standing committees in reaching conclusions, it was found, were using different terms for the same mechanical parts of interlocking system, and, as this caused considerable confusion in submitting the various reports to the principal standing committee, it was decided that the various committees in making out their reports shall submit an index containing definitions of the terms contained within the report, and the chairman of the leading committee—No. 8—will then decide which terms are to be used. The secretary of the association is Mr. H. S. Balliet, assistant signal engineer of the Lehigh Valley railroad, of South Bethlehem, Pa.

The York County Traction Company of York, Pa., through its subsidiary companies, has secured the right to build two important trolley extensions. The one proposed extension is from Red Lion to McCall's Ferry and the other from Hanover to New Oxford, in Adams County.

1. From a topical discussion before the Mechanical Section of the Engineers' Society of Western Pennsylvania, May 2, 1905.

Indiana Telephone Items.

Mr. Mullendore, former manager of the Franklin Telephone Company's exchange, has sold his entire holdings in the company to Louis Holweg of the New Telephone Company, Indianapolis. Ferdinand B. Strickler, original controller of the stock, has resumed management. Mr. Holweg also purchased a majority of the stock held by Messrs. Frank F. and Victor C. Smith. As the business has rapidly grown, the service will be extended, and it is expected that many of the local exchanges throughout the county will be absorbed by the Franklin company and that additional toll lines will be installed.

The Central Union Telephone Company has been refused permission to lay conduits in the streets of Richmond until all the companies using wires are prepared to do so.

The Big Four railroad has begun putting in a telephone service between the principal points on its lines, using the telegraph wires for the service. The Lake Shore and New York Central have independent wires for telephone and telegraph, but the Big Four management believes that the use of the same wires for both services will be entirely practicable on that system. The telephone service will not displace, but simply supplement the telegraph.

M. F. Hosea, manager of the Citizens' Telephone Company of Columbus, has purchased the Elizabethtown exchange. The line is being looked over by linemen from the local company, and a metallic circuit will be connected in a few days. It is understood that the Citizens' company will also purchase the Hope exchange.

Several of the districts of the Indiana Independent Telephone Association have selected the date and place of their meetings, as follows: Second district—W. L. Moellering of Fort Wayne, vice-president—Fort Wayne, September 12th; seventh district—W. W. Mendenhall of Westfield, vice-president—Indianapolis, September 27th; ninth district—W. C. Curil of Petersburg, vice-president—Princeton, September 20th; tenth district—C. D. Knoefel of New Albany, vice-president—New Albany, September 18th and 19th.

Improvements that have recently been made by the Independent telephone companies of Indiana include the following: At Decatur, the entire plant is being rebuilt and much cable laid; at Portland much cable has been laid and many new telephones added; Richmond has installed several sub-exchanges; Boston has had a new exchange put in; at Winchester a new toll board has been installed and many new farm telephones added to the lines; the Carmel exchange has installed a new switchboard; at Union City there has been a general overhauling and placing of new equipment; Orangeville has installed a new switchboard, and much cable has been laid at Tipton.

Lewis Blades of Hope, who was seeking a franchise for a second telephone system in Hope, has found opposition so strong that the application for a franchise was not presented. There is already an Independent system in Hope.

The Central Union Telephone Company is planning to capture the long-distance business of Green, Monroe and Brown counties. Munson Atwater of Indianapolis has been in Bloomington making preliminary arrangements to connect Bloomfield, Bloomington, Nashville and Columbus, via the Calvert station. He says Spencer and Ellettsville are also to be connected. The Bloomfield-Columbus line will give the Central Union system a direct connecting line across the southern part of the state, from east to west. S.

Ohio Telephone Notes.

Frank A. Knapp, postmaster at Bellevue, has purchased a controlling interest in the Bellevue Home Telephone Company and the Local Telephone Company, both of Bellevue. These plants, in connection with a line at Crestline, have considerably more than 4,200 telephones installed and more than 200 miles of toll line. Interested with Mr. Knapp are some of the most prominent Independent telephone men in the state, it is said. It is also reported that the same men are after the plants at Norwalk and Monroeville. It is probable that considerable outside capital will soon be interested in the direction of controlling other exchanges in that section.

The Toledo Home Telephone Company has received 100,000 feet of conduits, which will be used for the extension of the conduit system. Much of the work will be done this fall and will begin as soon as permits can be secured.

A story from Cincinnati is to the effect that the Adams Express Company has been able to reduce the number of trunk lines required in its office from six to three by employing a man to see that no conversation other than that pertaining to the business is carried on from its private exchange. Formerly the 300 employes were allowed to talk as they pleased over the lines, and the annoyance was allowed to go.

The Big Four railroad will probably extend its telephone service from Galion to Cincinnati and from Springfield to Sandusky. It now has a service over its lines from Cleveland to Galion and from Galion to Bellefontaine.

Thad S. Lane of Jamestown, N. Y., has purchased a controlling interest in the Independent telephone company at that place from capitalists at Warren, this state, who built it. Mr. Lane is securing large holdings in Independent companies for an eastern syndicate, it is said. C.

Texas Telephone News.

The Fort Worth Telephone Company is making extensive improvements and extensions of its system in the city of Fort Worth.

The Hanover Telephone Company of Cameron has let the contract for extending its line to Milano.

The Coast Telephone Company has been organized at El Campo with a capital stock of $5,000. T. J. Poole is one of the incorporators.

The Martin Telephone Company, which recently increased its capital stock from $10,000 to $20,000 and changed its principal office from Johnson City to Llano, has had a wonderful growth. The company has made arrangements to either build new lines or connect with the lines of other companies from Mason to the San Angelo Company's line at Menardville and from San Saba to either Comanche or Brownwood, to form a junction with the Roberts Independent Telephone Company at Midland and the Riddle Independent telephone system at Weatherford. The carrying out of these plans will give a complete system of long-distance telephone lines from Austin to all points west and northwest in Texas, controlled by Independent people alone. The Martin company now has two direct lines from Austin to Llano. Among the stockholders of the Martin company are Otto Ebeling, M. H. Reed, R. H. Evans, all of Marble Falls, Texas; David Martin of Llano and Levi Crownover of Blanco, Texas.

The Ellis County Independent Telephone Company of Waxahachie has almost completed the work of extending its long-distance line to a connection with the system of the Fort Worth Independent Telephone Company. The completion of this connection will give Waxahachie direct connection with Fort Worth, Gainesville, Sherman and other points in North Texas.

The Block House and Leander Telephone Company, composed of citizens of those two towns, has been organized to operate the telephone line which runs from Leander to Block House, a distance of six miles. A. Bittick is president and L. F. Chapman, secretary, of the new company. The line will probably be extended.

It is stated that the Commercial Telephone Company, which was recently sold by order of court to pay off its bonded indebtedness, will be reorganized and placed upon a solid footing. This company operates about 500 miles of long-distance telephone lines in Texas. The company has filed suit against H. M. Aubrey of San Antonio, a director of the company, for $77,000 damages, said to have grown out of the alleged over-bonding of the plaintiff company. Mr. Aubrey has brought suit against his co-directors in the courts of Ohio, where they reside.

A telephone line is to be built from Missouri City to De Walt. The distance is seven miles. H.

Telephone News from the Northwest.

The District Court in St. Paul has ruled against the Northwestern Telephone Exchange Company in the matter of paying taxes on a vacant lot owned by the company. The company objected to paying taxes, holding that the gross earnings tax covers its property, and also that the lot is necessary to its existence. The court holds that the lot is not essential to the use of its building and no sufficient use or need has been shown for the lot.

The Board of Aldermen of St. Paul has voted down an ordinance providing for a maximum charge for telephone service.

The New Ulm Rural Telephone Company has reached an agreement with the City Council of New Ulm, Minn., whereby the company will extend its underground work for another block and a half, and is given permission to set its wires on the same side of the alleys occupied by the city electric-light wires, the poles to extend 10 feet above the light wires.

On September 1st the Norman County Telephone Company took over the local telephone exchange at Ada, Minn., which it bought from the Iron Range Telephone Company, and the new owner has decided to reduce the charge for business connections from $2.50 to $2 per month.

Mayor Jones of Minneapolis declares that telephone and other wires must go underground, and the matter is now before the council of the city.

The Midland Telephone Company at Milford, Iowa, has raised the monthly rental of business connections to $1.25, the former rate being $1.

The Woodward Mutual Telephone Company of Woodward, Iowa, has been incorporated with a capital stock of $15,000.

A disagreement over switching charges between the Eldora Mutual Telephone Company and the farmers lines at Eldora, Iowa, has started a considerable discussion. The Eldora Mutual has a contract with the Bell lines for toll service, and the complaint includes that arrangement. Threats are made of starting an exchange for the farmers' lines, in addition to the present exchanges already there. R.

Telephone Items from Mexico.

The telephone lines of the Compania Telefonica de Chihuahua in the city of Chihuahua are to be rebuilt and extended. New instruments are to be installed and other improvements made. Governor M. Otero of Santa Fe, N. M., is president of the company.

A party of electrical engineers from Stockholm, Sweden, have arrived in the City of Mexico for the purpose of installing the central exchange for the New Telephone Company, which is owned by L. M. Ericsson and associates of Stockholm. This company is now pushing the work of laying its underground conduits. An additional story is to be added to the office building of the company on Sapo Street. The company expects to begin business within a year with a large list of subscribers.

William B. Hale, the new general manager of the Mexican Telephone and Telegraph Company, says that the work of laying the underground conduits of that company in the City of Mexico will soon be resumed. He says that this work should be completed by the first of the coming year. The central-energy lamp-signal system is to be installed and a vast amount of other improvements as well as important extensions to the system are to be made. H.

Compact Condenser for Telephone Service.

A condenser is one of the most valuable of the many different kinds of apparatus that make possible the majority of the telephone systems of the present time. The fact that a condenser is opaque to a direct current and transparent to an alternating current makes it one of the most important adjuncts of practical telephony. If telephone builders were suddenly deprived of the use of this simple little thing, its loss would be felt keenly, and some systems would have to be entirely remodeled.

It is often a hard problem to find space in certain telephones or switchboards in which the desired condenser may be conveniently mounted. This problem has been solved by the Kellogg Switchboard and Supply Company of Chicago, which is now successfully manufacturing what it asserts to be the smallest condenser known, and which is illustrated herewith. The condensers possess a relatively large capacity, a high insulation resistance, and are practically proof against burn-outs or punctures. They are made of the finest rice paper and the best tinfoil wound on a form. They are then baked, in order to drive out any remaining moisture, and then dipped in boiling paraffin, and sealed into a tin case, which is rubber-enameled. These condensers must stand the following tests: Against a ground on the case; a breakdown test in which the condenser must withstand, without puncture, alternating current of over 200 volts pressure; a test of insulation resistance, for instance, a two-microfarad condenser must show an insulation resistance of at least one megohm; a test for capacity.

COMPACT CONDENSER FOR TELEPHONE SERVICE.

The dimensions of the condenser are 2¾ (including terminals) by 1¼ by three-fourths inch.

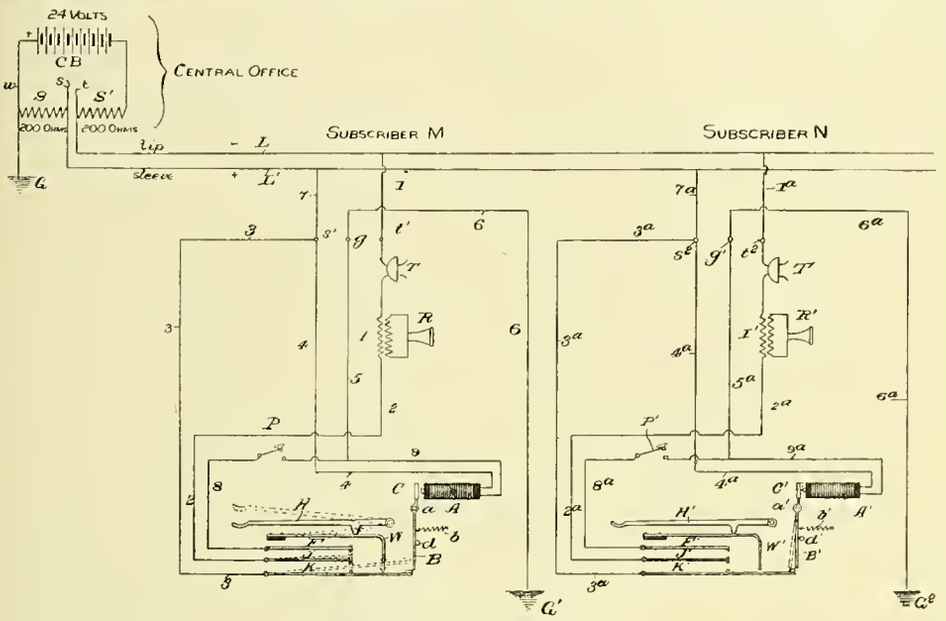
London Electrical Exhibition.

The preparations for the big electrical exhibition in London, England, are almost complete, and the show will be opened on September 25th. A special feature is to be made of the use of electricity for domestic purposes, and prizes are to be offered for cooking apparatus.

Common-battery Lock-out Telephone.

A lock-out device designed for common-battery party-line telephones, by means of which all parties are locked out except those properly using the line, so that the conversation may not be overheard by others on the line, has been patented by Mark P. Boone of Peru, Ind. It is said to be applicable to any common-battery system which has one side of the battery grounded and has impedance coils interposed between the opposite poles of the battery and the two line wires at all times.

The invention consists in the novel construction and arrangement of the electromechanical parts and their co-operating circuits, in which, when the line is clear and no party is talking, a lock-out electromagnet at a subscriber's station connected between the earth and a wire leading through an impedance coil to one side of the battery will be inoperative; but if a circuit be established between the two lines (through a telephone bridged on the line, for instance) then all the subscribers' lock-out electromagnets connected as described become operative.



COMMON-BATTERY LOCK-OUT TELEPHONE.

It also embodies a special push button and supplemental circuit leading to ground at the subscriber's station to enable a subscriber to communicate with another on the same line when the call is for a subscriber on the same line.

In the accompanying diagram (C B) represents the common battery of the central office. The positive side of the battery is connected to the ground. This side of the battery is also connected, through an impedance coil to the sleeve contact of the jack which leads to the line wire (L'). The negative side of the battery is connected, through an impedance coil, to the tip contact which leads to the line wire (L). The resistance of the two impedance coils is the same. As shown, it is 200 ohms, while the battery is of 24 volts. The two wires represent one of the party lines and extend to the instruments of all the subscribers on that party line.

The electromagnet (A) controls the lock-out devices and circuits as follows: (C) is an armature mounted in front of the electromagnet upon a locking lever (B) fulcrumed at (a) and normally held against a stop (d) by the spring (b). When so held the armature (C) on the upper end of the lever is removed from the pole of the electromagnet, and the lower end of the locking lever is removed from range of interference with the rise of the extended end of the contact spring (K), so that the contact spring can rise past the lower end of the locking lever to close the contacts (F) (J) (K), as shown in dotted lines, whenever the receiver is taken off the hook; but if the electromagnet (A) be energized, then the armature is attracted and the locking dever is deflected, as seen in dotted lines at station (N), and the lower end of the locking lever passes above the extended end of contact spring (K') and prevents its rise, so that even if receiver (H') of this other station is taken off the hook the contacts (F') (J') (K') are not closed for talking or hearing. The full-line positions represent the positions of the parts when the line is not in use. If station (M) is in use a potential is set up between the sleeve side of line and the earth, which does not exist when station (M) is not in use. This difference in potential operates the lock-out electromagnet (A') of station (N) and all other stations on this line. A portion of the current will go to the positive side of the battery at central office through impedance coil (S) and part over the line wire (L') to the high-resistance electromagnets (A') of the other station. The other portion of the current, passing from (7) to the right on line (L'), goes to station (N) and all others. The effect of this portion of the current which goes to all the other subscribers (N) on the line is to energize electromagnets (A'), and by attracting armature (C') throw the locking lever (B') over the extended end of spring (K'), and by preventing the closure of contacts (F') (J') (K') to cut out all these other subscribers from talking or hearing.

If it happens that the subscriber (M) wishes to communicate with another, (N) on the same party line, this is accomplished through the agency of the push button (P) as follows: The subscriber (M) first gives to central office the number of (N's) telephone. Central office then rings (N), after which (M) presses his button (P), and this grounds the circuit and cuts off or de-energizes the lock-out electromagnets (A') of all other subscribers, so that their contacts (F') (J') (K') may come in contact upon removal of the receiver from the hook. Subscriber (N) having answered, subscriber (M) releases push button (P), and this again locks out all the other subscribers on that line except (N). (N's) electromagnet is by this act energized, and his instrument would be locked out but for the fact that his spring (K') has risen in front of lever (B'), as shown by dotted lines at station (M), and his lever (B') cannot get on top of it to interfere with its already closed circuits.

GENERAL TELEPHONE NEWS.

The Home Telephone Company of Los Angeles, through a representative, has applied to the trustees of Nevada City and Grass Valley, Cal., for a franchise.

The Pacific States Telephone and Telegraph Company will erect a telephone exchange building at Aberdeen, Wash., and install the express system. A new copper lead will be strung between Aberdeen and Olympia.

Oscar Wentworth Rogers, a well-known figure in the telephone field, died at a sanitarium in Martinsville, Ind., on August 16th. His home was at West Union, Iowa, but of late years he had spent much of his time in Chicago and New York.

The Chicago Telephone Company reports a net gain during August in the number of instruments connected to its lines of 1,498, of which 1,141 were installed in the city and 357 in the country. The company reports a grand total of 133,859 instruments connected to its lines in city and country. Wires in some of the northern suburbs are being put underground and the company is building a number of new exchanges and is erecting a large steel building for its central exchange in the rear of 100 Washington Street.

CORRESPONDENCE.

Great Britain.

London, August 30.—When electricity first appeared as a competitor with gas it was the pleasure of the gas interests in Great Britain to treat the matter flippantly and to seek comfort in the reflection that the new power was of the mushroom order and would as quickly disappear, from the commercial point of view. Time has falsified that opinion, however, in a striking manner, and today our gas friends have shifted their ground somewhat. We are now told that the legitimate sphere of electrical energy is for motive-power purposes, tramways, railways, and so on, and that for lighting, electricity is utterly and hopelessly beaten. Unfortunately, in almost every town in Great Britain the gas interests are particularly strong, and this has given opportunities to the gas companies for making a very large show, under conditions, it must be said, greatly favorable to themselves. Thanks to the invention of the incandescent-gas mantle and the absence of anything substantial in the way of assisting small householders to have their houses wired for the electric light, gas has practically a monopoly of the small private house, although strong efforts are now being made to retrieve the position, on the part of the electric-supply authorities.

In the matter of street lighting, however, the reverse has obtained for several years, and therefore it is becoming somewhat disconcerting to find a tendency in some quarters—not uninfluential—to revert to gas. The position would not be so terrible were competition allowed on equal terms, but this is not so. With the improvement in high-pressure gas and its fittings, offers are being made to some local authorities to erect trial apparatus and to compare it with electric arcs erected years ago, and, unfortunately, a willing ear is being lent to these propositions, no reciprocal advantage being offered to the electric-supply authority. This point has become of particular interest in the city of London, where the type and design of the arc-lamp globes were selected many years ago by the engineers of the corporation—the supply being furnished by a company—notwithstanding protests that the best results could not be achieved with the design selected. The great and recent improvements in electric arcs of the flame type have been demonstrated to the disadvantage of high-pressure gas on many occasions, and reports have been issued by the municipal electrical engineers at Sheffield, Croydon and other places, these reports having been adopted. The hereditary conservatism of the city corporation, however, has resulted in the electric-light company being given notice to remove a certain number of its arc lamps, without an opportunity of demonstrating what can be accomplished with the most modern electric arcs. I have already reported that the companies will probably take the case into the law courts, if necessary, owing to the previous involved history of electric supply in the city of London—certain ancient contracts still existing—but this matter has again become important in consequence of further definite evidence having been forthcoming that modern electric arc lighting, both as to price and efficiency, is superior to gas. The borough engineer at Croydon has issued the results of tests made which tend to prove this conclusively.

Interest in the telephone agreement has been sustained by the issue of the report upon the New York telephone system, which has come at a very opportune moment from the point of view of the government. It appears that the New York system is similar to that now being adopted by the government and the National Telephone Company, whose undertaking is being acquired. Yet the whole trend of the evidence of the municipalities which was placed before the select committee which considered the agreement was that this system is inefficient. The engineers of the Post Office expressed themselves very strongly upon the matter to the committee, but obviously the point at issue was too involved for the committee to consider, much less settle. The first fruits of the agreement between the company and the postmaster-general will be given to the public almost immediately. Intercommunication will now be given between subscribers on the National company's exchange and those on Post Office and municipal exchanges, while all the advantages which the Post Office subscribers now enjoy with regard to express letters, telegrams, etc., by telephone, will be conferred upon the subscribers to the National Telephone Company.

Further lines have been converted to electrical working during the week upon the District Railway. All the company's lines contiguous to the Inner Circle are now "electrified" and the latter is expected to be in operation by electric traction before the end of next month. It is stated that some novel appliances will be used for cleaning the tunnels when the steam trains have altogether disappeared. Instead of doing this solely by hand labor, some sort of revolving brushes on mechanical arms are to be used which are expected to expedite the work considerably. In connection with the District Railway, Mr. Yerkes, who has been

lying very ill for a long time, has now recovered sufficiently to go abroad in charge of two physicians.

The British Association meeting in South Africa this year has excited but little interest in electrical engineering circles here so far, partly owing to the paucity of "electrical" papers and partly owing to the distance. So far as the reports in the daily papers go, it would appear that the chief interest has been sightseeing, the members taking advantage of the opportunity to see South Africa thoroughly.

The scare raised a few weeks ago in a certain daily paper as to the coming influence of the motor omnibus upon electric tramways, which so thoroughly alarmed tramway shareholders and ratepayers in districts owning electric tramways, has now been finally laid by the heels. The scare in question was evidently inspired by the motor-bus interests, yet only last week the chairman of the London General Omnibus Company—one of the companies experimenting with motor buses—stated to his shareholders that the horse bus would be the mainstay of the company for several years to come and that he believed those companies which had gone in largely for motor buses of the present type would regret their action ere long. G.

New York.

New York city, September 9.—The New York Central railroad is making very satisfactory progress with its terminal rebuilding at Forty-second Street, and by October 1st will have a new temporary building ready on Vanderbilt Avenue for the use of its clerical force. It will be at least two years, however, before the present passenger station will be rebuilt for the pending electrification of the system. According to the Brooklyn Daily Eagle, the New York Central has definitely arranged to electrify its whole system from New York to Buffalo.

An organization described as the Central Long Island Railroad Company is said to be planning extensive new trolley lines in Queens Borough, with a special view to secure a franchise for a line over the unfinished Blackwell's Island Bridge, which will connect New York and Ravenswood.

President Alexander E. Orr of the Rapid Transit Commission has finally induced the Interborough Rapid Transit and the Metropolitan Street Railway companies to come to terms as to the repaving of Lenox Avenue. The work is to be done jointly by both companies, and where the companies' engineers cannot agree Mr. Orr will be arbitrator.

Ex-Judge Alton B. Parker has been appointed by the New York Supreme Court to act as referee in proceedings relating to damages to real estate consequent upon the change in plans of the subway between Thirty-fourth and Forty-first streets. Mr. Parker is also reported to have been appointed counsel for the Brooklyn Rapid Transit Company at a salary of $100,000.

The falling off of the Sunday traffic on the Subway has led the Interborough Rapid Transit Company to run only three-car trains during most of the daylight hours on Sundays.

Four boys and several junk dealers have been arrested in connection with thefts of the brass fittings of lamps on the cars of the New York City railway.

The Mount Vernon (N. Y.) board of aldermen has granted a franchise to the New York, Westchester and Boston Railroad Company, which will enable the company to build the local section of its line from the New York city boundary. There is to be a local five-cent fare, a minimum number of trains, an immediate commencement of construction work and completion within four years.

National electric elevators are being put in at a new apartment house on Riverside Drive and Ninety-second Street.

F. W. Cohn, electrical engineer of 1122 Madison Avenue, is contracting for the electrical work at a new office building at 36 East Twenty-third Street.

A cable message received in this city yesterday announced that the New York Telephone Company has received an award at the international exhibition now in progress at Liège, Belgium. The New York Telephone Company's exhibit at Liège illustrates, among other things, the very satisfactory methods employed by the company for the care of its exchange employes.

The Brooklyn Rapid Transit Company has been experimentally spraying a portion of its track with crude oil with a view of combatting the mosquitos, which at points on the Bay Ridge section are particularly virulent. After the tracks are oiled, which is planned to be done each 10 days, the rails are sanded.

The Clyde Gas and Electric Company of Clyde, N. Y., has been reorganized with a capital of $25,000, and a local directorate comprising P. W. Summers, C. S. Sheppard and W. T. Morris. D. W. W.

New England.

Boston, Mass., September 9.—The Boston Elevated Street Railway Company will erect a new power station in Medford to give additional power during the rush hours.

The contract for the steel work on the extension of the elevated structure in Boston has been placed with the Fort Pitt Bridge Works of Pittsburg. Work is getting under way on the cement foundations for the steel uprights, and the determining of the locations for stations will be accomplished in the near future.

The next Legislature will be asked to sanction the absorption of the West End Street Railway Company, now under lease to the Boston Elevated company, by the latter. It is proposed that the Boston Elevated company shall issue $16,089,250 preferred shares to purchase the West End company's shares, of which there are outstanding $6,400,000 cumulative eight per cent. preferred and $9,689,250 common stock, paying seven per cent. The par value of West End shares is $50, but it is proposed to put the new issue on a basis of $100.

George S. Taft of Worcester, Mass., announces that the Hampshire and Worcester street railway, of which he is receiver, will be sold at auction on September 16th, in the town of Ware. The line is about 12 miles long and is mortgaged for $400,000 to the American Loan and Trust Company, trustee for the bondholders.

Capt. Henry Grover, who has retired from the superintendency of the Chelsea division of the Boston and Northern street-railway system, is succeeded by George H. Gray, heretofore in charge of the Woburn division. Albert Myers of the Lowell division succeeds Mr. Gray at Woburn.

John J. Flaherty, representative in the Legislature from East Boston and an old-time telegrapher, has been honored with election to membership in the Old Time Telegraphers' and Historical Association.

In the United States District Court at Brattleboro, Vt., Judge Wheeler on September 5th appointed W. H. Borce, manager of the St. Albans Street Railway Company, receiver of the road, on the petition of Jerome Marble of Worcester, Mass. Mr. Marble holds $77,000 of the company's $200,000 bonds outstanding. It is thought that the liabilities of the road will not exceed $250,000.

A new telephone exchange was opened on September 3d in Stoneham, Mass. The exchange is an offshoot of Winchester, the latter office retaining about 600 subscribers out of its former 700. B.

Southeastern States.

Charlotte, N. C., September 9.—About $5,000 has been raised at Rockmart, Ga., for an electric-light plant. R. R. Beasley is the moving spirit in the enterprise.

A Gamewell fire-alarm system is being installed in Columbus, Ga., under the supervision of O. P. Crocker of Atlanta.

The city of Jackson, Ga., has voted a bond issue of $40,000 to be used for an electric-light and waterworks system for the municipality.

It is asserted that the purchasers of the Frederick and Middletown (Md.) electric railway are the promoters of the road projected from Baltimore to Hagerstown, to be known as the Baltimore and Frederick electric railway. The necessary financial backing is said to have been secured.

Apropos of the fight now on in Asheville, N. C., over improving the Bell telephone system by order of the city, a franchise has in the meantime been granted to W. A. Wynne of Raleigh for an underground system, it being stipulated that the city shall receive one per cent. of the gross receipts of the new company. L.

Mexico.

City of Mexico, September 7.—Col. Daniel M. Burns of San Francisco, Cal., owner of the Candelaria Mines, situated in this district, will erect a large hydro-electric plant for the purpose of supplying electric power for the operation of his mines and other mines and reduction plants in the San Dimas district. The power plant will be located on a mountain stream and a waterfall will be utilized to provide the initial power.

Andres Lefebre is having the surveys made for a large electric power plant, which he will establish at Xicotlacotla. The power plant will be located on the Amacuzac River, where a waterfall will be utilized. Transmission lines will be built to the town of Guerrero and the state of Morelos.

It is reported that the electric-light and power plant of the Compania Industrial de Guadalajara in the city of Guadalajara, is about to be sold to Canadian capitalists, who are largely interested in the Mexican Light and Power Company of the City of Mexico. It is stated that these Canadian interests have offered $1,200,000 for the Guadalajara plant and that this offer is now under consideration. The company is now completing installations at its principal power plant on the Santiago River near Guadalajara, which when completed will increase its capacity to 7,200 horsepower. These improvements will cost about $200,000. The company had planned to further increase the capacity of its power plant next year.

It is announced that the Pachuca and Real del Monte railway system, which extends to all parts of the city of Pachuca and to the mines of the district, is to be converted into electric traction and otherwise improved. Engineer B. M. de Arozarena, the owner of the system, is now in New York arranging the details of the transaction. It is said that American capitalists will be associated with him in the ownership of the property.

The Mexican government has granted a concession to Andres Matienzo to establish an electric power plant on the Atoyac River near the town of Texmelucan. He is authorized to build a dam across the river, construct a canal and bridges, build transmission lines and to construct and operate telephone and telegraph lines along the canals and transmission lines. The power from the main generating plant will be transmitted to a number of towns in that region.

A company has been organized for the purpose of establishing a large electric power plant at Micos. The proposed plant will be located at the waterfalls, where it is estimated that not less than 10,000 horsepower can be generated.

The Compania del Alumbrado Electrico del Comercio de Zacatecas has been organized for the purpose of constructing and operating a large electric-light and power plant in the city of Zacatecas. The company has a capital stock of $100,000 and is composed of local business men.

It is announced that J. W. Conger, brother of E. H. Conger, former ambassador to Mexico, who recently obtained an option on the street-railway system and electric-light and power plant in Chihuahua, is meeting with success in organizing a company of Americans to take over these properties.

It is reported that La Electra Company of Guadalajara will reduce its prices for light and power about 50 per cent. upon the completion of its new hydro-electric plant at the Falls of Juanacatlan. The work of constructing the new power plant is making good progress. The company owns a concession for the construction of a system of electric railways in that city and is asking for bids on 3,000 tons of steel rails, which are to be used in the construction of the lines. It is stated that the company will soon place an order for 25 miles of trolley wire and for a large amount of first-class equipment.

The City Council of Metepec has taken preliminary steps looking to the installation of an electric-light and power plant for the city.

The formal consolidation of the street-railway lines in Monterey which were owned by the Empresa-Mexicana Company and S. W. Slayden, the latter of New York, has taken place. The new owners are Mackenzie & Mann, a Canadian concern. The consolidated system will probably be operated under the name of the Monterey Electric Tramway Company. William Mackenzie of Toronto, Canada, is at the head of the new company.

E. T. Hovelman of Chinipas will establish an electric power plant on the Chinipas River for the purpose of operating mining machinery and reduction works. W. D. H.

Texas.

Austin, September 9.—The Board of Trade of Corsicana is considering a proposition that has been made by another syndicate of eastern capitalists for the construction of an interurban electric railway from Corsicana to Palestine. A preliminary survey for the proposed road has been made. It is estimated that it will cost about $450,000 to build and equip the line.

The City Council of Palestine has received an application from the representative of local capitalists for a franchise to build and operate a system of electric railway in the city. The franchise will probably be granted.

The North Texas Traction Company is planning to extend its lines in Fort Worth. Blake a Mapledoram is general manager.

General Manager Daly of the Houston Street Railway Company announces that the Franklin Avenue line will be extended from its present terminus on Engelke Street along that street three blocks to Milby Street and thence to the Harrisburg Road and into the city.

The plant and property of the Bay City Ice, Light and Power Company is to be sold to the highest bidder by order of court. The plant cost about $40,000. Judge W. C. Carpenter can give information.

The Consumers' Light and Heating Company of Fort Worth, which was recently organized with a capital stock of $100,000, will install an electric-light and power plant. Winfield Scott is one of the incorporators. H.

Ohio.

Cleveland, September 9.—At the annual meeting of the Cincinnati, Dayton and Toledo Traction Company, held at Hamilton a few days ago, directors were chosen, and the following-named officers were subsequently elected: President, George B. Cox; vice-president, C. C. Richardson; second vice-president, J. B. Foraker, Jr.; secretary and treasurer, F. R. Williams; general counsel, W. C. Shepherd. The matter of arranging for the entrance of the proposed Cincinnati, Toledo and Detroit Short Line into Cincinnati over the Cincinnati,

Dayton and Toledo tracks was discussed. No action was taken, however.

Reports are to the effect that plans have been made to build a traction line from Canton to East Liverpool, where it will connect with lines running into Wheeling, W. Va., and Steubenville, Ohio. At Salem it will also connect with the Stark Electric and also with the Northern Ohio, through other roads. This would give a through line from Cleveland to the West Virginia towns. Because of the rough country through which this would pass, the cost is estimated at about $1,500,000.

An application for the sale of the Springfield, Washington Court House and Chillicothe line has been filed in the court, and the hearing will take place on September 13th. The line is in operation from Springfield to South Charleston.

On October 2d the stockholders of the Sandusky Southwestern Railway Company will hold a meeting to vote upon the increase of stock from $1,000,000 to $2,000,000 common stock. It is said the indebtedness of the company will then be paid off. Lowther & Dickenson of New York will look after the matter.

Bonds are being sold by the Canton-Akron road, it is said, and the money thus secured will be used for improvements in the roadbed and equipment.

The Loveland Citizens' Electric Company of Loveland has given a mortgage in favor of the Central Trust and Safe Deposit Company to secure a bond issue of $50,000, the money to be used in the extension of the plant.

C. H. Hubbell of Cleveland has been granted a franchise by the Cuyahoga county commissioners for a line from South Brooklyn, a suburb of Cleveland, to Berea.

The Toledo Gas, Electric and Heating Company, a consolidation of three other companies, has made a first consolidated mortgage to the Ohio Savings Bank and Trust Company, as trustee, to secure the issue of $2,500,000 gold bonds, drawing five per cent. interest. About $2,000,000 of the bonds will be outstanding when the merger is completed and the additions already planned are made to the plants.

F. F. Beam of Cleveland and S. D. Gilbert of Cincinnati, both electrical engineers, have purchased the property of the Salem Electric Light and Power Company. It is the intention to improve and enlarge the plant.

The Liverpool and Wellsville Interurban Street Railway Company of East Liverpool has been incorporated with a capital stock of $10,000 by C. E. Hamilton, J. W. Clark, V. C. Deford and others.

Officials of the Toledo, Port Clinton and Lakeside Railway Company are considering the plan of bridging the bay at Sandusky and extending the line to that city. The Lake Shore and Michigan Southern crosses the bay there on a bridge.

A story has been printed to the effect that the bondholders of the Miami and Erie Canal Transportation Company have about given up hope, and believe the company is dead. The last straw is the statement that the attorney-general will bring suit to oust the company from its charter, and it is believed by some that the Cincinnati end will then go to Cincinnati people for some other purpose. The bondholders think that about $300,000 is all that will be realized from wrecking the plant.

The Plymouth and Shelby Traction Company of Norwalk has been incorporated with a capital stock of $200,000 by B. B. Avery, Sherman Culp, G. L. Rebman, Frank L. Scott and Sterling Parks.

It is believed by Toledo people that the formation of a new lighting and power company in that city, by the merger of the three smaller plants, will bring about sharp competition. The Toledo Railways and Light Company has had practically a monopoly of the business in the downtown section of the city, but the new company is bringing its lines up and getting ready to do business. It is also enlarging its plants and has installed a large turbine engine in one of them. The lines are being strung in the Home telephone conduits, space having been leased for that purpose by the new company. Charles R. Fabin will be appointed general manager of the Toledo Gas, Electric and Heating Company, it is said. John Cummings is chairman of the board.

The Toledo Railways and Light Company has returned for taxation $498,344 of personal property.

The council committee on railways at Toledo has approved an ordinance granting the Toledo Railways and Light Company a five-year franchise on Bancroft Street.

The committee appointed some time ago to investigate the municipal light plant at Columbus, in its report to the council says that if it is "carefully managed' it can be made to pay a handsome profit to the city. Opponents of municipal ownership find much significance in the words "carefully managed," and say that careful management has not characterized the history of many municipal public-service plants of any kind.

The Cleveland City Council this week adopted a resolution requiring the Cleveland Electric Railway Company to remove the old cable slots on Hough and Payne avenues and Superior and Water streets at once, or, in event this is not done by the company, the Board of Public Service is to take charge of the work and charge the cost up to the company. The health authorities claim that the slots are unsanitary.

The Electrical Construction Company of Columbus has been incorporated with a capital stock of $15,000 by B. R. Hedges, L. W. Jaquith, Jennie Ackley and others.

The Milloy Electric Company of Cleveland has been incorporated by P. D. Milloy, I. Milloy, F. L. Taft and others. The capital stock is $10,000.

O. M. C.

Indiana.

Indianapolis, September 9.—The Hope (Ind.) electric-light plant, owned and operated by George S. Cook at Hope, is operating satisfactorily. The town is supplied with 10 arc lights which have been placed at the chief street crossings. Five hundred incandescent lights have been installed in the homes and business places of Hope, rendering the town well lighted.

The Indiana Central Traction Company has filed a mortgage of $800,000 to protect a bond issue with which it proposes to build a line from Wabash to Warsaw. The Indiana Northern Traction Company, now operating from Marion to Wabash, is said to have also financed a project to build an extension of its line from Wabash to Warsaw.

Grant County commissioners have granted two franchises to interurban-railway companies. One was to the Indianapolis, Hartford City and Celina Traction Company, which is constructing a line from Hartford City to Alexandria. The proposed road will pass across the southeast corner of Grant County. . The other franchise was granted to John Ratliff, Alexander Lindsay and Jacob Strauss, who are said to represent Chicago and Indianapolis capitalists. This road is to run from Marion to Noblesville. The fare charged by both roads is not to exceed 1½ cents per mile.

A contract has been let by the Indiana Union Traction Company to Eshelman & Kaufman of Anderson for an $8,000 building at Tipton, to be used as a passenger and freight station and also for division offices of the Indianapolis-Northern and Tipton-Alexandria divisions. It will be the largest station building owned by the Indiana Union Traction on its entire system.

The St. Joseph Valley traction line is now in operation from Lagrange, Ind., to Shipshewana, 18 miles west of Lagrange. The extension of the line from Middlebury to Shipshewana has just been opened to traffic. The gasoline-electric car which runs on the line makes the 18-mile run in an hour.

There promises to be interesting competition between the new line of the Louisville and Southern Indiana Traction Company from Jeffersonville, Ind., across the Ohio River to Louisville, Ky., and the Louisville and Jeffersonville Ferry Company, when the traction company begins its service over the Big Four railroad bridge across the river. The ferry company has at present the larger part of the business, especially of the regulars, who go over by hundreds daily to work. With the electric line in operation it is said the ferry company will give three-cent fares one way, and a five-cent fare for the round trip instead of the straight five-cent fare. The "monthly" ticket will be cut from $2 to $1. The traction company will have an advantage in the location of its Louisville terminal.

One of the new cars which will be put in the through limited service between Fort Wayne and Indianapolis by the Fort Wayne and Wabash Valley Traction Company is being tried. The car has high wheels and will be able to make 70 miles an hour, it is said. Several more of these cars are to be delivered the company next month.

The commissioners of Monroe County have granted a franchise to the Indianapolis and Ohio Valley Traction Company. The commissioners also agreed to grant a franchise to the Wabash and Southeastern under the same conditions, viz., that work on the road be begun by May, 1906, that the road be in operation within two years, and that no subsidy shall be asked from Bloomington or Perry township.

The directors of the Evansville and Eastern Electric Railway Company are going to present a petition to the commissioners of Spencer County, offering two townships stock in the company to the amount of subsidies they may vote. Subsidy elections will be held in Ohio and Luce townships on September 21st. Ohio Township is asked to vote $94,000 and Luce $42,000.

A franchise has been granted by the Bedford City Council to the Indianapolis and Ohio Valley Traction Company, which proposes to build an electric railway from Indianapolis to Rockport and Evansville. The franchise calls for the completion of the line by January 1, 1908.

At the next meeting of the Indiana association of interurban railway men it is expected that plans will be formulated for the establishment of an information bureau in the Traction Terminal station at Indianapolis. The matter is now in the hands of a committee of that body.

The central car shops for the entire Union Traction system of Indiana will be built in Anderson next year, says President Brady, and the only important work that the company will enter on before winter will be the building of a new or more direct line from Jonesboro into Marion, to be known as the Jonesboro cut-off, which will require the building of about three miles of new track and some heavy grading.

The Fort Wayne and Wabash Valley Traction Company has completed a new electric railway, known as the Battle Ground interurban line, which will connect Lafayette with the camp-meeting ground and the field of the battle of Tippecanoe, eight miles north of Lafayette. Work on the line has been in progress all summer, and several difficult engineering problems have been solved in its construction.

S. S.

Northwestern States.

Minneapolis, September 9.—The Sioux Falls Interurban Electric Railway Company has been incorporated at Sioux Falls, S. D., by R. F. Brown, J. P. Bleeg, Eugene Staenger, G. W. Abbott and Dr. George Pettigrew. The company proposes building lines west from Sioux Falls to Flandreau and Brookings.

The Electric Light and Power Company of McIntosh, Minn., is constructing a new power house of hollow concrete blocks.

Capitalists of Indianapolis have become interested in the projected interurban railroad from Waterloo to Marshalltown, Iowa, and interest therein has been revived.

The council committee in Marshalltown Iowa, has been authorized by the council to make repairs to the electric-light plant. The plant is in bad shape, as the dynamos have been continuously subjected to an overload for a long time. New dynamos are needed.

C. H. Holcomb of Huron, S. D., contemplates installing an electric-light plant at Tyler, Minn.

The Northwest Electrical Equipment Company of St. Paul suffered a considerable loss by fire, which destroyed the building which it occupied. The estimated loss is $30,000, fully insured.

An electric-light plant is being installed at Everist, Iowa, to furnish light for the mines there. The plant will cost $25,000.

R.

Pacific Slope.

San Francisco, September 8.—The Ocean Shore Railway Company has closed a contract with C. E. Loss of New York for the construction of its new 83-mile double-track electric road, extending from San Francisco to Santa Cruz. Work will be commenced at San Francisco and as soon as the franchise giving the right to enter the city is granted a power house will be erected near Halfmoon Bay that will supply abundant power for the operation of heavy cars at 60 miles an hour on portions of the line. The average speed will be 45 miles an hour.

Surveys have been made for electric lines through the campus at Stanford University. It is learned that the San Jose-Los Gatos Interurban Railway Company contemplates extending an electric road to Stanford University requiring about 15 miles of road to be built from Meridian Corners. It would also be feasible to construct an electric line from the University to a connection with the United Railroads of San Francisco at San Mateo.

The Union Light and Power Company, just incorporated in San Francisco with a capital stock of $2,000,000 by Mortimer Fleishhacker, John Humphreys and their associates, will be a merger concern taking in the Reno Power, Light and Water Company, the Washoe County Power and Development Company and several water companies. The light and power business at Reno, Nev., will be handled from the plants of the above-named companies.

It is reported that the Diamond Match Company will in the near future use electric motors to replace the steam donkey engines now used in the logging camps for the purpose of snaking the logs from the canyons to the railroad. The company has a large sawmill at Stirling City, Cal. The cost of transforming the present system of logging by steam into an electric proposition will be in the neighborhood of $10,000.

The City Council of West Seattle, Wash., has called for estimates on a municipal lighting system and also on the cost of power purchased from outside sources.

An additional 1,500-kilowatt three-phase generator with an impulse water-wheel direct connected will be purchased by the Vancouver Power Company of Vancouver, B. C., which will make the fourth unit at the Burrard Inlet power station. The capacity of the plant has been increased considerably this year, a large tunnel giving a better water supply.

The Coos Bay Light and Power Company is enlarging its power house at Marshfield, Ore. An additional Crocker-Wheeler generator having a capacity of 150 kilowatts will be installed.

The Llanos de Oro Mining and Milling Company, which has mines near Altar, Sonora, Mexico, is in the market for two three-phase generators, one of 30-kilowatt and the other of 75-kilowatt capacity. The specifications, issued by C. A. Copeland, 441 Bradbury Building, Los Angeles, also call for two

engines of 110 horsepower and 40 horsepower, respectively, one being direct connected and one belted.

Naylor & Nordin have taken a contract at Lewiston, Ida., for the construction of 24 miles of the Lewiston-Grangeville electric raiway, work to begin within a month.

The Seattle Electric Company of Seattle, Wash., has been awarded a franchise to construct an electric railway in the Fremont and Green Lake districts. Construction will be commenced within 30 days. A.

PERSONAL.

B. J. Shockley has resigned as manager of the Albert Lea Light and Power Company of Albert Lea, Minn., and has gone to Canton, Ohio, where he will be connected with the installation of a large electric-light and steam-heating system.

Daniel E. Carter, well known as a telegraph operator in Boston, Mass., has accepted a position as manager of the Postal Telegraph-cable Company's office at Springfield, Mass. He was presented a handsome diamond charm by his Boston associates before leaving for his new position.

H. F. J. Porter, M. E., well known in Chicago and the West, has opened an office as consulting engineer in New York city "to fill the demand for someone who has had experience in establishing modern methods of organization and management in industrial establishments where older and cruder methods exist and where assistance is needed to effect the change along lines which have been proved to be efficacious."

Samuel Insull, president of the Chicago Edison and Commonwealth Electric companies of Chicago, has returned from Europe after his vacation sojourn, and characterizes as absurd a report that he will make his permanent residence in England. "I am an American citizen," he said. "My business interests are mainly here. Neither is there anything in a business way which would compel residence in England. It is true that I am interested in the London Power Company, but it is the interest of a comparatively small stockholder. I have absolutely nothing to do with the management."

Several changes have recently been made in the general office of the Indiana Union Traction Company at Indianapolis. P. J. Mitten of Milwaukee succeeds S. B. Thompson, resigned, as superintendent of motive power; William C. Sparks of Anderson, a graduate of Indiana University, who has been an assistant in the office of chief engineer, was advanced to the position of superintendent of roadway, having charge of all the track work; Guy S. Kelsay of Wapoloneta, Ohio, recently with the Western Ohio Traction Company, was appointed electrical engineer, succeeding A. S. Richey, resigned. Mr. Richey will continue in office, however, until September 30th.

William B. Gill, long a superintendent for the Western Union Telegraph Company, with headquarters in Philadelphia, died at his home in Cheltenham, a suburb of Philadelphia, on September 6th. He was 59 years old and had for some time suffered from a complication of diseases, superinduced by a weak heart. Mr. Gill was born in Philadelphia, where he entered the service of the Western Union company as a messenger boy. He won promotion until he became superintendent of the district including Eastern Pennsylvania, Southern New Jersey, Delaware and part of Maryland. This position he relinquished in 1881 to organize the Bankers' and Merchants' and American Rapid Telegraph systems, but in 1883 resumed his place with the Western Union and held it until 1902. He was famous for his skill in manipulating election returns, which brought him into favor with the political chieftains. His widow and five children survive him.

W. S. Doran, formerly associated with the British Westinghouse Electric and Manufacturing Company, has just been appointed manager of the power department of the Allis-Chalmers Company, in which capacity he will have complete charge of the company's commercial affairs pertaining to reciprocating steam engines, steam and hydraulic turbines, condensers, gas engines, blowing engines for iron and steel blast-furnace service, and rolling-mill engines, with headquarters at the general offices of the Allis-Chalmers Company in Milwaukee. He started on his business career with the Southwark Foundry and Machine Company of Philadelphia, later becoming connected with the United Gas Improvement Company of Philadelphia and with Henry R. Worthington, with whom he remained for many years. In 1899 he joined the Worthington Pumping Engine Company, with headquarters in London, England, where he took charge of the company's various branch offices and the important negotiations in Great Britain and Ireland. In 1901 Mr. Doran became associated with the British Westinghouse Electric and Manufacturing Company, and since then has been establishing its branch offices and supervising its sales. Mr. Doran has mastered the intricacies of the commercial side of large manufacturing establishments, as well as the engineering end of the business. He has a delightful personality, to which no small measure of his success may be attributed. As an evidence of the high esteem with which he is regarded by his business associates, a banquet was tendered him on the eve of his departure from England, attended by many well-known railway officials, manufacturers, electrical engineers, and representatives from practically all the large electrical manufacturing concerns in England.

W. S. DORAN.

ELECTRIC LIGHTING.

A committee headed by W. A. McKliffee has been appointed to consider the construction of electric-light plant and waterworks in Greenville, Ky.

The Pend d'Oreille Electric Company, capitalized at $50,000, has bought out the Sandpoint Electric Company of Sandpoint, Ida., and will operate the lighting plant.

The Jackson Light and Power Company of Jackson, Miss., has increased its capital stock by $10,000 and will enlarge its plant, installing new machinery for increasing the capacity.

The Sikeston (Mo.) Ice, Light and Power Company has been incorporated with a capital stock of $25,000 by Charles D. Matthews, Jr., Edward C. Matthews, Joseph E. Armstrong and others.

The Gilliam (Mo.) Electric Light and Power Company has been incorporated with a capital stock of $5,000 to operate an electric-light and power plant. The incorporators include David G. Burton, J. E. Kirk and A. W. Deis.

A report from Topeka, Kan., says that E. E. Roundebusch is forming a company with a capital of $100,000 to buy the local municipal electric-light plant; the city plant, it is added, has not been giving satisfaction. The city plant at Topeka was installed at a cost of $85,000 and began operation in 1888.

The Rockford Edison Company is making a number of noticeable improvements, among them being the enlarging of the power equipment. Three sets of new boilers, two in each battery, have been installed in the new boiler house. There will be another set of boilers installed to complete the equipment. The above together with the changes in the waterpower dam and race leading to the power plant will greatly enlarge its power capacity.

Proposals for installing a system of electric wiring and fixtures in the government building at Toledo, Ohio, will be opened on September 19th. The Toledo Bee of recent date says: "The contract with the Toledo Railways and Light Company for lighting the building with electricity expired on July 1st and the Toledo Gas Light and Coke Company was given a contract for lighting the building throughout with gas. The gas wasn't satisfactory and the government is going back to its first love."

ELECTRIC RAILWAYS

At Olean, N. Y., the Tunesassa and Bradford Railroad Company has been organized with a capital of $50,000 to operate five miles of street railway. The directors are J. B. Wright, D. H. Miller and F. L. Bartlett.

The Central Railway Company of Kansas City, Mo., has been incorporated with a capital of $1,500,000 to build an electric railway between Miami and Sedalia, Mo. E. C. Wright of Kansas City holds $14,900 of the 15,000 shares in trust for a syndicate. Both freight and passengers will be handled.

The recent activity in the securities of the United Railway Company, controlling all the street-railway lines in Baltimore, Md., and vicinity, is believed in Baltimore to be the result of a movement by the Blair-Ryan syndicate and other New York interests to get the lines. The Blair-Ryan syndicate already dominates the Consolidated Gas, Electric Light and Power Company, as well as the Consolidated Gas Company.

Preparatory to receiving Niagara Falls power in Syracuse, N. Y., the Syracuse Rapid Transit Railway Company is preparing plans for the alteration of its power house in Tracy Street. Two transforming stations are to be operated in Syracuse, according to the plans. The larger one will be constructed on the West Shore right-of-way at a point where the electric current from Niagara is delivered to Syracuse.

All of the preliminaries for the construction of the Oklahoma, Lexington and Sulphur Springs electric railway, which is to connect Oklahoma City and Sulphur Springs, Okla., have been completed, and it is stated by the promoters that work is to be commenced. Instead of the usual system of demanding bonuses, the towns along the line of the new road have been asked to take stock in it, and over $100,000 in stock has been purchased by residents of towns along the Washita Valley.

The first electric-trolley line constructed in Japan was that opened in Kioto in 1895. Since then other cities have built similar lines, and there are now 17 companies, capitalized at $18,000,000, operating 120 miles of road and building 85 more. Most of these companies, says the New York Tribune, have not yet a very profitable business; but that the profits will be large is indicated by the fact that the electric tramways of Tokio already pay annual dividends of not less than 10 per cent.

A step toward the construction of its proposed road from Philadelphia, Pa., to Parkersburg, W. Va., by the Philadelphia and Western Railroad Company was the filing a few days ago of a $15,000,000 mortgage held by the Mississippi Valley Trust Company. In the mortgage it is mentioned that power houses are to be erected, which shows that the new road will be operated by electricity. It will parallel the Pennsylvania railroad and will terminate in Philadelphia at Sixty-third and Market streets.

Superintendent C. A. Gage of the Chicago and Oak Park Elevated Railway Company finds that polite, neatly dressed trainmen tend to an increase in business. An order has gone out from the company requiring the conductors to appear in clean linen and polished shoes and to have their uniforms pressed at least once a month. The company is aiming to have the neatest appearing conductors in the city and proposes to pay half the expense of pressing uniforms; besides, it has equipped the Ashland Avenue office with whisk brooms, combs, brushes, shoe-shining outfits, etc.

The Puyallup Valley Railway Company has filed articles of incorporation in Tacoma, Wash., the capitalization being placed at $250,000. The company names as its objects to construct and operate an electric railway between Tacoma and Puyallup and other valley towns; to build bridges, warehouses and docks, and to furnish electricity for heat, light and power. The incorporators, all of whom give their residence as Chicago, are Fred Chamberlain, W. D. Cotter, W. H. Elvins, J. E. Stevenson, M. J. Brooks, John Mills, W. R. Scott, L. A. Chamberlain and Charles Fulmer.

Work has been started on the proposed line of the Pittsburg and Butler (Pa.) Street Railway Company. The line will be a little over 32 miles in length and have terminals in Etna and Butler, Pa. From Etna the cars will go to Pittsburg over the lines of the Pittsburg Railway Company, taking passengers to Sixth Street and Liberty Avenue. The company was incorporated in January with a capital of $1,500,000 and bonds for the same amount were issued, being taken by the Pittsburg Trust Company. The officers of the company are: President, John C. Reilly; vice-president, George E. Tener; secretary and treasurer, George Heard; chief engineer, Hudson F. Layton; consulting engineer, G. A. Gilfillan.

POWER TRANSMISSION.

A semi-official intimation has been made that President Roosevelt is likely to take steps for the creation of an international commission to consider means of preserving the natural beauty of Niagara Falls.

The Rifle River Power Company of Saginaw, Mich., has filed its articles of association. The company is organized to produce electricity for light, heat and power. Its plant will be erected at Rifle River. The capital stock is $2,000, all subscribed. The stockholders are George Silsby of Saginaw, Frank E. Kleinfeld of Saginaw, Alvah E. Kendall of Saginaw and Edwin Stapleton of Saginaw, with 25 shares each.

The York Haven Water and Power Company has commenced work on the pole line for the proposed electric power transmission to Middletown, Harrisburg and other points in Dauphin and Lancaster counties, Pennsylvania. Agents of the company are still engaged in securing rights of way for the construction of the proposed line, and it is said that the corporation will soon have all of the necessary rights so that it can dispose of its power across the river. Preliminary work is now being done for the erection of the cable beneath the Susquehanna River from the York Haven plant to a point on the Lancaster County shore, where a terminal station will be built.

The work of surveying for the large power plant to be built at Aroostook Falls, to develop the waterpower of the Aroostook River in Maine has begun under the direction of the Maine and New Brunswick Power Company of Fort Fairfield, Me. The estimated horsepower at the falls is 8,000, and the river has a drop of 72 feet in three-quarters of a mile. Electric power will be furnished for a greater part of Aroostook County, and the western part of New Brunswick, including Fort Fairfield, Houlton, Presque Isle, Caribou and Limestone in

Maine, and Andover and Perth in New Brunswick. The town of Houlton, 50 miles south, has voted already to take power for street lighting.

PUBLICATIONS.

The new panel-board catalogue, No. 205, of the J. Lang Electric Company, Chicago, has just been issued. It is one of the Lang card-size catalogues, made to fit in a five by three-inch card index, a feature which makes it available instantly when needed.

Charles R. Underhill of 55 Liberty Street, New York city, has recently issued a sheet with 35 cuts showing various types of electromagnets, alternating current and direct current. This, together with the booklet, "Facts About Electromagnets," will be sent free to any address.

SOCIETIES AND SCHOOLS.

The Southern Hardware Jobbers' Association announces that its next annual convention will be held at Hot Springs, Va., on July 12 to 16, 1906. F. B. Dunlop of Fort Smith, Ark., is president of the association.

The Massachusetts Supreme Court on September 6th handed down a decision in which it ruled that the Massachusetts Institute of Technology cannot use more than one-third of its estate in Boston for buildings, and cannot sell the property under the grant given by an act of the Legislature of 1861. Indirectly the construction of the grant made to the corporation has an important bearing on the Harvard-Technology merger plan. Under the terms of the grant to the Institute of Technology and the Natural History Society the square now occupied by both was to be reserved forever as an open space or for the use of the two societies, but neither society was to cover more than one-third of its area with buildings.

MISCELLANEOUS.

Among the recent new Illinois incorporations is noticed the Public Ownership League, Chicago, which, according to its articles of incorporation, is for political purposes. The incorporators are M. Ashton, D. B. Bradley and J. G. Grossberg.

The Erie railroad has arranged, it is said, for the immediate expenditure of $225,000 for the installation of a railway signal system—the Hall electric semaphore normal clear system—which is operated by stationary storage batteries. The line between Bergen, N. J., and Middletown, a distance of 68 miles, is to be equipped at once. For the first 32 miles the signals will be put two-thirds of a mile apart; for the rest of the distance, about 1⅓ miles apart. Five power plants, which will be required for charging the batteries, will be at Rutherford Junction, Ridgewood Junction, Suffern, Oxford and Middletown.

Efforts are being made to have the different municipal societies in the United States and Canada join forces for a joint municipal congress in Chicago next year. The convention would include an exhibit of municipal accomplishments. Hugo Grosser, city statistician, and other city officials of Chicago, and the Commercial Association, are laying the plans.

William G. Zeigler, a miner in the vicinity of Buena Vista, Cal., recently found what he believed to be platinum-bearing sand. He sent samples of the sand to the United States Geological Survey, and the returns showed values of 1.999 ounces of gold per ton and 43 ounces of platinum per ton. A letter from the Geological Survey requested that larger samples be sent.

Fire which started in the wire tower of the Niagara Falls Hydraulic Power Company at Niagara Falls, N. Y., a few days ago destroyed many power conduits and left half the city in darkness. The aluminum manufacturing plant of the Pittsburg Reduction Company was damaged by the fire and other large establishments in the milling district were threatened.

TRADE NEWS.

The rumor that the Westinghouse Electric and Manufacturing Company had bought land near Niagara Falls on which to erect a large new factory is found to be without foundation.

The Rogers Telephone and Electrical Company of Danbury, Conn., has filed a certificate of incorporation. It has a capital stock of $25,000, and it is organized to manufacture and deal in telephones, switches, batteries, motors, dynamos and allied articles. The incorporators are N. Burton Rogers and George L. Eastman of Orange, N. J.; C. B. Rogers and A. P. Davenport of Danbury, and Frank E. Misks of New York.

Putnam A. Bates, consulting electrical engineer of 42 Broadway, New York, has succeeded to the business of the firm of Bates & Neilson, which was recently dissolved by limitation. Mr. Bates will continue the work along the same lines as before, giving special attention to the preparation of plans, specifications and supervision of electrical installations and also to special investigations and reports and to the application of electric power to machinery.

Wilbur B. Driver is engaged in a lawsuit with the Driver-Harris Wire Company of Harrison, N. J., regarding the construction of a restrictive contract which he made with the company during the early part of this year, when he sold to it his controlling interest in the company. Since resigning from the Driver-Harris Wire Company Mr. Driver has produced some resistance wires which are said to be marked improvements over anything now manufactured. It is mainly to determine the question of marketing these improved products that the present suit is being conducted.

BUSINESS.

Mr. H. F. Stratton, who has been connected with the principal office of the Electric Controller and Supply Company at Cleveland, Ohio, has accepted the position of New York representative of the same company, with offices at No. 136 Liberty Street, New York city.

Users of wooden conduit will be interested in the announcement of the Chicago House Wrecking Company, to the effect that it has 100,000 feet of wooden conduit, size 4½ by 4½ inches, which it secured from its purchase of the material used at the St. Louis World's Fair.

It is announced that in accordance with the demand of G. Martin Brill, head of the new combination of street-car builders, the original plan of financing the concern has been changed so as to provide for $2,000,000 more working capital. The first plan was to hold in reserve $2,000,000 of 5-per cent. bonds, but it has been decided to sell them at once. The companies concerned in the merger are preparing detailed reports, and all orders are taken subject to execution by the combination in case the Independent companies do not have time to fill them before negotiations are closed.

The latest addition to the list of reinforced concrete power houses is that being built for the Waltham Gas Light Company of Waltham, Mass., by J. G. White & Co. The entire building is to be of reinforced concrete construction; no exposed steel frame work will be used. The equipment of the power house will include two 500-kilowatt Parsons turbo-generators direct connected to Westinghouse dynamos. The White company is rushing the work and when completed the Gas Light company will have an electric power station which for fireproof qualities and low operating cost will be difficult to surpass.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) September 5, 1905.

798,589. Resistance Device. George Baehr, McKeesport, Pa. Application filed September 28, 1904.

The resistance device comprises a pair of side members, suspending hooks formed on the edges thereof and a series of resistance units secured between the side members.

798,602. Automatic Carrier for Electric Wires. Frank E. Detchon, Delta, Colo. Application filed August 4, 1904.

A wheeled carrier is arranged to travel on an overhead support and supports the wires.

798,606. Machine for Insulating Electrical Conductors. Charles H. Hawkins, Long Island City, N. Y. Application filed November 28, 1904.

A machine for applying insulating material to electric conductors is described.

798,611. Surgical Appliance. Willard F. Main, Iowa City, Iowa. Application filed June 16, 1903.

An apparatus for applying galvanic currents to certain parts of the body for therapeutical purposes is described.

798,615. Pleasure Railway. James A. Mayhew, St. Louis, Mo., assignor of one-fourth to Carl Roberts, St. Louis, Mo. Application filed October 28, 1904.

The cars on the pleasure railway are electrically operated.

798,641. Machinery for Making Electromagnets. Richard Varley, Providence, R. I., assignor to the Varley Duplex Magnet Company. Application filed October 1, 1903.

A wire-covering machine and a winding device adapted to operate at different relative speeds are associated with a take-up or reservoir interposed between them through which the wire leads from the covering machine to the winding spindle. A stopping and starting device is actuated automatically when the reservoir is full and empty.

798,671. Automatic Telegraph. Alfred C. Gilmore, Chicago, Ill., assignor to James H. Peirce, Chicago, Ill. Application filed March 10, 1903.

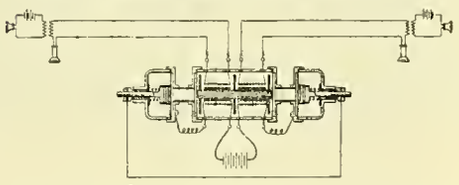
In an automatic telegraph system separate relays are arranged to respond differently to the modified code impulses. A type carrier and a series of adjusters for variably shifting the carrier are provided, each of the adjusters being controlled by the combined operation of the separate relays.

798,673. Trolley. Robert G. Griswold and Charles C. Willits, Quincy, Mass., assignors of one-half to Jerry Morrow, Wellston, Ohio. Application filed October 13, 1903.

Details are described.

798,676. Electric Sign. Carl Haller, Chicago, Ill., assignor to the Haller Machine Company, Chicago, Ill. Application filed October 19, 1904.

A metal back to the sign carries lamp sockets in letter outlines. An open-bottom letter-outline shell houses the sockets and is secured to the back plate, the front of the shell being provided with apertures in alinement with the several housed sockets to receive the lamps. A rim in the back plate constitutes a box-like border to strengthen and stiffen the plate.



NO. 798,720.—TELEPHONE REPEATER.

798,691. Trolley Finder. Jerry Morrow, Wellston, Ohio, assignor of one-half to R. G. Griswold and C. C. Willits, Quincy, Mass. Application filed July 6, 1904.

Combined with a trolley pole are a stationary toothed member carried thereby, a pivoted finder having teeth meshing with the teeth of the stationary toothed member, a pivotal harp carried by the pole, a trolley wheel carried by the harp, stops carried by the pole at opposite sides in the pivotal path of the harp to limit its movement in opposite directions and means tending to yieldably force the harp toward one of the stops.

798,702. Spark-ignition Device for Explosive Engines. Thornton B. Rennell, Denver, Colo. Application filed December 30, 1903.

The sparking terminals are associated with a spring for interrupting the primary circuit of the induction coil at two or more points simultaneously.

798,720. Telephone Repeater. David H. Wilson, Chicago, Ill., assignor to George W. Kretzinger, Chicago, Ill. Application filed February 14, 1903. Renewed February 11, 1905.

A telephone repeater comprises a core having two coils thereon, a receiver associated with the core, a transmitter associated with the receiver, a coil on the core in circuit with the transmitter and a source of electric supply in circuit with the coil. (See cut.)

798,742. Automatic Train Signal. Clay H. Martin, Jackson, Mich. Application filed December 20, 1904.

The train signal comprises an electrical alarm in the way-car, a luminous signal on one of the cars forward from the way-car, means for displaying the luminous signal, and means actuated by the severing of the train for simultaneously actuating the signal-displaying means and closing the alarm circuit.

798,748. Conduit for Electrical Conductors. William C. Robinson, Allegheny, Pa. Application filed October 5, 1904.

Two tubular portions with a web portion intermediate are so arranged that the web portion is tangential to the tubular portions, and the surface of the web opposite the tubular portions is concave to form longitudinal bearing lines for the conduit.

798,770. Governor for Dynamos. Charles A. Eck, Newark, N. J. Application filed August 12, 1903.

Combined with a driving wheel and a dynamo, one of which is mounted at an angle to the other, are a magnetic field in the dynamo, a beveled friction pulley adapted to engage with the driving wheel and a rotatable armature shaft carrying the pulley, and carrying also an armature and a commutator, mounted to move longitudinally within the field, and adapted to be moved into its central longitudinal position by the action of the field when the voltage increases above a certain point; this decreases the speed of the armature shaft and means automatically move the shaft out of its central longitudinal position when the voltage drops below a certain point thereby increasing the speed of the armature shaft. (See cut on next page.)

798,784. Control of Apparatus Governing the Passage of Cars Along Railways. Henry W. Griffin, New York, N. Y., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed April 1, 1905.

An automatically acting train stop comprise a trip for each block section and two circuits for each train stop either of which when closed prevents the trip from being moved to its operative position. One of the circuits is opened by the passage of a train into a block section succeeding that for which the stop is provided and the other is closed by the entry of a train into the block for which the stop is provided.

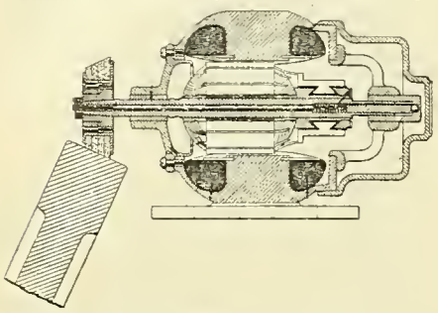
798,790. Electrolytic Process. Carl Hering, Philadelphia, Pa. Application filed July 13, 1901.

In an electrolytic process in which there exists in solution in the electrolyte an ingredient which is objectionable because hindering the desired electrolysis, the

method of making the objectionable ingredient inert consists in electrolyzing the solution with an electrode of a material with which the ingredient will combine to form a chemical compound which is inert in the desired process and is thereby removed from further action.

798,803. Pocket Electric Burglar Alarm. Herman A. Kreh, New Orleans, La. Application filed December 30, 1904.

Contact mechanism is associated with a number of members movable relatively to each other for the purpose of opening and closing the contact mechanism, the members are bifurcated for the purpose of engaging the stem of a jewel or the like, and alarm mechanism is connected with the contact mechanism.



NO. 798,770.—DYNAMO GOVERNOR.

798,826. Regulator. Alphonse F. Pieper, Rochester, N. Y. Application filed August 29, 1903. Renewed March 3, 1905.

Combined in a motor for alternating currents are field windings, armature coils, commutator and commutator brushes connected in series. A number of inductive windings differing in induction are provided, a conductor connecting one of the brushes with the windings and a separate conductor leading from the other brush and adapted to coöperate with the windings to close the circuit and form a shunt around the brushes.

798,838. Telephone-exchange System. Ernest H. Strauss, Chicago, Ill. Application filed August 29, 1903.

The central station is provided with a telephone set, a series of separately connected and mounted annunciators and a switchboard consisting of two series of conductors crossed, each conductor or one series being electrically and permanently connected to the corresponding conductor of the other series. Each conductor of one series is also electrically connected to an annunciator, and means are provided for electrically connecting any conductor of one series with any conductor of the other series.

798,853. Memorandum Attachment for Telephones. Frank R. Welsh, Philadelphia, Pa. Application filed June 8, 1905.

A device for holding a memorandum to the subscribers telephone set is described.

798,906. Storage Battery. Alfred E. Knight, Somerville, Mass., assignor to James H. Churchill, trustee, Quincy, Mass. Application filed November 16, 1904.

The battery plate is provided with slots extended from one edge or side to form arms having their edges separated from one another. A guide is loosely applied to the plate and extends transversely of the arms to direct the arms in their expansive movement laterally.

798,914. Apparatus for Mechanically Chalking Billiard Cues and the Like. Claude I. Michaelson, Edinburgh, Scotland. Application filed January, 29, 1904.

An electric motor actuates a chalk holder on the motor armature. Upon inserting the end of the cue in an opening and holding it against the chalk, contacts are closed and the motor put in operation.

798,915. Electric Switch. McGonigale Miller, Louisville, Ky., assignor of one-half to Herman C. Tafel and one-half to Edward W. Wolff, Louisville, Ky. Application filed September 30, 1904.

A solenoid actuates an electric switch in circuit with one side of a main feed line to the switch. Means are supplied for short circuiting the current from the solenoid, a core within the solenoid being adapted to be reciprocated by the periodic short circuiting.

798,920. Method of Reducing Oxalic Acid and Its Derivatives by Electrolysis. Emil von Portheim, Prague, Austria-Hungary. Application filed January 29, 1904.

A method of obtaining glyoxalic acid, its esters and amides from compounds containing the radical oxalyl (C_2O_2) consists in dissolving the compound to be treated in dilute sulfuric acid in the cathode compartment of an electrolytic apparatus and then electrolyzing the solution at a low or moderate temperature.

798,932. Electric-lamp Socket. George B. Thomas, Bridgeport, Conn., assignor to the Bryant Electric Company, Bridgeport, Conn. Application filed March 6, 1905.

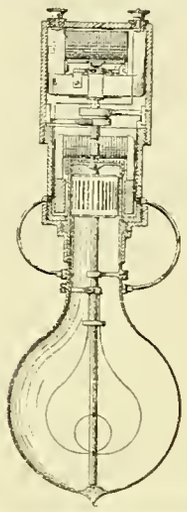
Details are described.

798,954. Electric Incandescent Illuminating Apparatus. Gerald B. Francis, Woking, England. Application filed December 17, 1904.

Electric incandescent illuminating apparatus comprises an exhausted translucent casing, a body mounted to rotate within the casing, a filament secured within the casing to the body so as to be at least in part external to the axis thereof, means adapted to rotate the body within and in relation to the casing so as to carry round the filament at a speed such as to comply with the law of persistence of vision and means for conducting current to and from the filament during the rotation. (See cut.)

798,975. Electromagnetic Power Generator. Joseph L. Potter, Indianapolis, Ind. Application filed April 3, 1905.

An electromagnetic power generator includes a combination case and frame formed as a single hollow structure having an open end to receive a battery cell and provided on its exterior with a shaft support. A rotative crank shaft is mounted in the support and power-generating mechanism is mounted on the exterior of the case and frame and connected to the crank shaft.



NO. 798,954.—ELECTRIC INCANDESCENT LAMP.

799,010. Telephone System. Oscar M. Leich, Chicago, Ill., assignor of one-third to said Leich, one-third to J. G. Ihmsen and one-third to Max W. Zabel, Chicago, Ill. Application filed February 9, 1900.

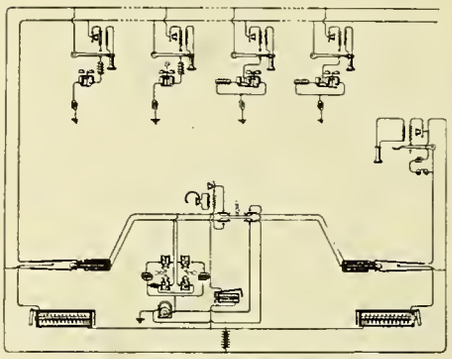
An electric signaling apparatus comprises an electromagnet for operating a signal, normally non-neutralized inductive means for preventing the operation of the electromagnet upon neutralization of inductance in the means, and means for at will causing the neutralization. (See cut.)

799,016. Electric Bell or Like Device. Carl J. Schwarze, Adrian, Mich., assignor to the Schwarze Electric Company, Adrian, Mich. Application filed May 31, 1904.

Combined with a pair of electromagnets are bars of magnetic material connected with the cores and extended lengthwise of the magnets between them. A strip of non-magnetic material is interposed between the bars, and an armature is provided for the electromagnets.

799,017. Electric Bell. Carl J. Schwarze, Adrian, Mich., assignor to the Schwarze Electric Company, Adrian, Mich. Application filed September 10, 1904.

The mechanical features of an electric bell are described.



NO. 799,010.—TELEPHONE SYSTEM.

799,019. Telephone Switch. Michael Setter, Chicago, Ill., assignor to the American Electric Telephone Company, Chicago, Ill. Application filed September 13, 1902.

A switching device is composed of a number of push buttons, some of which are circuit-closing keys and one is a restoring key. A locking device is adapted to hold any circuit-closing key in operative position, and adapted to be shifted to unlocking position by any one of the push buttons.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on September 11, 1905:

389,186. Secondary Battery. C. B. Askew and J. K. Pumpelly, Chicago, Ill.
389,189. Current Collector for Electric Railways. J. L. Blackwell, New York, N. Y.
389,196. Electromagnetic Device. H. A. Chase, Stoneham, Mass.
389,197. Electric Motor. H. A. Chase, Stoneham, Mass.
389,207. Electric Motor. A. E. Eastwick, Detroit, Mich.
389,230. Motor Box for Electric Vehicles. W. H. Knight, New York, N. Y.
389,229. Electrically Propelled Vehicle. W. H. Knight, New York, N. Y.
389,254. Switch for Electric Motors. G. D. Shepardson, Granville, Ohio.
389,265. Thermal Device for Varying Electric Resistance or Currents. E. Thomson, Lynn, Mass.
389,272. Electrical Protective System. E. Weston, Newark, N. J.
389,273. Electrical Recording Mechanism. E. Weston, Newark, N. J.
389,278. Electric Railway. E. M. Bentley, New York, N. Y.
389,279. Electric Railway. E. M. Bentley, New York, N. Y.
389,280. Electric Lamp Socket. S. Bergmann, New York, N. Y.
389,281. Contact Device for Electric Railways. J. L. Blackwell, New York, N. Y.
389,282. Electric-Railway Trolley. J. L. Blackwell, New York, N. Y.
389,297. Electric-lighting System. W. W. Griscom, Haverford College, Pa.
389,314. Electric Conductors and Process of Uniting the Same. C. McIotire, Newark, N. J.
389,337. Telegraph Relay. F. Stitzel and C. Weinedel, Louisville, Ky.
389,352. Alternate-current Electric Motor. W. A. Anthony, Manchester, Conn., and D. C. Jackson and H. J. Ryan, Lincoln, Neb.
389,356. Reversing Switch and Rheostat for Electric Circuits. C. G. Bickley, New York, N. Y.
389,369. Incandescent Electric Lamp. T. A. Edison, Llewellyn Park, N. J.
389,378. Annunciator. R. P. Garsed, Norristown, Pa.
389,421. Electric Gas-Lighting Device. W. Tag and S. C. Smith, Philadelphia, Pa.
389,423. Electromechanical Gong. J. P. Tirrell, Boston, Mass.
389,448. Electric Primer. S. A. Day, Bowling Green, Ohio.
389,455. Electrode for Secondary Batteries. R. M. Elliott, Washington, D. C.
389,526. Incandescent Electric Lamp. F. Moore, Pittsburg, Pa.
389,532. Battery Jar. J. Serson, Boston, Mass.

SPECIAL MENTION.

"The Ideal line will save you money," says the Ideal Electric and Manufacturing Company of Mansfield, Ohio, therefore "it's a safe line to tie up to." Among the varied kinds of electrical apparatus manufactured by this company are motors, generators, controlling apparatus, standard switchboards and panels, enclosed arc lamps, special incandescent lamps, etc.

The date of the New York Electrical Show, which is to be held in Madison Square Garden, December 11th to 23d, leaves nothing to be desired. Not only is December the height of the season for New Yorkers, but conservative estimates place the transient population at fully 750,000 for that month. Publicity is a phase of the work which has been given elaborate attention; already a competent advertising department has been established. This department has been given a generous appropriation for advertising, and it is thought certain that the Madison Square Garden Electrical Show will arouse as much public enthusiasm as has the Automobile Show. From the exhibit end of the show come equally encouraging reports. Dr. George F. Lever of the Department of Electricity of Columbia University is director of exhibits, and he has already secured enough exhibitors to make the show an attractive one. Any manufacturer seeking this opportunity to acquaint the public with his product is requested to get in communication at an early date with the show company, the office address of which is 26 Cortlandt Street, New York.

W. F. Leggett of 56 Pine Street, New York, is the owner and manager of a new enterprise, which is the getting out of distinctly manufacturers' catalogues. All the leading manufacturers have furnished him with plates on their product, thereby saving the supply house wishing to list its line all expense for doing so. The element of being able to select the pages wanted and arranging the sequence of them guarantees the individuality of each book, and the result is that the supply house can now obtain a complete and correct catalogue, heretofore an expensive undertaking, at a small cost. Mr. Leggett has had much previous experience with catalogue work, having compiled many of the recent catalogues of the Western Electric Company.

That portion of Minnesota lying in the northwest corner of the state which will soon be given transportation facilities by the building of the Greenbush extension of the Great Northern railroad running from Greenbush to Roseau, in Roseau County, will open a section of country that has marked advantages for the home seeker and investor. The state of Minnesota will hold a sale of state lands aggregating 60,000 acres at Roseau on October 28th. Favorable terms are offered, and the man of small means, it is said, will find in this sale an opportunity seldom offered. An extension of 15 miles is being built by the Great Northern from Ellendale, N. D., southeast, and a new town will be established at the terminus of this extension. This new town will be named Forbes and will offer opportunities for business openings that will at once appeal to the investor. The first sale of lots will be held at Ellendale, N. D., on September 19th at two o'clock. A representative of the Dakota Development Company will be on the ground September 17th and 18th. It is expected that regular train service will begin about October 15th. Mr. D. N. Tallman, president of the Dakota Development Company, of Willmar, Minn., will furnish any further information, and on request will send a pamphlet, "New Towns in North Dakota," giving detailed description of the opportunities in the new towns now being built on the new extensions of the Great Northern.

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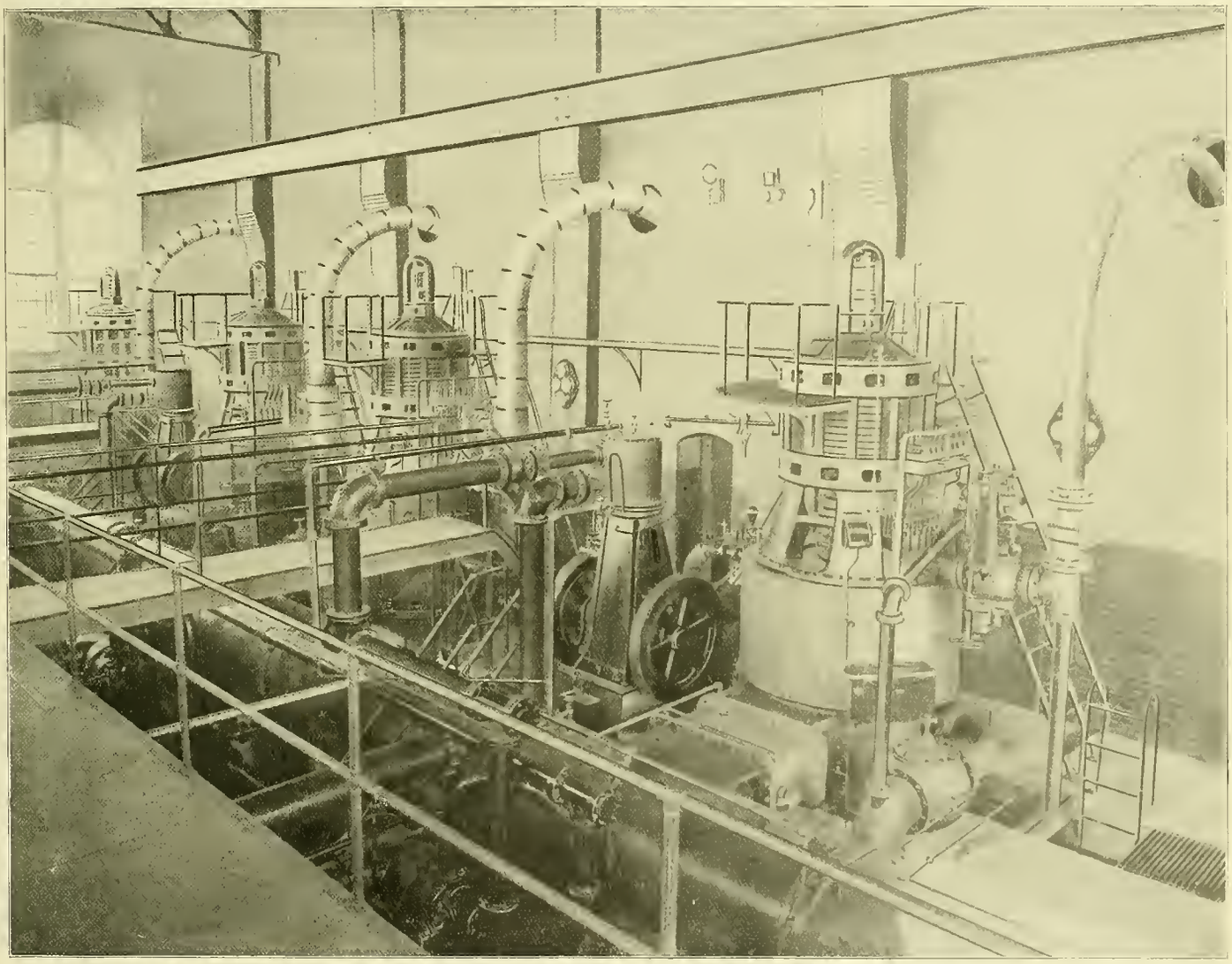
Street Railways and Electric Light and Power Service of Dubuque, Iowa.

BOTH from its interesting history and from the entirely modern and high-class plant and equipment and administrative methods now in use, the development of the street railways and the electric-light and power service of the city of Dubuque, Iowa, is worthy of attention. One company, the Union Electric Company, capably managed by Mr. L. D. Mathes, supplies both the street-railway and the general electrical needs of the city; but 10 years ago, when the place had 35,000 inhabitants, there were four companies struggling for foothold in this restricted field—two operating street railways, one giving both railway and lighting service and the fourth doing a lighting and power business. Naturally, none of them was successful, and the strained and unsatisfactory situation was eventually cleared by absorptions which resulted in the existing company, which is just putting the finishing touches on the fine power station illustrated herewith, and which possesses equipment and furnishes service probably not surpassed in any city of equal size in the country.



THE FOUR 500-KILOWATT FOUR-STAGE STEAM TURBINES IN UNION ELECTRIC POWER HOUSE IN DUBUQUE, IOWA.

Dubuque, which is now reckoned to have 42,000 inhabitants, is the second city in Iowa in point of size and the oldest place in the state. It is located on the Mississippi River, five hours west of Chicago by railroad, and is a solid, substantial city, with important manufacturing and commercial interests. Many fortunes have been made in the town in the lumber and other industries, and the place is the home of much conservative wealth. Formerly, and to a less proportionate extent at the present time, Dubuque was an important distributing point for territory farther west, and for this reason is often known as the Key City. Topographically, it presents some peculiarities which make it a hard town to cover adequately by street railways. The business and manufacturing district of the city lie on low and comparatively level land along the bank of the river. But back of this strip rise steep hills or bluffs, and many of the fine residence streets are in this elevated region, from the brink of which a fine view of the river may be obtained. The grades are in most places impracticable for ordinary street-railway operation, as explained in greater detail farther on in this article, and this fact explains why the map of street-railway lines on the next page shows wide areas apparently neglected. Subject to this inexorable limitation, the street-railway service is excellent. It will be of interest to trace, in the curious street-railway and electrical history of Dubuque, the forerunners of this service.

Historical Sketch.

The pioneer street railway of Dubuque was a horse-car line established about 1868 on Main Street by the Dubuque Street Railway Company. It was about two miles long and was operated in that shape until about 1890, when a two-mile extension was made to Eagle Point. At that time the stock of the company was held principally by J. A. Rhomberg and J. J. Linehan.

About 1880 the Hill and West Dubuque Street Railway Company was organized. It built a road from the foot of Eighth Street 2½ miles over the hills to West Dubuque. This was originally a steam-dummy line, but the dummies were not a success. There was a 10 per cent. grade to overcome, and the small steam locomotives were unable to stand up under the strain for regular and satisfactory service. After five years' struggle the Hill line was reorganized as the Key City Electric Company, and the dummies were not long after superseded by electric cars operated on the overhead trolley system.

In 1890 the electric railway was attracting much attention throughout the country, and in Dubuque there arose an agitation for the "electrification" of the Main Street horse-car line. But Mr. Rhomberg was opposed to the overhead trolley and proposed the introduction of storage-battery cars. This belief led to an interesting chapter in the checkered street-railway history of the city. Mr. Rhomberg experimented for two years with storage-battery cars, which proved unsuccessful, particularly in winter. He became involved in litigation with the battery makers, and the case attracted much attention. Finally the storage battery was abandoned and the ordinary trolley system was established by the Dubuque Street Railway Company.

It was at about this period that William L. Allen and T. O. Swiney, who had built an electric railway in Davenport, applied for a franchise in Dubuque. Their application was granted, and for routes largely paralleling those of the Dubuque Street Railway Company. The newcomers incorporated as the Dubuque Electric Light and Power Company. They built trolley lines under their city franchises and also extended to Union Park,

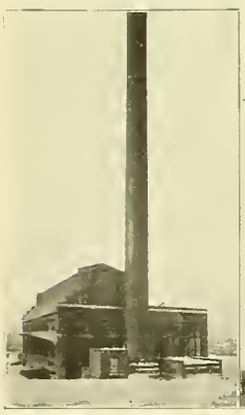
three miles north of the city limits. In addition they put in an electric-lighting system. But before this, it should be mentioned—about 1888—the Star Electric Company had been established to do an electric-lighting and power business. The Star company had a plant and had secured the street-lighting contract.

Allen and Swiney ran their company for three or four years, when the mortgage was foreclosed. But in the meantime they had taken the city lighting contract away from the Star people at $78 a lamp. The mortgage on the property was approximately $700,000. The Thomson-Houston Electric Company, being the owner of most of the bonds, bought in the outfit for $50,000. After the mortgage was foreclosed the Star Electric Company again secured the city lighting contract.

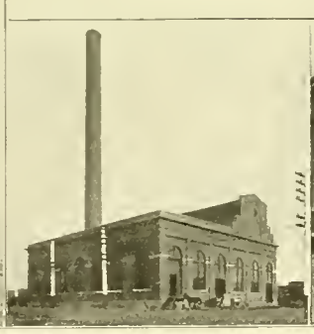
The purchasers of the Allen and Swiney property reorganized it as the Dubuque Light and Traction Company. There were thus, in 1895, four street-railway and electric-light companies in Dubuque—the Dubuque Street Railway Company, Dubuque Light and Traction Company, Key City Electric Company and Star Electric Company. All the properties were operated at a loss; there was fierce competition and much friction between the companies. If a man was hurt on one line, the other companies would help him get up his evidence. If there was a collision and two companies were sued jointly, there would be no joint defense, but instead each defendant would directly or indirectly aid the plaintiff to score against the other, with the result that that fortunate individual would get a verdict against both.

But this anomalous condition of affairs could not last. First the Key City line was foreclosed and sold to the Dubuque Light and Traction Company. Then, after the death of Mr. Rhomberg, which occurred about 1898, the owners of the Star Electric Company bought the Dubuque Street Railway. In 1900 the owners of the Light and Traction Company purchased the Star Electric Company and the Dubuque Street Railway Company (the organizations having been kept separate). They next organized the present Union Electric Company on the remains of the four old companies, and a strong, well-organized company emerged from the fray. But it was not until after some two million dollars had been sunk in the expensive pastime of endeavoring to support four competing street-railway and central-station companies in a city of less than 40,000 inhabitants.

The Union Electric Company was organized with capital stock of $500,000 preferred and $500,000 common. The various properties were physical wrecks, and the new company proceeded to install in the old Star lighting plant modern alternating-current machinery and to strengthen the street-railway power plant. The operation of these two separate power plants was continued until the spring of 1904, when the work of building the new power station to supply current for railway, commercial power and lighting circuits was begun. This improvement was made possible by the issue of $700,000 five-per cent. bonds, taken by the stockholders. The proceeds of this bond issue and a further sum contributed by the stockholders were used for the building of the new power house and the reconstruction of the street-railway system, including the erection of a new car barn. The new power house, designed for exclusive steam-turbine operation, is now nearly completed. For some time it has carried a good share of the load, the remainder being taken by the old Star plant. The old street-railway plant was shut down some time ago, and within a month or so the Star plant, too, will be abandoned, and the machinery composing it—much of it modern and efficient—will be sold.



South and East Sides, Showing Stack, Oil House and Pump-room Extension.



North and West Sides.

North Front, Showing Eighth Street Pole Line.

EXTERIOR VIEWS OF NEW POWER HOUSE IN DUBUQUE.

The New Steam-turbine Power House.

The new plant is located at the foot of Eighth and Washington streets, in close proximity to the Mississippi water front, in order to obtain the advantages of an abundant supply of water for condensing purposes.

The ground along the water front at any point in the city is such as to require pile foundations, being a mixture of torpedo gravel, blue clay and coarse sand. Under the foundation of the power plant are driven 464 concrete piles 20 feet in length, six inches diameter at the bottom and 20 inches at the top; 57 of these piles are directly under the stack. About 2,000 yards of concrete was also used in the foundations.

Substantially built of brick, with a steel frame, concrete floors and a fireproof tile roof covered with slate, the power house covers a ground area of 114 by 96 feet, with an extension at the east end of 32 feet 8 inches by 23 feet, in which are located the circulating pumps. The only wood used in the construction of the building is in the door and window frames, and every effort has been made to make the building absolutely fireproof. The success of this endeavor is shown by the fact that the basic rate of Iowa insurance is $1.25, while the rate named on this plant is 50 cents, made after a special and very careful inspection.

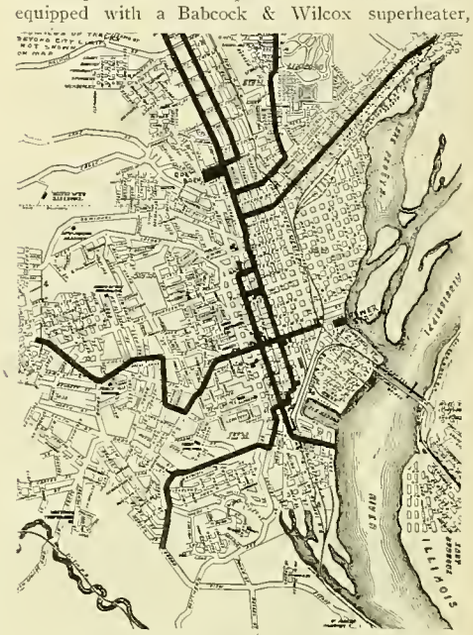
The main station is divided into two sections by a division wall, the boiler room being 56 feet wide between walls, and the turbo-generator room 45 feet wide inside. The generator room has a free height under roof trusses of 22 feet 9 inches, while the boiler room has a similar clear height of 33 feet 9 inches. The turbine room has a 14-foot basement on the south side, which contains the condensers, hot-well pumps, step-bearing pumps and circulating water piping. Separated by another fireproof wall and directly in front of the switchboard is another basement of nine feet in the clear, in which are carried all wires and cables from the generators to the switchboard. Potential and current transformers for generators are also located in this chamber. Back of another fireproof wall and directly under the switchboard is a third basement, in which is located all rheostats, current transformers for rotaries, cables from switchboard to transformers and rotaries, and all lightning arresters for the entire system.

All of the high-tension wiring in the entire plant is of the open type, held in place by iron racks and porcelain insulators. All lightning arresters, current and potential transformers are located in plain view and accessible. Easy access is given to all portions of the basement by conveniently located stairways, and fire doors close all openings.

Under the boiler room a 10-foot basement has been provided, in which is located all auxiliary piping, the coal-handling mechanism and oiling system.

The general building contract was carried out by Witherspoon, Englar & Co. of Chicago, Ill., while the structural steel work was done by the Morava Construction Company, also of Chicago. The turbo-generator-room roof is carried above substantial roof trusses of eight panels each. The boiler-room roof and lantern are carried by a roof structure consisting of composite trusses of great strength; this construction was required to carry the weight of the coal bunkers at the south side. The lower chords of the trusses on the south side which carry the coal pockets are heavily reinforced with plate girders of 30-inch web; these are assisted in carrying the load by floor supports in the form of steel posts located between the boilers and in line with the boiler fronts. These posts support the plate girders at points 18 inches from the outside boiler wall.

Boilers.—The present boiler equipment consists of four Babcock & Wilcox horizontal water-tube boilers of 400 rated horsepower capacity each, arranged in two batteries. There is also additional space provided for a future battery of two boilers. These boilers are of the new all-wrought-steel construction and are designed for a working pressure of 200 pounds to the square inch. Each boiler is equipped with a Babcock & Wilcox superheater,



MAP SHOWING STREET-RAILWAY LINES IN DUBUQUE, IOWA.

which gives 150 degrees Fahrenheit of superheat to the steam delivered. The furnaces are equipped with the Babcock & Wilcox chain-grate stokers, which are driven by Krieble vertical engines. Coal is delivered from the coal bunkers directly into the hoppers of the stokers by conveniently arranged swinging chutes.

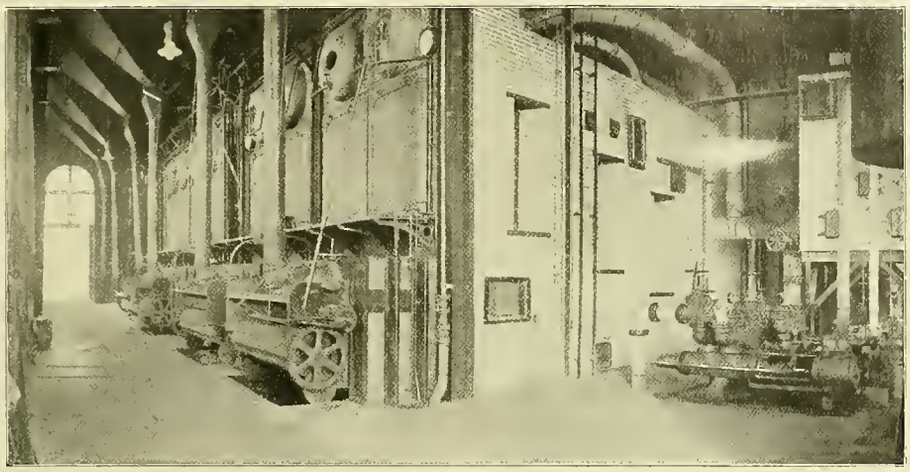
Stack.—A noticeable feature of the power house is the graceful stack, which is of the self-supporting steel type, 200 feet high, with a clear opening of 11 feet throughout, having a solid fire-brick lining extending the entire height and thoroughly reinforced around the flue opening. This stack rests upon a concrete foundation 17 feet deep and is held down by 16 2½-inch bolts 20 feet six inches long, extending to the bottom of the foundations. Special bolt connections for anchoring the stack to the foundations are provided; these are very heavily constructed, of structural shapes, and riveted to the lower portion of the stack. The stack is double-riveted to a height of 100 feet. It was built by the S. Freeman & Sons Manufacturing Company of Racine, Wis.

Boiler Auxiliaries.—Boiler feed is obtained by two horizontal duplex feed pumps furnished by the International Steam Pump Company. These pumps are of the pressure pattern, having separate removable valve chambers and plungers instead of pistons. Each pump has a capacity for six 400-horsepower boilers when working at 50 per cent. overload.

The feed-water heater is the Webster star vacuum and receiver, class C, manufactured by Warren Webster & Co. of Camden, N. J. It is a special type of heater with a very large receiver and is especially fitted with the Webster self-cleaning oil separator for freeing the exhaust system of oil in order to deliver the feed-water pure. The capacity of the heater is nominally 4,000 boiler horsepower. It is built entirely of cast iron, fitted with perforated-copper heating trays, all of the parts in contact with the steam or water being made of either cast-iron, copper or brass. The filter is of the upward filtration type, in which the water, after being heated, flows first to the receiving compartment below the filtering material, where the heavy impurities are deposited, the water rising in an upward direction through the filtering material. The feed-water heating system of this plant embodies some new and interesting features, and in many points may be rightfully considered an ad-

vance step in power-plant practice, particularly in view of the use of the vacuum heater in connection with the turbine plant.

Both wet and dry vacuum pumps are used in connection with the condenser, the wet vacuum pump being of centrifugal type, removing the water directly from the hot wells of the condenser and discharging through an eight-inch pipe into the



BOILER ROOM IN NEW DUBUQUE POWER HOUSE.

water-sealed inlets of the vacuum feed-water heater. The use of a centrifugal pump in this manner is the most recent practice of the General Electric Company, which was the first, it is believed, to adapt this form of pump to this service. There is no regulating device of any kind which governs the admission of the hot-well water into the feed-water heater, the accumulation being considered at all times to be in proportion to the demands for feed-water. Provision is made for the introduction of make-up feed-water by a connection from the circulating water system to the top of each condenser. Within the vacuum heater are located two floats at diffeerent levels, the higher one being connected by a series of levers and chains to a single-seated, piston-balanced, water-regulating valve, which governs the amount of make-up water from the circulating system. In this way all of the make-up water passes down through the condenser and is handled by the wet vacuum pumps in the same manner as the condenser system. If at any time the turbines should be running non-condensing the feed supply to the vacuum heater is taken from a separate low-service pump or from the city water mains. The second float in the heater governs this source of supply.

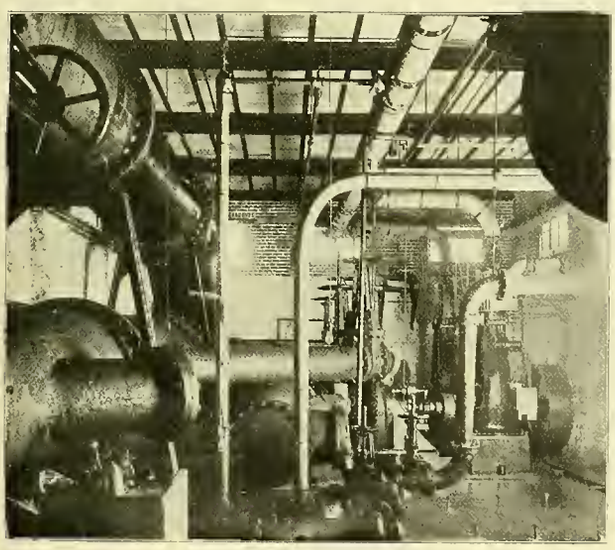
Steam Turbines.—Designed entirely from the ground up for steam-turbine operation, the present equipment of this station consists of four 500-kilowatt four-stage Curtis turbines, manufactured by the General Electric Company of Schenectady, N. Y. Space is provided and foundations and bolts are in for two additional units of this size whenever needed. These turbines are designed to operate at 200 pounds pressure with 150 degrees superheat. They embody the latest engineering practice in steam-turbine work, being of the four-stage type and the first of their particular class to see operation in this country. These machines, while having a nominal rated capacity of 500 kilowatts, are designed for a constant overload capacity of 50 per cent., and the generators are so wound that the greatest current output can only be 3½ times the normal load; therefore no circuit-breakers are used. The turbines are provided with extremely sensitive governors and regulating mechanisms, as shown by the fact that both railway and lighting service are being done from the same generators, and the extreme variation at any time is less than two per cent. The generators are of the three-phase, 60-cycle, 2,300-volt type and run at a speed of 1,800 revolutions per minute.

Condensers.—Condensing equipment consists of four Worthington surface condensers, fitted with brass tube heads and coolers and extra high hot-wells, each condenser having 2,000 square feet of cooling surface. The condensers are supplied with cooling water from the Mississippi River by two 14-inch Worthington steam-driven volute circulating pumps, located in the pump house at the east end of the power station. Each of these volute pumps is driven by a vertical engine built by the New York Safety Steam Power Company, having a throttling governor. The hot water of condensation is removed from the hot-wells by four 1½-inch two-stage volute pumps, driven by three-horsepower induction motors. These pumps deliver the condensation direct to the Webster vacuum feed-water heater. Two rotative dry-vacuum pumps are provided for the removal of air and vapors, these pumps being of the reciprocating type, with eight-inch steam cylinders, 16-inch vacuum cylinders and 12-inch stroke. The vacuum cylinders are placed vertically and the steam cylinders horizontally, being attached to a common crank-pin. The volute wet-vacuum pumps are located below the hot-wells so as to receive their suction by gravity. In this way the pump always runs ahead of the water and there is no necessity for floats, valves or other automatic devices. This entire condensing equipment was furnished by the International Steam Pump Company.

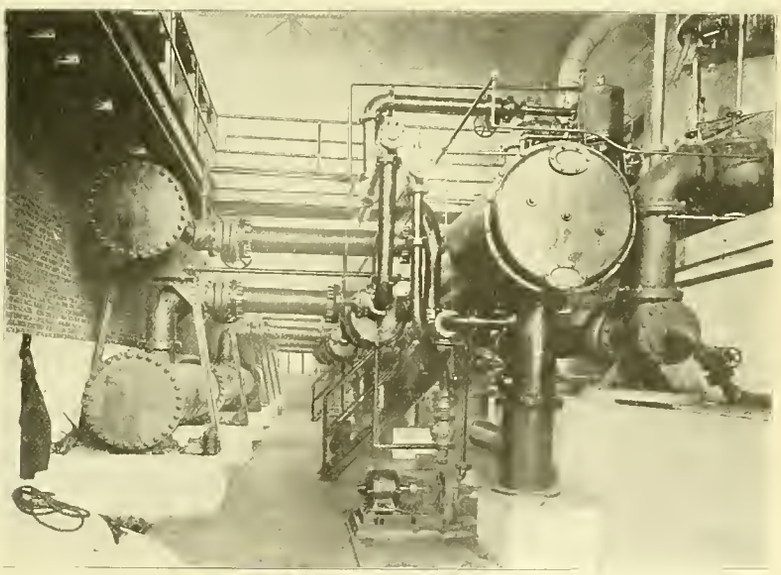
Lubrication.—All of the machinery of the power station is lubricated by a gravity system from a common supply tank located about 30 feet above the highest bearing. The oil, after use, is returned to a separator, where the water is taken out; thence it flows into a Turner oil filter of a capacity of 1,500 gallons per day of 24 hours. After being thoroughly filtered, the oil flows into a receiving tank, from which duplex oil pumps in duplicate raise the oil again to the supply tank. A centrifugal extractor is also used for extracting the oil from the waste used in the plant.

Coal and Ash Handling.—A side track delivers the fuel directly to the power station, and the coal is dumped from the cars directly into the hopper above the coal crusher. The coal crusher is of the well-known McCaslin single-roll type, provided with a swinging corrugated counterweighted baffle plate, so arranged that any foreign substance contained in the coal will pass through the crusher without doing damage to it. The capacity of the coal-crushing and coal and ash-conveying equipment is from 40 to 45 tons. The coal-crusher mechanism and condensers are driven by General Electric three-phase variable-speed induction motors provided with a starting and speed-regulating controller by which the amount of coal delivered from the receiving hopper through the crusher, and in turn into the conveyors, is regulated. This entire coal and ash-handling equipment, including coal crusher, was furnished and installed by what is now the Mead-Morrison Manufacturing Company of New York. The coal and ashes are discharged from the upper horizontal run of the conveyor into the elevated coal and ash bunkers by means of a movable tripper supported on a trackway provided for it. The ashes may be loaded directly into either wagons or cars from the ash bunker.

Electrical Equipment.—In addition to the four 500-kilowatt generators there are also four 300-kilowatt rotaries for the street-railway service and four 330-kilowatt air-blast transformers of the new three-phase type recently developed by the General Electric Company. The switchboard consists of 32 panels of blue Vermont marble. The turbo-generators deliver the 60-cycle, three-phase alternating current at 2,300 volts direct to the switchboard. There will be two sets of bus-bars on the switchboard, one for the lighting load and the other for the railway system, with connections so arranged that any one of the turbo-generators may be thrown on to either bus, or the buses may be connected together in parallel. The commercial lighting feeders are operated at 2,300 volts, single phase, while the street arc-lighting circuits are operated on a constant-current system by the use of General Electric "tub" transformers. Three-phase circuits are provided for large alternating-current motors. The 600-volt power circuit for



Interior of Circulating-pump Room.



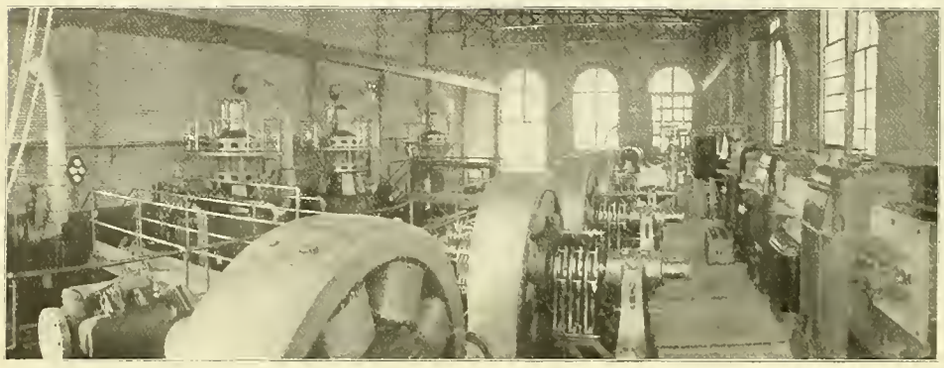
Condensers, Hot Wells, Wet Vacuum Pumps and Circulating-water Piping.

VIEWS IN THE NEW POWER HOUSE OF UNION ELECTRIC COMPANY, DUBUQUE.

street-railway system is supplied through the four 330-kilowatt transformers and rotary converters. The direct-current sides of the rotary converters are arranged for two sets of bus-bars, so that the direct current may be carried independent of the grounded railway circuit when required. Two of the rotaries are in use for railway service and one for the 500-volt direct-current commercial motor service. One rotary is kept in reserve at all times.

The exciter equipment for the turbo-alternators consists of a 35-kilowatt General Electric marine-type steam-generating set and a 30-kilowatt motor-generator set, either of which has sufficient capacity for the excitation of the entire installation.

All of the high-tension alternating-current panels



VIEW IN TURBINE ROOM OF NEW DUBUQUE POWER HOUSE, SHOWING ROTARIES AND TRANSFORMERS.

are provided with the latest type of oil-break switches. All of the low-tension circuits are run in iron-armored conduits embodied in the concrete floors. A motor-driven air compressor supplies air at all times for cleaning of the machinery. All of the electrical apparatus, including the turbo-generator units, rotaries, transformers and blowers, exciter sets, cable, etc., and the switchboard equipment was supplied and installed by the General Electric Company.

Dubuque has long been known as the center of severe lightning storms. During the last 15 years, on account of the severity of these discharges, it has been customary to suspend operation of the street railway during a heavy storm, it having been found that the discharges burned up the generating machinery, disabled the motors and worked havoc in general. Since the beginning of service from the turbine plant Dubuque has been visited by a number of unusually severe storms, which have left their marks through the destruction of trees in the public parks, and in many instances buildings. The street-railway system has for the first time in its history operated uninterruptedly during these periods. The outside circuits and the car equipments were protected by the well-known General Electric type of lightning arrester. During one storm the circuit-breakers on the railway panels were opened through lightning discharges over 200 times, but through the protection afforded by the lightning arresters in no instance did the discharge reach or interrupt the rotaries.

It is proper to note in this place that the constructing and supervising engineer of the Union Electric Company in building its excellently equipped generating plant was Mr. W. E. Boileau, who is an electrical and mechanical engineer of established reputation and whose work in Dubuque has been of a high order. It will be remembered that when the Iowa Electrical Association met in Dubuque last April and inspected the then unfinished station, one of the features of the meeting was the reading of Mr. Boileau's illustrated paper on "Steam Turbines." (See Western Electrician of April 29th, page 328, and May 27th, page 412.)

STREET-RAILWAY SYSTEM AND NEW CAR BARN.

The street-railway system of the Union Electric Company of Dubuque consists of 18 miles of track, 14 miles of which is within the city limits, and operated on an 18-hour schedule the year around. Some four miles of track beyond the city limits serves Shooting Park, Nutwood Park, which is the home of the Tri-state Fair Association, and Union Park, the latter a place of great natural beauty and the property of the company, the company also being the owner of Nutwood Park.

It will be noted that for a city of 42,000 the street-railway mileage is much less than that which is usually found serving a corresponding population. The restricted mileage is due to the fact that Dubuque is compactly built and at the same time affords physical barriers to the extension of the street-railway system. The commercial district lies on comparatively level ground running north and south, paralleling the Mississippi. A large portion of the middle or laboring class resides in that portion of the city to the north and east of the commerical and manufacturing districts. The choicer residential section is located upon the hills to the west. These hills are almost perpendicular, there being but two points at which they may be penetrated by traction lines. Two lines take advantage of these openings—one, the Dodge Street line, touches the extreme southern end of the hill section; the second, the Eighth Street line, is also south of the center of population of the hill districts. Both of these lines involve 10 per cent. grades.

At Fourth Street and at Eleventh Street are located wire-rope inclined railways which mount grades of 45 per cent. These enterprises are owned and operated by independent corporations, but contribute to the Union Electric Company through the purchase of power for the electric motors used for hauling the cars up the grade. As these two lines land their passengers but a short distance from the heart of the city, they do not to any great extent act as feeders for the street railway.

Track Work.—During the summer of 1904 11 miles of the street-railway system was entirely rebuilt, the track in the business section being laid with 72-pound T rail on a base of 12-inch Portland cement concrete, paved with vitrified brick. The remaining track was laid with 70-pound A. S. C. E. rail, with a rock base and filled with macadam. Dubuque, being a city of rock, provides at a slight cost an excellent grade of macadam. The entire trackage is on white-oak ties, six by eight inches by eight feet, with 24-inch centers, double-bonded with No. 0000 General Electric concealed type of rail bond, and cross-bonded every 1,000 feet with No. 0000 cable. All special work in addition to the bonding mentioned is provided with a loop of two No. 0000 cables, which connect the straight track on each side of special work. For the return to the station there is, in addition to the four No. 0000 bonds on the Eighth Street line, which ties in all other trackage, an overhead return which picks a connection with each line of track.

At Second and Main streets a Y is installed which permits cars with trailers to turn and run north to the park section without shifting trail cars. At Union Park, which is to the extreme northern end of the line, a loop is provided which is valuable in accelerating car movement on rush days.

Cars and Traffic.—The company has of various classes 50 cars—a complete equipment of both closed and open cars for the two seasons. There are 26 car equipments using G. E. 67 motors. Eighteen cars are operated on the regular schedule, additional equipment with trailers being added as traffic demands.

For the fiscal year ended July 31st last there was recorded 1,000,000 motor and trail car-miles, which involved the handling of 4,000,000 passengers.

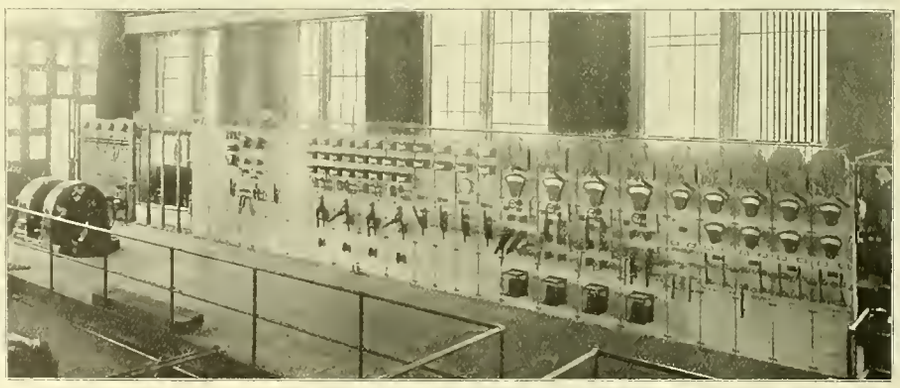
Owing to the bad service rendered by the predecessors of the Union Electric Company the people of Dubuque had developed into what the Chicago Tribune terms "the greatest walkers in the world." With the reconstruction of the system and the establishment of more frequent and reliable schedule the public has promptly shown its appreciation of improved traffic facilities, and the business of the company is each month showing a substantial increase, to such an extent in fact that orders are now being placed for additional motor and car equipment.

Fares and Transfers.—The franchise life of the company is for 25 years. One of the conditions of the franchise is to the effect that the company shall sell a form of workingmen's tickets at half fare. These tickets are issued 40 coupons in a book for one dollar and are accepted for passage between the hours of 6:15 to 7:45 a. m. and 5:15 to 6:45 p. m. For children under three years there is no collection of fare; for children under 12 years of age a three-cent fare applies, and at the office of the company children's tickets can be purchased at a rate of 2½ cents each, with age limit as above stated. These two ticket forms are the only ones in vogue in Dubuque. Transfers are issued, for a continuous passage only, from one line to the other upon the payment of a cash fare or the presentation of one of the above two ticket forms. The company does not consider the ordinance covering workingmen's tickets a burden, as it stimulates travel and materially assists in the education of the public through the advantages of rapid transit as afforded by the company's service.

Parks.—At the northern end of the Main Street line is located Schuetzen Park, a beautiful and well-kept park, which is owned by the Schuetzen Society. This park is under lease to an individual, who in turn sublets it for picnic parties, lawn fetes and entertainments of a like character.

During the season just passed there was conducted at this park the White City Vaudeville. The lessee of the park and the street-railway company jointly provided a well-constructed and equipped outdoor theater, turning it over free of rental to the proprietor of the Bijou Vaudeville Theater. High-grade vaudeville performances were given afternoon and evenings, Sundays included, during the entire season.

A half mile beyond Schuetzen Park is Nutwood



SWITCHBOARD IN NEW POWER HOUSE IN DUBUQUE.

Park. This 75-acre tract contains the finest full-mile race-course in the West, commodious grand-stand and stabling for 1,000 head of horses and cattle. At this park during one week each year is conducted the Tri-state Fair—an institution which has proved very successful and contributed materially to the income of the street-railway company.

One and one-quarter miles to the northwest and at the terminus of the line is Union Park. The railway line runs up a rugged, rocky gorge, forming a loop around flower beds and foliage, which demonstration of the florist's skill adds an artistic touch to the lavish work of nature. Union Park has a well-stocked and well-conducted refreshment stand, a large dancing pavillion and restaurant and ice-cream parlors. An open band-stand is built among the rocks and trees, and as oppor-

tunity affords high-grade attractions, such as band concerts, etc., are put on by the company. There is no admission to the park or charge of any character, with the exception of the car fare. A five-cent rate prevails on the company's lines to Nutwood Park; from this point on the outgoing trip an additional five-cent fare is collected. On return trip a single five-cent fare entitles passenger to a passage to any part of the city reached by the company's lines.

Car-barn and Shop Facilities.—Operating an 18-hour schedule, with much of the mileage over grades running from two to 10 per cent., involves hard service on car-motor and truck equipment, and necessarily calls for a strict system of inspection and maintenance.

In the reconstruction of the railway system particular attention was given the question of car-house and repair-shop facilities. At an expense of approximately $50,000 a car barn was erected on Couler Avenue. This building and its equipment have been most favorably commented on by many competent authorities as being particularly well designed, embodying much flexibility for the maintenance of the equipment of a system of Dubuque's class. Trackage is afforded for 50 cars. It should

A VIEW IN UNION PARK, DUBUQUE.

be mentioned that at Nutwood Park the company provides a car or storage house in which a portion of the surplus equipment, particularly the trailers when not in use, are stored. The new car barn is 108 by 204 feet over all. The building was designed and built with the end in view of creating a structure which would class high in fire underwriting circles; that this object was achieved is shown by the fact that the rating on the car barn and the car and motor equipment is but 25 per cent. of the rate paid on the old car house and shops.

The building is divided into two main sections, the dividing line being an 18-inch fire wall. The north section consists of a four-track car inspection and storage section, with subdivisions (with steel rolling doors) for the carpenter shop, machine shop, blacksmith shop, boiler room, coal and sand storage, stables and toilet facilities. The south section contains five car-storage tracks with inspection pits, and at the rear are divisions for paintshop facilities, winding room and stock and toilet rooms. All walls are of brick and stone; floors are of concrete, and there is a steel-girder and gravel roof. A 100-horsepower boiler furnishes steam for the heating of the building and hot water for the several equipments of wash basins and shower baths. A second story at the front of the building provides large, well-lighted and ventilated quarters for the superintendent, receiving clerks, and a commodious clubroom for the motormen and conductors. This room contains an individual steel locker for each trainman, billiard and pool tables, and an abundant supply of popular periodicals, and in addition thereto toilet rooms, which include hot and cold-water basins and shower baths. The construction work on the new car barn and track and overhead work was done by the L. E. Myers Company of Chicago.

In the shops of the Union Electric Company are found many interesting features. In the north section a Pittsburg car hoist has been installed; this hoist consists of four six-inch steel shafts, which are threaded into heavy cast-iron pedestals, a chamber below the base of pedestal permitting the screw to work down when the car-body is to be lowered. This mechanism is operated by a motor which is directly geared to the four shafts above mentioned. The old system consisted of four oil barrels, four men, four jacks and a miscellaneous assortment of blocking, involving 30 or 40 minutes of time and creating considerable hazard. With

THE NEW CAR BARN OF THE UNION ELECTRIC COMPANY, DUBUQUE.

this hoist the car-body can be raised five feet in 2½ minutes. When not in service the two steel I beams, which run parallel with the track rails and are secured to the heads of the four shafts, drop even with the flooring and offer no obstruction.

The machine-shop equipment consists of a 150-ton Schaefer hydraulic press, a Schumacher & Boye 36-inch lathe, a Reed 14-inch lathe, a Barnes radial drill press, a Fay-Eagan band saw, a Buffalo motor-driven forge, a Watson-Stillman buffing and emery-wheel lathe, lead grinder and miscellaneous small tools.

This company takes care of its wheel and axle work, truck repairs and maintenance. It has also an armature-winding department equipped with lathe and electric oven; it grinds all lead for paint stock, maintains a master painter and conducts its operations independent of outside shops and influences.

In the maintenance of 25 miles of overhead construction, involving light and power lines independent of the street-railway system, there is considerable amount of blacksmith work. This work is all taken care of at the street-railway shop and billed back to the light and power department.

A question which often presents itself to medium-

TRACK WORK AT MAIN AND JONES STREETS, DUBUQUE.

sized street-railway systems is that of how far a system of this size can go with its shop work, taking into consideration the fact that the interest on the investment, depreciation and all other shop expenses must show a gross figure which will compete with the prices of independent shops. The experience of the Union Electric Company has been that both time and money are saved, and more satisfactory results secured, through the operation of the shop equipment as above mentioned. Each of the various tools in the shops of this company is driven by a direct-connected General Electric 500-volt motor, with the exception of forge, buffer, emery wheel and lead grinder, which are controlled by induction motors made by the same company. This system of independent drive permits of the highest economy in the operation of the equipment.

All current consumed for both lighting and power purposes in the shops of this company is metered and billed to the street-railway company on the same basis as the company's regular patrons.

Other interesting features of this company's car barn are found in the steam sand dryer, concrete wash track with hot and cold water, permitting cars to be washed regardless of the outside temperature, and a motor-driven ventilating outfit for the paint shop. A portable air compressor is used with flexible shaft for truck drilling, and there is a sand blast for removing the paint from dashboards, etc. An independent telephone system gives communication by which the superintendent from his desk can communicate with any one of 15 stations in the shops. An electric lacquering equipment is installed, while an overhead carriage system for handling armatures and car wheels, storage racks for brake shoes and truck-repair parts and many other little devices and arrangements contribute in their way to the maintenance of the equipment involved.

Electric-light and Power Service.

Current goes out from the new power house as 2,300-volt 60-cycle alternating for commercial and street lighting or 600-volt direct for railway and commercial power service. It goes over a main pole-line lead, going up Eighth Street, which is a model of what overhead construction should be, as one of the pictures shows. While the alternating current is generated three-phase, it is distributed single-phase. The company has the street-lighting contract and supplies 600 enclosed constant-current alternating-current arc lamps for this purpose, burning on the moonlight schedule. The contract price is $65 a year. It has also on its circuits 350 commercial arcs, all supplied through tub transformers. The incandescent load consists of 24,000 16-candlepower equivalents, including many Meridian lamps. The power load consists mainly of direct-current motors of varying sizes up to 50 horsepower and aggregating 1,200 horsepower. There are, however, a few 110 and 220-volt induction motors, which the company recommends in small sizes.

In the business section 20-kilowatt transformers in multiple are used. They are placed on poles and usually located in alleys. In the residence districts customers are grouped on transformers as far as practicable, with the idea of installing the multiple system as soon as possible.

The lighting rate is 14 cents a kilowatt-hour for the first two kilowatt-hours for each 16-candlepower equivalent installed. For all current consumed over that the price is six cents a kilowatt-hour. This works out at an average of about eight cents. The power rate averages about six cents, the rate varying from 10 cents for the first 100 kilowatt-hours to five cents for over 1,000

A WELL-LOADED CAR IN DUBUQUE.

kilowatt-hours. Special rates are made for power used in very large quantities. Continuous 24-hour service is given for both light and power. Free lamp renewals are given, both for ordinary incandescents and Meridian lamps. The company also trims and repairs the commercial arc lamps without charge.

The Union Electric Company is an enterprising concern. It demonstrates up-to-date electrical appliances in its large showrooms on Main Street

and has made an active campaign in placing domestic electric heating and cooking utilities. With electric flatirons it has been particularly successful. Referring to the electric iron in one of its circulars to the housewives of Dubuque, the company says: "Over a hundred of these greatest of all domestic utilities have been placed in Dubuque, and we take pride in saying that, although they all went out on the 'Bring-it-back-if-you-don't-like-it' plan, we have never yet had one returned." Probably the proportion of electric flatirons in use in Dubuque is greater than in many a larger city. Electric signs are in use to some extent, and it is noticeable that nearly all of those installed are well made and attractive. That is characteristic. Dubuque is inclined to be rather conservative in laying out money for new things, but, once convinced, it is able and willing to pay for an article of good quality. The Union Electric Company believes in central-station advertising, and goes after new business in many original and effective ways. Mr. Mathes, its manager, is an indefatigable student of the problems of electric lighting, and readers of the Western Electrician will recall his excellent Iowa convention paper on "Methods of Obtaining New Business," given in this journal of June 3d last.

Tests have not been made on the new power house as yet, but the load curve is quite satisfactory, owing to the railway, lighting and power business being carried by the same machines. During the peak of the load three or possibly all of the four generators may be running. Machines are taken off as the load permits, at least one being always in operation.

Organization and Personnel.

The directors of the Union Electric Company are F. D. Stout, B. W. Lacy, D. D. Myers, J. R. Lindsay, J. Ellwanger, W. J. Brown, G. W. Kiesel, W. W. Bonson and H. Parsons. The officers are: President, F. D. Stout; vice-president, D. D. Myers; secretary and treasurer, J. R. Lindsay; general manager, L. D. Mathes. Reporting to the general manager are G. E. Miller, superintendent of the railway department, and H. G. Gorr, superintendent of the lighting department.

While the company is fortunate in the character of its directorate, nearly all of the members of the board are men of affairs, with other large interests, and the admirable efficiency of the company is very largely due to the intelligence, enterprise and high personal character of Mr. Mathes, the general manager. This gentleman is young in years, but old in practical electrical experience. He is a native of Memphis, a graduate of the University of Tennessee, and a descendant of a family long and honorably known in the South. After leaving college he engaged in practical electrical work, beginning at the bottom of the ladder in his home city. Since then, during 15 years of hard work, he has filled nearly every position in operating electric-light and railway companies, and has also been connected with manufacturing companies. He has held responsible positions in Charleston, Norfolk, Philadelphia, New Orleans, Brooklyn and Trenton, N. J., coming from the last-named city to Dubuque, where he has been executing his present duties for two years and a half. He is highly regarded in the community and directs the interests of his company with complete fidelity and conspicuous skill.

L. D. MATHES,
General Manager, Union Electric Company, Dubuque.

Tunnel Connections Cause the Trouble.

A supplemental report from the committee of engineers appointed by the commissioner of public works of Chicago to investigate the Illinois Tunnel Company's conduits states that the greatest danger to big buildings from the tunnels is found in making the connections from the tunnels to the basements of buildings. The committee found that several buildings where these connections were being made settled considerably, and to avoid serious damage work had to be stopped in several instances. Not much damage is found to result from the main tunnels.

How the Time Ball Is Dropped.

Comparatively few people realize the extent and efficiency of the time service which the United States government, with the co-operation of the telegraph companies, now furnishes to all parts of the United States, as well as Havana and Panama. This service was begun in August, 1865, and since then telegraph signals have been sent out daily to mark the hour of noon. Nineteen time balls are dropped in accordance with these signals in the principal seaports and ports on the Great Lakes, and probably in no other country do such signals cover so large an extent of territory and render such great service to both water-borne and inland commerce.

Chicago is one of the lake ports where a time-ball service is maintained, and a description of the mode of operation here will, in general, cover that at the seaports and other lake ports where time balls are dropped. The work at Chicago is under the supervision of Lieutenant W. J. Wilson of the Hydrographic Bureau. Lieutenant Wilson is a thorough student, and is a graduate of Aannapolis. He was at one time lieutenant in the navy and, being a practical navigator, is well aware of the importance of the time service to the mariner. The headquarters of the bureau in Chicago are in the new Federal Building, but the time ball is on the Masonic Temple, some blocks away, and is operated from the central office. The actual dropping of the ball on the Masonic Temple is better suited to mariners than it would be on the Federal Building.

At the Naval Observatory in Washington, D. C., is located the master clock that sends out the time signals for all parts of the country east of the Rocky Mountains. For the parts west of the Rocky Mountains the signals are sent out from the Mare Island navy yard. The master clock is corrected very accurately shortly before noon from the mean of three standard clocks that are regulated by star sights with a meridian transit instrument, so that the noon signal is seldom in error more than one or two-tenths of a second.

Precisely at five minutes before noon, Washington time, all the circuits of the telegraph companies are cleared and connected to the circuit of the transmitter clock at Washington. This clock then beats off the seconds over the wires, each second being represented by a break in the circuit. During the interval of five minutes every second is ticked off with the exception of the 29th second of each minute, the last five seconds of each of the first four minutes and the last 10 seconds of the last minute. The first click after the final 10-second pause means that it is noon in Washington, though, of course, where central time prevails it will be only 11 o'clock, with corresponding differences for mountain and western time.

Having now in mind the general method pursued in sending the signals out over the telegraph lines, the next thing to investigate is the manner in which they are received, and how they are made to serve a useful purpose. To do this a typical example may be taken of a receiving station which has combined with it a time-ball service, as, for instance, the one in Chicago.

Fig. 1 is a view of the apparatus which is involved, with the exception that the chronometer which is to be corrected by the signals from Washington is not shown, it being set down in a recess in the top of the cabinet. At the right in the picture is the graphical recording instrument which registers the number of beats of the transmitting clock at Washington and the chronometer in the station. It consists of a drum driven at a uniform speed by clockwork. A sheet of paper is fastened to the surface of the drum, and a fountain pen bears upon the surface of the paper and leaves a line as the drum revolves. The speed of the drum is such that it makes one revolution in a minute. The pen which draws the line is mounted on a carriage which moves at a uniform rate across the face of the drum, thus drawing one continuous spiral line. The carriage is provided with an electromagnet, the armature of which is mounted on a vertical shaft, having cone bearings top and bottom. At right angles to this is another shaft carrying the pen bar, with a connecting link between the two. Thus, when the circuit is closed the armature is drawn up to its magnet, and the pen is thus drawn over on the surface of the paper in a direction parallel to the axis of the drum. When the circuit is broken, which is done by breaks in the circuit caused by the clock at Washington or those of the chronometer at the Chicago station, the aramture is released and the pen flies back, making a jog in the line drawn.

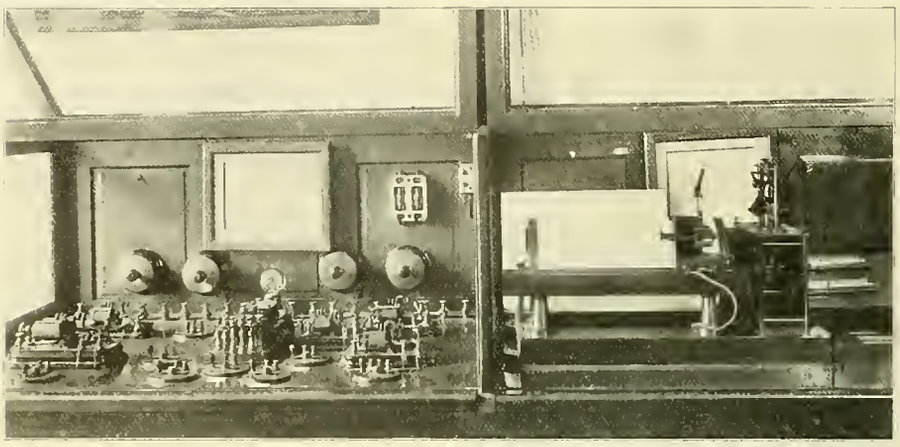


FIG. 1. RECORDING CHRONOGRAPH AND RELAYS USED IN STANDARD-TIME SERVICE.

The shape of the break in the line depends, of course, on the length of time the magnet is out of circuit, and this makes it possible to distinguish on the diagram which beats are made by the master clock at Washington and which by the chronometer at the station. Referring to Fig. 2, which is a reproduction of a small portion of one of the records, the square jogs or breaks are made by the Washington clock and the pointed ones are made by the chronometer.

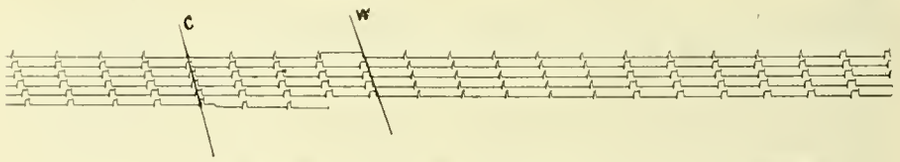


FIG. 2. PORTION OF CHRONOGRAPH RECORD SHOWING NOON LINE AND ZERO OF CHRONOGRAPH.

The diagram shown in Fig. 2 is a very interesting one, and it is by means of such a diagram that the chronometer in each station is corrected once a day.

When the signals began to come in from Washington the drum was started revolving, and the pen began to mark out the bottom line of the diagram. At each beat of the master clock one of the square jogs was made. The chronometer also beat out its seconds, but, in the case of this particular record the two coincide and therefore only the square break is shown except at the end of the minute. It ordinarily happens, however, that the two clocks are not in synchronism, and in that case the beats of the chronometer are shown interposed between those of the master clock.

Referring again to the diagram, the pen moves on around the drum until it has made one revolution, or, in other words, one minute has passed. As already stated, the last five seconds of each

of the first four minutes are not ticked off by the master clock. By inspecting the diagram this will be found true, and just to the right of the line (W) only the pointed breaks of the chronometer are to be seen for the last five seconds on each of the first four minutes. The clock at Washington also fails to tick off the last 10 seconds of the last minute, as shown by the upper line. But at exactly 12 o'clock Washington time (11 o'clock in Chicago) there is one long click, and at the beginning of this click or break the line (W) is drawn on the diagram, which is the noon mark. The first break in the chronometer circuit in this diagram is shown at (C), four spaces to the left of (W). Now it was known that the chronometer in Chicago at the time this record was taken, September 13th, was something over 50 seconds fast. If (C) were to be moved up until it coincides with (W) the chronometer would then be exactly one minute fast. As it stands now, however, it is clearly four seconds less than a minute fast, or 56 seconds fast.

It is in the manner above described, then, that the superintendent at each station knows each day just how fast or slow his chronometer may be. Knowing this, he is in a position to drop the time ball or correct clocks in his vicinity with just as much accuracy as if his clock was on time to the tenth of a second, as is the one in Washington. At the Chicago station the signals come in at 11 o'clock, giving ample time before noon to put everything in readiness for the dropping of the time ball on the Masonic Temple. Anywhere within the bounds of eastern time the signals would, of course, come in at noon, and in that case, during the 10-second pause just before noon, the circuit for dropping the ball would be thrown on the telegraph circuit.

The time ball and the mast upon which it is raised form a rather interesting piece of apparatus. On the top of the Masonic Temple (the highest building in Chicago) may be seen what appears to be an ornamental flagstaff. This is, however, a hollow mast six inches in diameter and 32 feet high made of galvanized steel tubing. The time ball embraces the mast, and slots in the upper and lower stays of the ball fit over guides placed parallel with the mast. The mast head is 328 feet above the street, or 342 feet above the level of Lake Michigan. The ball is built of a steel framework four feet six inches inside diameter, covered with heavy canvas painted black, and weighs 150 pounds. The external diameter is four feet 10 inches. It may be seen raised part way up in Fig. 3. The ball, after being raised up the mast, drops 26 feet into a wrought-iron cylinder which does not show in the picture. The air in this cylinder acts as a cushion and gently breaks the momentum of the ball.

FIG. 3. TIME BALL PARTIALLY HOISTED ON THE MASONIC TEMPLE, CHICAGO.

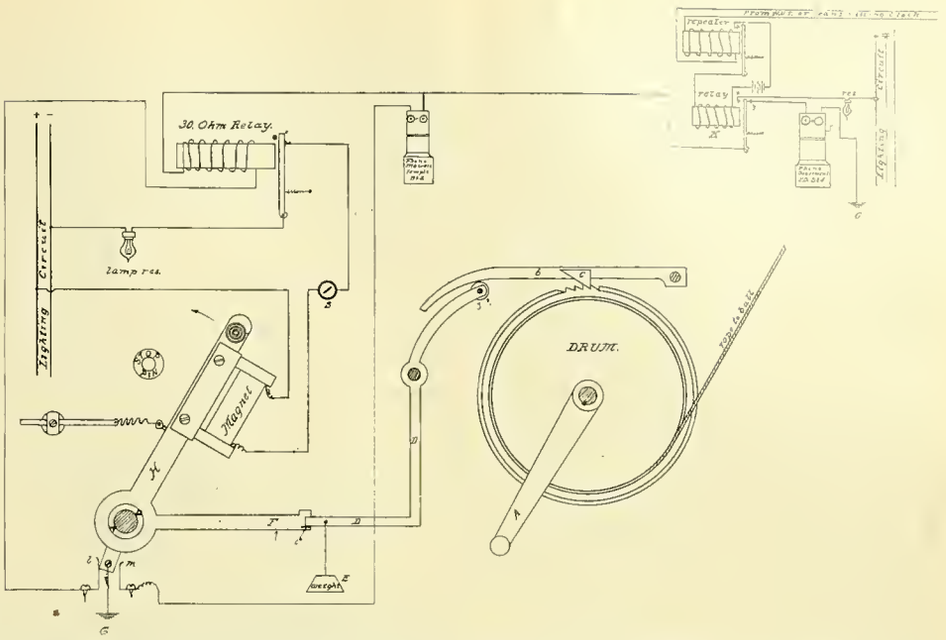


FIG. 4. DIAGRAM OF APPARATUS FOR DROPPING TIME BALL AND TELEPHONING OVER SAME WIRE.

By referring to Fig. 4, it may be seen how the time ball is raised to its dropping position, and also how it is dropped electrically from the Federal Building at exactly noon daily. A lever crank (A) is keyed to the raising drum, as shown, at five minutes before noon each day, and an attendant winds up the drum which reels in a rope from the top of a mast. This in turn hoists the ball, which is about 4½ feet in diameter and weighs 150 pounds. The ball is secured when up by the lever (b), which has a triangular dog (C) inserted in the teeth on the perimeter of the drum.

It is now evident if the lever (H) is allowed to fly back against the stop pin, the arm (F) of the same lever will take an upward course, and the tripping lever (D), with the weight (E), will be forced out clear of the small catch (i), allowing the weight (E) to fall. This latter movement will give an upward motion to the roller (J), thus raising the ratchet lever (b). The dog (C) then releases the drum, and the weight of the time ball will unreel the drum and let the ball drop.

The lever (H) is held in the position shown by an electromagnet energized from the lighting circuit of the Masonic Temple through an indicating switch (s), lamp resistance, and contact points of a 30-ohm relay. The normal position of the armature of this relay is, as shown, closed on the lighting circuit; therefore, if the circuit is broken at this point the magnet is demagnetized and the lever (H) will fly back, as described before, and drop the ball if the latter is hoisted.

To show how this 30-ohm relay is operated, it will be noticed that there are two wires in the right-hand upper corner of the sketch marked "transmitting clock." This circuit leads from the transmitting clock in the Federal Building, above referred to. By tracing this circuit it will be noted that it is connected to a repeater. For simplicity only one set of contacts is shown, while in reality this is a six-point repeater, which performs other functions besides dropping the time ball, which will be explained later on.

When the ball is to be dropped the switch to the ball is thrown in five seconds before noon. Its operation is as follows: Current from the transmitting clock works the six-point repeater, and this repeater works the double-point relay (K), and this latter relay closes a contact shown at (x), and opens the one at (y). As the contact at (x) is attached to one leg of the lighting circuit of the Federal Building through a lamp resistance, and, as a three-wire system with grounded neutral is used in this building, it is evident if the contact at (x) is closed the current will travel the wire to the next ground, which, by tracing the wires, will be seen to traverse the 30-ohm relay located at the Masonic Temple roof, and thence to ground, as shown at contact (1), and this operation will break the circuit at the relay points, thus releasing the lever (H), as explained before, and drop the ball.

It was desirable to maintain a telephone communication between the two distant points, and the engineer of this work, Mr. G. W. Richardson of Chicago, hit upon an original scheme for doing it, in that he accomplished this end by not using any other wire than the one used to drop the ball. In Fig. 3 the two telephones are indicated, being shown out of service, as the circuit is open at (m), because the lever arm (H) is set ready to drop the ball. But the normal position of this lever is against the stop pin, and this position will ground the telephone at (m), allowing communication between the two distant points to be carried on for 23 hours and 55 minutes, all that is desirable for the operation of the system. It will also be noted that the relay (K) automatically cuts out the telephone when current is to be sent over the line. The apparatus has been in service for over four months and has given the best of satisfaction.

In addition to the time-ball service, the repeater, through other relays and numerous contrivances, performs another duty. A large gong is located on the eighth floor of the Federal Building, in which the last minute of the eleventh hour is tapped off, omitting the twenty-ninth second, then continuing until the fifty-fifth second, there then being an interval of five seconds (during this time the time-ball switch is thrown in), then the last tap of the repeater taps the sixtieth second, or the 12-o'clock signal, on the gong, and drops the time ball on the roof of the Masonic Temple Building.

Wireless Tower for Washington Navy Yard.

The Navy Department is erecting a space-telegraph tower 200 feet high at the Washington navy yard, in an effort to communicate with the wireless station at the Brooklyn navy yard. Heretofore messages between the two places have been sent by relay. With powerful instruments at either end, it is expected that the operators will have no difficulty in exchanging messages. The tests will begin as soon as the Washington station is completed, which will be in about five weeks. The Bureau of Equipment of the navy, in charge of the wireless work, has just been informed that the operators at St. Augustine, Fla., and Cape Cod, Mass., have been enabled to exchange messages.

Artom Space-telegraph System.

Alessandro Artom, who is professor at the Galileo Feraris School of the Royal Industrial Museum of Turin, Italy, is an inventor of note in the field of space telegraphy. Readers of the Western Electrician will remember the article by Professor Artom in the issue of March 11, 1905. In that article the author described experiments which he made to produce, by means of suitable oscillators, a class of circularly or elliptically polarized rays of electrical power. It is interesting, therefore, to note that Professor Artom has recently taken out a patent upon some new improvements to his system, which are here illustrated and described, Fig. 1 being a diagram of the transmitting apparatus and Fig. 2 of the receiving apparatus.

Referring to Fig. 1, the transmitting apparatus consists of two discharge conductors (1) and (2), or any other suitable oscillator. The discharge conductor (1) is connected to a condenser that in turn is connected to a closed loop containing primary coils of transformers (43) and (44), the self-induction (12) and condenser (19). The other discharge conductor is electrically connected to the closed loop at a point opposite to and symmetrical to the other point of connection. There is a pair of masts or aerial conductors (14), (15) and (16), (17) making an angle of 90 degrees with one another, preferably, but not necessarily, crossing one another and suitably insulated. Each mast is connected to one of the grounded secondaries of the transformers (43) and (44). The secondaries are united by suitable wires and grounded at (8).

The receiving mechanism (Fig. 2) comprises two masts or aerials in the same relative angular relation to one another as the masts at the sending station and likewise insulated from one another. Each mast is connected to one element of a transformer (43) and (44), respectively, and these elements are connected by wires and grounded at (8). There are two closed circuits (61) and (71), one for each transformer and containing the other element of the transformer. The circuit (61), which contains the other element of the transformer (43), contains besides the battery (62), the coherer (63), relay (64) and the self-induction coil (65), all in series. The circuit (71), which is similar and symmetrical to the circuit (61) and contains the other element of the transformer (44), also contains battery (72), coherer (73), relay

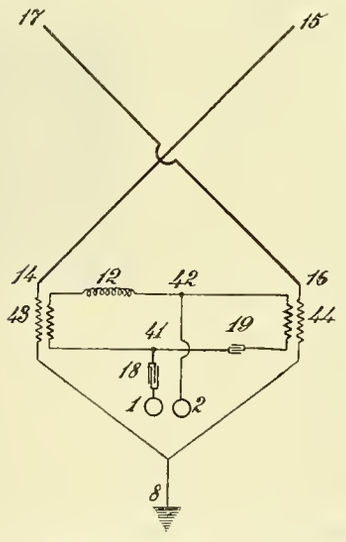


FIG. 1. ARTOM SPACE-TELEGRAPH SYSTEM.—TRANSMITTER.

(74) in series, and condenser (75) in a derived circuit. The only difference between the two circuits (61) and (71) is that the former contains a self-induction coil (65) in series in place of the condenser (75) of circuit (71) in derivation. Between the two circuits (61) and (71) is arranged the local-battery circuit or main circuit (81) containing a local battery (82) and a Morse machine or other telegraphic appliance adapted for recording the signals received. This main circuit is closed by the relays (64) and (74), and the self-induction (65) and capacity (75) should be so regulated that the two relays operate simultaneously.

In the transmitting apparatus the oscillatory discharge takes place between the two discharge conductors, the conductors being connected with a source of high-potential current.

The parts of the main circuit are traversed by oscillatory currents, and the condenser (18) serves to increase the quantity of current supplied to the circuit. At the points (41) and (42) branch off two derived circuits, (41), (12), (42) and (41), (19), (42). The oscillatory currents passing through these derived circuits induce similar high-potential currents in the secondaries of their respective transformers (43 and (44), which in turn transmit such currents to the aerials from which the corresponding polarized electromagnetic waves

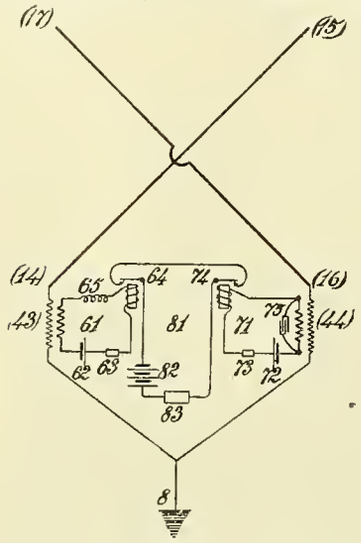


FIG. 2. ARTOM SPACE-TELEGRAPH SYSTEM.—RECEIVER.

emanate and are received by the corresponding aerials at the receiving station, where the transformers (43) and (44) cause a simultaneous variation in the closed circuits (61) and (71), thereby simultaneously increasing the current in these circuits sufficiently to attract the armatures of the relays (64) and (74) to temporarily close the main circuit (81) and send the local-battery current through the Morse apparatus to record the signal.

The Edison Convention.

A successful convention of the Association of Edison Illuminating Companies was held at Bluff Point, Lake Champlain, N. Y., on September 12th, 13th and 14th, it being the twenty-sixth convention in the history of the organization. There were about 200 delegates present, representing nearly all the operating companies throughout the United States that formerly were licensees of the parent Edison company. Business and pleasure alike shared the attention of the delegates. Business sessions were, as usual, open only to members of the association.

As usual at these conventions, the papers prepared were of timely interest and written by men who are recognized authorities in their respective fields. The steam turbine came in for its share of the discussion, and two papers were prepared for the convention on this subject, one by J. A. Radford of Chicago, and the other by W. L. R. Emmet of Schenectady, N. Y. Practical experiences in the operation of steam turbines and the latest improvements in their construction were brought out in these papers.

Four papers were read upon the general subject of lamps, which were of particular value to the central-station operator. Dr. C. R. Sharp of New York gave his experiences in testing all kinds of lamps, including the Nernst lamp. C. P. Steinmetz of Schenectady spoke upon some new phases of street lighting, bringing into his discussion magnetite arc lamps, mercury-vapor lamps and mercury-vapor arc rectifiers in connection with electric-light and power service. The "Use of Small-size Carbons" was the title of a paper by G. N. Eastman of Chicago, and W. T. Morrison talked on the practical operation of the Nernst lamp.

Papers bearing upon the maintenance and operation of electric-light systems were numerous and carefully prepared. Two of these were read by W. F. Wells of New York. One set forth clearly the method to follow in starting up large interconnected systems quickly after a partial or total shutdown. The other set forth a plan for the instruction and training of men belonging to the construction and operation departments in high-potential work. Gerhard Goettling of Boston read a paper entitled "Relative Merits of Discharging Batteries on Edison Systems Through Reversible Boosters and Through End-cell Switches." Charles H. Parker read a paper on the subject of the repair and maintenance of coal and ash-handling machinery. The relative advantages of 25 and 60-cycle current were brought out by a joint paper by Philip Torchio of New York and W. C. L. Eglin of Philadelphia.

Of a more general nature were the three remaining papers on the programme, which were as follows: "Data on Various Manufacturing Requirements," by E. W. Lloyd of Chicago; "Refrigeration by Means of Electric Motors," by G. W. Goddard and H. K. Mohr, both of Philadelphia, and "The International Electrical Congress at St. Louis," by J. W. Lieb, Jr.

The choice of officers for the forthcoming year resulted in the election of the following-named gentlemen:

President—Joseph B. McCall of Philadelphia.

Vice-president—D. L. Huntington of Spokane, Wash.

Treasurer—Alex Dow of Detroit, Mich.

Secretary—G. B. Stetson of New Bedford, Mass.

Assistant secretary—H. C. Lucas of Philadelphia.

Executive committee—Joseph B. McCall (chairman), Samuel Insull of Chicago, L. A. Ferguson of Chicago, J. W. Lieb, Jr., of New York, Charles L. Edgar of Boston and Thomas E. Murray of New York; Messrs. Dow, Huntington and Stetson ex-officio.

The Chicago Edison Company was well represented at the convention by Messrs. L. A. Ferguson, P. Junkersfeld, J. F. Gilchrist, Ernest Lunn and W. L. Abbott.

The place chosen for the convention was a beautiful one, and all enjoyed themselves by taking part in the various sports and pastimes provided for their entertainment. Those whose skill enabled them to carry off the golf prizes were L. A. Ferguson, W. C. L. Eglin and J. R. Lovejoy of Schenectady. Thomas A. Edison, who expected to be present, sent word that owing to the press of work he would not be able to attend.

Reclamation Service Wants Generators.

An interesting announcement is made by the Interior Department at Washington, which shows that, as anticipated, the United States Reclamation Service (for the reclamation of arid or semi-arid lands by irrigation) is making power-development opportunities as its work progresses. Of course the impounding of water in reservoirs for irrigation creates also heads which may be utilized by hydro-electric plants and electric power transmission. One such opportunity exists at Roosevelt, Arizona, and the Interior Department, through the electrical engineer of the Reclamation Service at Los Angeles, Cal., is inviting sealed proposals until November 1st for furnishing complete, f. o. b. bidder's works, one or more alternating-current 900-kilowatt 25-cycle generators; one or more 100-kilowatt direct-current generators for exciters, and one switchboard containing one panel for generator and one panel for exciter for use in the Roosevelt power house, Salt River Project, Arizona. Prospective bidders can obtain full particulars on application to the chief engineer of the Reclamation Service, Washington, D. C., or to O. H. Ensign, electrical engineer, 398 Pacific Electrical Building, Los Angeles, Cal.

How to "Flag" an Interurban.

The accompanying illustration, which is self-explanatory, may prove of use to some who are at a loss to know how to "flag" an interurban car.

AT NIGHT

Stand near the track, light a match, and hold it up in the manner shown in illustration, and the car will come to a stop when it reaches you, provided, of course, you are at one of the regular designated "stops"

IN DAY TIME

Stand near the track, waving your hand, hat or handkerchief across the track. Your signal, whether at night or day, will be answered by two short whistles. You should give the signal when the car is at least ten trolley poles from the stop

THE WAY TO FLAG AN INTERURBAN CAR

HOW TO "FLAG" AN INTERURBAN.

The suggestion, as here reproduced, is contained in an attractive booklet issued by the Rochester (N. Y.) and Eastern Rapid Railway. The Rochester and Eastern is a rapid-transit electric railway connecting Rochester with Geneva, 44 miles distant, and passing through Pittsford, Victor, Canandaigua and Seneca Castle.

International Waterways Commission.

[Special correspondence of the Western Electrician.]

Niagara Falls, N. Y., September 15.—It is generally conceded that the interests of Niagara Falls in any works that may be constructed to raise the levels of the Upper Great Lakes are greater than those of any other point likely to be affected by any changes which might be made, and for this reason the meeting of the International Waterways Commission at Niagara Falls on September 13th and 14th was of importance. This commission is composed of Col. O. H. Ernst, George Y. Wisner and George Clinton, with Louis C. Sabin, as secretary, representing the United States, and Louis Coste, John P. Mabee and W. F. King, with Thomas Cote as secretary, representing the Dominion of Canada. The commissioners spent Wednesday, September 13th, in viewing the Niagara gorge and the power-development works in Victoria Park on the Canadian side. On Thursday morning they visited the plants of the Niagara Falls Power Company and the Niagara Falls Hydraulic Power and Manufacturing Company; also the New York state reservation. It was after a thorough inspection of the Niagara locality that they assembled in the International Hotel to meet the representatives of the various interests they had inspected.

Those who attended the meeting were Hon. O. W. Cutler, mayor of Niagara Falls; Hon. A. K. Potter and Mr. Alexander J. Porter, commissioners of the New York state reservation; Edward H. Perry, superintendent of the state reservation; George H. Wilkes of Brantford, Ont., a commissioner of Victoria Park, and James Wilson, superintendent of the same Canadian possession; Attorney F. L. Lovelace, Resident Engineer Van Cleve, Superintendent P. P. Barton, Third Vice-president de-Lancey Rankine of the Niagara Falls Power Company; Hon. Arthur Schoellkopf and Chief Engineer John L. Harper of the Niagara Falls Hydraulic Power and Manufacturing Company; Banker R. Payne and Attorney F. W. Hill of the Ontario Power Company; Engineer B. F. Value of the Electrical Development Company of Ontario; Patrick F. King of the Niagara, Lockport and Ontario Power Company, who also represented the Lower River and Water Supply Company, and the International Power and Transmission Company.

INTERNATIONAL WATERWAYS COMMISSION (AMERICANS STANDING, CANADIANS SITTING).

Col. O. H. Ernst presided, and called upon Mayor Cutler to speak for the city of Niagara Falls. Briefly, Mayor Cutler welcomed the commissioners and thanked them for their thorough inspection. He made mention of the fact that the navigation, commercial and scenic features of Niagara were very important to the welfare of the locality, and he hoped the commission would keep in mind that it was Niagara's desire that the upper river be kept open to navigation and unobstructed.

Hon. A. K. Potter was first to speak in the interests of the New York state reservation, and he felt that it was due to the world that the Falls of Niagara be preserved. Among other things, he said:

"At the request of our commission, I desire to present to you certain reasons which are more particularly addressed to the legal and practical aspects of the question. There are two aspects of the question, international and national. I first ask your attention to the international aspect of the case.

"The Niagara River is not only a national boundary, but it is, in contemplation of law, throughout its entire length, a navigable stream. The two countries which it separates are bound by treaty obligations and by the common law of each land to maintain it as a navigable stream. The waters of Niagara River cannot be lowered upon one side without the corresponding loss of water upon the other side. The public, as such, which in the United States at least, means the entire people, and I suppose the same is true in Canada, have the right to the use of the waters of Niagara River for purposes of navigation, and to require of the government that the navigability of the river be preserved from any encroachment upon the one side or the other. That the Niagara River throughout its entire length, is, in law, a navigable stream and therefore subject to the laws which govern navigable streams, and which give the people at large a right to the use of them, has been held in the United States courts and in the courts of the state of New York; and it has also been held that this is so, notwithstanding the interruption of Navigation by reason of the Falls and the Rapids. But the river is, in fact, navigable as far down as Port Day on the American side, and as far as Chippewa on the Canadian side, and has been in fact navigated to those points, and these are below the point at which water is likely to be taken from the river for hydraulic purposes. Briefly speaking, it is clearly within the power, and becomes the duty, of the respective governments to preserve the rights of the public of each country in this stream, for the purposes of commerce. It is a mutual obligation, because, as I have said, any injury to navigation on either side is an injury to the rights of the public on both sides. And, if there should be injury to navigation upon one side, the country upon the other side would feel in duty bound to have such injury restrained, which might lead to undesirable international complications.

"Upon the national side of the question, I address myself more particularly to the commission appointed by the president of the United States. The constitution distinctly gives to Congress the power to regulate commerce between the States and with foreign countries. It also gives to Congress the power to pass any legislation necessary thereto. The ordinance of 1787, establishing the Northwest Territory, distinctly provides that all waters leading to the St. Lawrence River shall be kept open and free to the citizens of all the country; and this compact has been recognized as still in force by the Federal courts. The chart made for the United States, under the supervision of Major Symons, in 1902, lays down the course of navigation to a point near Port Day on the American side and also to Chippewa on the Canadian side, and shows that the depth of water along these lines will stand no further diminution if the river is to be kept as it has been to these points, open to navigation. Mr. Dow, in his brief, has set forth the effect of concessions already made for hydraulic purposes upon the depth of water on the American side. It shows that the navigability of the stream is already threatened, and that it is liable to be considerably injured when the concessions already made have been put into use.

"For the reasons I have stated it is plain that it is not only within the power, but within the absolute duty, of the United States government to take steps, by appropriate legislation, or possibly by a treaty with Great Britain, to prevent the destruction of the rights of the public in this stream."

Commissioner Potter also presented this resolution adopted by the state reservation commissioners. It is as follows:

"Resolved, That this board earnestly requests the International Waterways Commissions to urge upon their respective governments the necessity and reasons for preventing the further diversions of the waters of the Niagara River from their natural course over the Falls."

Reservation Commissioner A. J. Porter of Niagara Falls followed Mr. Potter, presenting an address by Chairman Charles M. Dow of the Reservation Board, in which Mr. Dow says:

"In the first place, let me say that the considerations affecting the property which we have in charge are very different from those affecting the strictly commercial questions which will absorb your attention elsewhere, and, we trust, will be approached by you in a different mental attitude. There are large financial consequences involved in the maintenance of the volume of Niagara, of which we shall speak later, but first and foremost comes the very unusual but none the less important consideration of maintaining Niagara Falls as a great natural spectacle.

"The state reservation at Niagara was created solely for the preservation of the beauty and grandeur of this exceptional scene. It was done under no subterfuge of utilitarian ends. The purpose was frankly declared in the legislative act to be 'the preservation of the scenery of the Falls of Niagara.' On this action by the state of New York and the action soon following by the Dominion government, our two governments have undertaken a trust, to protect which we are morally responsible not only to the people of our respective jurisdictions, but also to the people of the civilized world.

"From June 10 to September 17, 1868, the United States engineers measured the volume of the Niagara River near its head, and found the mean to be 273,329 cubic feet per second. For the last 36 years since its publication in 1869, this figure has been more frequently quoted than any other as representing the volume of water passing over the Falls of Niagara. As a matter of fact, the discharge during that particular period was largely in excess of the average mean for an extended period, and later figures given by the United States engineers reduce the average mean flow for 40 years to 222,400 cubic feet per second. To this may be added the inflow from streams entering the river between Lake Erie and the Falls, making 224,000 cubic feet per second the figure now generally accepted by engineers in their calculations. (See "The Menace to Niagara," by Dr. John M. Clarke, New York state geologist, in the Popular Science Monthly for April, 1905.) A recent recalculation made by Dr. Clarke gives 3,800,000 horsepower as the equivalent of this discharge.

"Now it is self-evident that the volume of the Falls as a whole will be reduced in proportion to any subtraction of water from the river above them, but the volume of the American Falls and the Canadian Falls will be affected unequally for the following reasons:

"First—About 0.6 of a mile above the Falls the stream is divided by the apex of Goat Island. This point of division is about 750 feet from the American shore and 3,750 feet from the Canadian shore. If the cross-section of the river bed were horizontal, the gradient equal and the current parallel with the midstream line, this would divide the flow in the ratio of one to five, giving the American Fall one-sixth and the Canadian Fall five-sixths of the flow.

"Second—But the cross-section of the bed of the river is not horizontal, the bed being higher on the American side and tending to send the water by gravity toward the Canadian side. As a consequence, the sill, or rock edge, of the American Fall is 10 feet higher than the sill of the Canadian Fall, according to a statement of the state geologist, made this year.

"Third—The channel widens from the parting of the waters at the head of Goat Island to the American Fall, thus spreading the small proportion of water received thinly over a crest line of 1,060 feet, while the channel on the other side contracts, tending to deepen the water passing over the Horseshoe Falls.

"As a result of the first two factors, it is variously calculated that only from one-tenth to one-fifth of the volume passes over the American Fall. James Wilson, superintendent of Queen Victoria Niagara Falls Park, estimates 10 per cent. as the American Fall's quota. Isham Randolph, advisory engineer to the Canadian commission, estimates it at 15 per cent. An engineer consulted by the state

[Continued on page 240.]

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DATES AHEAD.

American Street Railway Association (annual convention), Bellevue-Stratford Hotel, Philadelphia, September 25th to 29th

Illinois State Electric Association (annual meeting), National Hotel, Peoria, Ill., October 5th and 6th.

Railway Signal Association (annual meeting), Niagara Falls, N. Y., October 10th.

FALL TRADE in the electrical industry is, and promises to continue to be, pleasing in volume and quality. While there is no phenomenal "boom," business is brisk, prices are satisfactory, collections are good and business men are cheerful and confident. The situation is better than last year at this time, when the Western Electrician described the electrical trade as "steady." The descriptive word now to be employed is "good." This opinion is based not only on our own observation but on the opinions of a number of representative electrical business men, expressions from whom are given elsewhere in this issue.

LAKE TITICACA in Peru, which is probably the highest body of water of its size in the world, is admirably situated for the production of hydro-electric power, its surface being no less than 12,644 feet above the level of the sea. Mr. Emile Guarini, who will be remembered as a frequent contributor to the Western Electrician and other technical journals, recently reported upon the utilization of the waters of Lake Titicaca for power purposes, having been commissioned by the Peruvian government to look into the matter. Mr. Guarini advocates that the waterpower of the lake be utilized to operate the railways of Southern Peru. The coal now necessary to operate the trains costs approximately $500,000 annually.

WHEN PRESIDENT ROOSEVELT first began, in his vigorous fashion, to further the wise policy of reclaiming arid lands of the Far West at government expense, by irrigation, the Western Electrician pointed out that the various projects would surely involve power-transmission possibilities that should be carefully considered. For about a year now work has been in progress by the United States Reclamation Service on one of the most important of these enterprises—that of the Salt River at the town or camp of Roosevelt, Arizona. By 1908 it is expected that a reservoir made by a dam 172 feet high—probably the highest in the world—will be the means of transforming 250,000 acres of land now barren, near Phœnix, into soil of rich agricultural possibilities. The work will cost over $3,000,000, or at the rate of $12 an acre, but the reclaimed land should be worth several times that. It is gratifying to observe that the hydro-electric opportunity presented by this head of water has not been neglected, and the Interior Department is even now advertising for a generator or generators to take advantage of it. The power canal, which is to be 19 miles long, is well under way. Its construction has involved the excavation of about 600,000 cubic yards of material and the driving of nearly 9,000 feet of tunnel. The plant will furnish electric power to operate all the irrigating works, and it is to be supposed that a much larger quantity can easily be supplied when there is a demand for it.

The engineering problems connected with the Salt River project are of interest. Before the dam could be commenced 80 miles of road had to be built. Most of the material must be brought from Globe, the railroad station, 40 miles away. The government will require about 200,000 barrels of cement in erecting the dam and will make it on the spot at an estimated saving of $2.61 a barrel, or $522,000 on the entire work. The cement mill is now in operation, using crude petroleum from California for fuel.

SOME interesting arguments were presented at the recent Niagara Falls meeting of the International Waterways Commission, reported at considerable length in this issue of the Western Electrician. The question of the waterflow of the Great Lakes is of great importance at Niagara Falls, where both the scenery-preservation advocates and the power-transmission men are keenly interested in the situation; but it is also of no mean consequence at other places, such as Sault Ste. Marie and Chicago. At these places it is not pretended that any beauty of natural scenery is injured or destroyed by the lowering of the water level, but nevertheless the not very successful power development at the "Soo" and the power plant building on the Chicago Drainage Canal are factors in the problem which are not to be overlooked. But the main interest centers at Niagara, where the question is how far the power companies shall be allowed to go in taking water from the Falls. Both Canada and the United States are, of course, interested in the question, and hence a joint or international waterways commission is studying the whole subject, which includes, also, the interests of a vast waterborne commerce.

The question at Niagara Falls is largely one of beauty versus utility, and the protagonists of scenic preservation and power utilization have, respectively, strong arguments to advance, while likewise suffering from the defects of their qualities. It is a question which may be argued interminably, from an academic point of view, without arriving at a definite conclusion. It would be a pity if the stupendous cataracts at the Falls were robbed of the grandeur of the pouring masses of water and reduced simply to cliffs with straggling rills trinkling over them. This would be scarcely less than profanation. No less would it be a calamity if the world were deprived of its greatest example of hydro-electric power development; if the Almighty's bounty in providing a great and comparatively easily utilizable source of power could not be realized, in some part, in the form of useful work, for the benefit of His toiling creatures. Either extreme is to be avoided. As it is now, and happily will be for many a year, we have the Falls and use them too. But it is clearly wise that a limit should be established beyond which the power users may not go. The international commission may advise where this line shall be drawn.

WHAT can be accomplished by intelligent, well-directed effort in the electric-railway and electric-light and power service of a city of 42,000 inhabitants is shown by the extended article in this issue descriptive of the utilities of this kind in the city of Dubuque, Iowa. This city presents a distinct and extreme example of the evolution of the central-station business in American municipalities. Ten years ago, with 35,000 inhabitants, the place had four competing street-railway and electric-light companies. The service was indifferent; the plants were in bad shape; competition was not merely keen, but fierce and unfair. The situation was strained, unnatural, absurd. Today there is one company; it is giving excellent service and has plant and equipment which is perhaps unsurpassed in any city of equal size in the country. The contrast is a very striking one and gives the electrical history of Dubuque a quite exceptional interest. The people of the town are now served by one strong, enterprising, fair-dealing company. The rates for light and power are reasonable and the current is available at any time, day or night. As to street-railway fares, the public has a particular advantage, for Dubuque is one of the very few cities in which workingmen's tickets, good during the "rush hours," are sold at 2½ cents each. The people have every reason to be satisfied with the service, and apparently they are. The company's new turbine station is very modern and complete—a model for a small city, in fact—and this adds to the prestige of the town; the electrical company is one of the important resources of the community. The company, for its part, has no competition, but is bound to give good service to retain and increase its business in order to make a return on the money invested in new buildings, machinery and track construction—a very large sum for a city like Dubuque. In a place of that size, everybody can walk on a pinch, and electric light and power can be dispensed with in case of dire necessity. It is thus "up to" the central-station company to "make good" with the public; the company's most valuable asset is not its fine plant, after all, but public confidence. And we believe that the Dubuque company, the outcome of a curious history of folly and failure, deserves and is receiving public confidence in ever-increasing measure. At any rate, the past experience of the city and its present high-grade equipment show to electrical men in cities of the same class many things to avoid and many to emulate. It is a "Look-on-that-picture-and-then-on-this" lesson practically applied in the electrical field.

OUTLOOK FOR FALL TRADE.

"Good!" That in one word is an epitome of the answers received from various leading representatives of the electrical industries to the Western Electrician's question, "What is the outlook for fall trade?" The electrical business generally is in a flourishing and healthy condition, with first-class prospects for a continuance in the same satisfactory condition. A perusal of the following expressions of opinion will show how widespread this sentiment is:

W. W. Mumma, Robbins & Myers Company, Springfield, Ohio: "Business has been picking up with our motor trade, and the prospects are that we will have a considerably better fall season than the last one."

Charles Blizard, manager sales department, Electric Storage Battery Company, Philadelphia: "The Electric Storage Battery Company is enjoying the best business in its history, and prospects for the remainder of the year are excellent."

George A. McKinlock, president, Central Electric Company, Chicago: "We believe that the business for 1905 will be very large, and it is now larger than it was in 1904. There is every reason why it should be, and no reason that we know of why it should not."

H. Kimball Loud, H. M. Loud's Sons Company (cedar poles), Au Sable, Mich.: "The market for poles has been very good this year, and the indications are that the fall trade will continue good. It seems likely that there will be a strong demand for short poles."

Gaston Harbison, National Battery Company, Buffalo: "From the large amount of business that we are handling and the many inquiries which we are receiving from all sections of the country, we are convinced that the prospects are excellent for a good fall trade in the electrical industry."

L. M. Kingsley, treasurer, Mica Insulator Company, New York: "Judging from our orders—and we furnish insulating materials to nearly all the large electrical companies in this country—the prospects are for a very large fall trade this year—we think much larger than ever before."

Frank H. Chapman, secretary, Yost Electric Manufacturing Company (sockets), Toledo: "We are pleased to say that our business has increased considerably over the corresponding periods of previous years and is growing steadily. We anticipate an increase of at least 50 to 60 per cent. for the year 1905 over 1904."

F. S. Hunting, sales manager, Fort Wayne Electric Works, Fort Wayne, Ind.: "The prospects for business this fall we consider very good. This year has thus far shown a very substantial improvement over conditions last year, and I have no doubt the showing this fall will be an improvement over the corresponding period last year."

E. H. Haughton, general manager, Bryan-Marsh Company (incandescent lamps), Chicago: "We are pleased to advise you that in the month of August and the first part of September we have had a larger demand for our lamps than at any other period in the history of our business. If the pace keeps up for the balance of the fall, we will have a record-breaking year."

A. F. Callahan, president, Universal Electric Storage Battery Company, Chicago: "We have been receiving orders and inquiries which indicate great activity in the demand for storage batteries, particularly for traction work. It is our aim to answer satisfactorily the question of their durability, which is a controlling factor, and one on which hinges a wide extension of the field for their use."

J. W. Marsh, vice-president and general manager, Standard Underground Cable Company, Pittsburg: "The prospects for the fall trade of 1905 in the electrical industry seem to us to be very good indeed. Both inquiries and sales have been, and are, very large—considerably in excess of last year, and we are inclined to think that this state of affairs will continue for some time to come."

James M. Gilchrist, general manager, Federal Electric Company (electric signs), Chicago: "The indications are that we will have a fair fall trade this year, although we do not look for anything extraordinary. While there are some stations that are going into the business of installing signs free on a flat rate, still the number is not as large as we would expect, after an examination of the profits of the scheme. It is a little early to give a more definite opinion as to what may be expected this year, as the average merchant does not begin to think of an electric sign until the evenings begin to grow longer."

W. E. Goldsborough, business manager, engineering department, J. G. White & Co. (engineers, contractors), New York: "The outlook for the fall trade of 1905 in the electrical industry seems to be exceptionally good. So far as this company is concerned, business is very active, and we have every reason to believe that the industry at large is benefiting from the present favorable conditions."

J. C. Fish, president, Shelby Electric Company (incandescent lamps), Shelby, Ohio: "From the indications we can say to you this year (as we have said for many years in the past) that it looks to us as though business was going to be better than ever before. With us this statement has proved true each year, and we trust that it has proved equally true with others engaged in our particular line. We are always glad to see our competitors' business grow when ours is growing as fast or faster."

T. P. Gaylord, Chicago manager, Westinghouse Electric and Manufacturing Company: "I am pleased to say that we regard the outlook for the fall trade in the electrical industry as particularly encouraging. There is the greatest activity among all the railroads in this section, in their preparations for handling large crops. The steel and wire mills are not only working to their full capacity, but are installing additional equipment to care for a large increase in business. As the electrical industries are, to a great extent, dependent upon industries in other lines, this may be taken as indicative of good business for the electrical industries. Aside from this, the financial interests are looking with much more favor upon electrical securities, making it possible for installations to be made that were heretofore impossible."

L. P. Sawyer, manager, Buckeye Electric Company (incandescent lamps), Cleveland: "The Buckeye Electric Company is looking forward to a largely increased business during the coming fall and winter, and as a consequence has materially increased its stock of lamps in Cleveland, Pittsburg and Chicago. Every indication points to a very active business in all the electrical industries during the balance of the year. Central-station men are beginning to take up the matter of advertising the different uses electricity can be put to, which fact alone should serve to stimulate the business in all branches. From reports received from our different offices and through salesmen who have attended state electrical association meetings, we find the central-station men in general looking forward to a larger business this year than they have had before."

W. W. Low, president, Electric Appliance Company, Chicago: "The prospects for fall business this year seem exceptionally bright, and, further than that, the natural increase of business which comes during the fall, we believe, has started up at least three weeks earlier than usual. Several manufacturers whose business is standard, showing an increase from year to year, have advised us that July and August of this year have been the largest months in their history, showing a far larger increase than any similar months in past years. This would look as if the jobber had good grounds for expecting a very large fall business and had been anticipating such in his orders. Our business has opened up unusually well this fall, and we see no reason for its not being a banner period, as consumers have not only their usual wants to buy for, but also, from the hand-to-mouth condition in which they have been carrying their stock, will have to buy more heavily to replace depleted stock."

V. R. Lansingh, general manager, Holophane Glass Company, New York: "The outlook for business for the Holophane Glass Company for this fall is extremely encouraging. There has lately been a gradual awakening to the fact that the Holophane system of illumination is a real scientific system, which, when properly used, fulfills a decided need in the lighting business. Our increase in business seems to be largely due to the fact that engineers, architects and others, who are in a position to judge of the true merits of the system, are beginning at last to appreciate its value, with a consequent revival in our business. As regards the fall trade, as a whole, from the reports we are receiving from our branches and salesmen, the prospects are that the business this fall, throughout the country will be fully up to the standard which has been set in previous years. Promising reports are received; collections are good, and indications are that the electric industry should increase largely this year."

Philadelphia Street-railway Conventions.

During the week of September 25th to 30th the American Street Railway Association and its affiliated organizations will be in session in Philadelphia. The meetings will be held in the South Building of the Philadelphia Museum, Thirty-fourth and South streets. The hotel headquarters will be at the Bellevue-Stratford. The time is assigned as follows:

American Railway Mechanical and Electrical Association—September 25th and 26th (Monday and Tuesday); Monday at 10 a. m., and 1:30 p. m., Tuesday at 9:30 a. m. and 1:30 p. m.

Claim Agents' Association—September 26th, 10 a. m.

American Street Railway Association—September 27th and 28th; one session each day, beginning at 10 a. m., with half-hour intermission for luncheon in the building.

Street Railway Accountants' Association—September 28th, 29th and 30th (Thursday, Friday and Saturday); first session at 2 p. m. on Thursday; sessions at 10 a. m. and 2 p. m. on Friday, and one on Saturday at 9:30 a. m.

PAPERS TO BE READ.

Mechanical Association.

"Power Distribution," by C. H. Hile, Boston (Monday afternoon).

"Power Station Load Factor in Cost of Operation," by L. P. Crecelius, St. Louis (Monday afternoon).

"Controlling Apparatus," by J. S. Doyle of New York, Hugh Hazelton of New York and W. A. Pearson of New York (Monday afternoon).

"Rail Joints," by F. G. Simmons of Milwaukee, G. E. Pellissier of Holyoke, H. B. Nichols and C. B. Voynow of Philadelphia (Tuesday morning).

"Maintenance and Inspection of Electrical Equipment," by William Pestell of New York (Tuesday morning).

"The Power Station," by F. N. Bushnell of Providence (Tuesday morning).

"Emergency Track Brake," by F. F. Bodler, San Francisco (Tuesday afternoon).

Question Box (Tuesday afternoon).

Street Railway Association.

"Single-phase Railway Systems," by C. F. Scott, Pittsburg.

"Electric-railway Equipment," by W. B. Potter, Schenectady.

"Diesel Engines," by E. D. Meier, New York.

"Organization," by H. L. Doherty, Denver.

"Design of Large Gas Engines," by Arthur West.

"Application of Gas Power to Electric-railway Service," by J. R. Bibbins, Pittsburg.

Accountants' Association.

"Standard Classification of Accounts," by C. N. Duffy, Chicago (Friday morning).

"Standard Forms of Report," by W. F. Ham, Washington (Friday morning).

"International Form of Report," by C. N. Duffy (Friday morning).

"National Association of Railway Commissioners, Birmingham, Ala., Nov. 15-17, 1904," by C. N. Duffy (Friday morning).

"National Association of Railway Commissioners, Deadwood, S. D., Aug 15-17, 1905," by W. F. Ham (Friday morning).

Question Box (Friday morning).

"The Cost of Carrying a Passenger," by C. L. S. Tingley, Philadelphia (Friday afternoon).

"Interurban Fare Collections," by Irwin Fullerton, Detroit (Friday afternoon).

"Interurban Ticket Accounting," by J. H. Pardee, Canandaigua, N. Y. (Friday afternoon).

"Accounting with Four Departments," by H. M. Beardsley, Elmira, N. Y. (Friday afternoon).

OTHER PREPARATIONS.

The entertainment and exhibits are in charge of the American Street Railway Manufacturers' Association, of which D. M. Brady is president and George Keegan is secretary, while C. C. Peirce of Boston is chairman of the entertainment committee.

On Tuesday evening, from 8:30 to 12, there will be a reception, with dancing, in the main banquet hall of the Bellevue-Stratford.

A theater party will be given on Wednesday evening at the New Lyric Theater.

The banquet will be held on Thursday evening. It is expected that W. Caryl Ely, president of the parent association, will act as toastmaster. Tickets will be sold to members of the associations.

On Friday afternoon there will be a trolley ride from the hotel through Philadelphia and its parks, by the courtesy of President Roberts of the Fairmount Transportation Company.

A vaudeville entertainment will be given at the Bellevue-Stratford on Friday evening.

The exhibition of street-railway machinery and appliances will undoubtedly be the best ever given under the auspices of the association, and that is saying much. It will be held at the Philadelphia Museum, Thirty-fourth and South streets. Take Walnut street cars to Thirty-fourth street, where free buses will be in waiting.

A light lunch will be served at moderate cost in the exhibition building. This feature is designed to save time and expedite business.

One feature of especial interest will be the ques-

tion of adopting the proposed constitution and by-laws of the American Street and Interurban Railway Association—the proposed successor of the American Street Railway Association. The debate on this important question of reorganization will probably come up on Wednesday forenoon. It will excite a great deal of interest, as it is proposed to remodel the association on more modern and effective lines.

The officers of the various associations are striving to make this convention the most successful ever held. President Ely and Secretary Pennington of the parent association and President Baker and Secretary Mower of the Mechanical Association have been particularly active in this endeavor, and are entitled to much praise.

The American Street Railway Association, through its secretary, has announced that the railroads have granted rates of fare and one-third on the certificate plan; that is, full fare going, and, on the presentation of 100 certificates, one-third fare returning. It is necessary that a certificate be secured from the ticket agent when the ticket is purchased, the certificate is then deposited with the clerk at the registration booth immediately on arrival at Philadelphia, where it is signed by the secretary and validated by the special agents of the railroads. A fee of 25 cents is charged on each certificate. Certificates for the return trip will be ready September 29th, although delegates may remain until October 4th before returning home. No stop-over is allowed on the return journey.

American Pacific Cable to Be Extended to China and Japan.

Clarence H. Mackay, president of the Commercial Pacific Cable Company, has announced that his company has secured the necessary concessions to enter Yokohama and Shanghai with a submarine cable to connect the United States with Japan and China. The connections will be made by extending the present lines of the company, which run from San Francisco through the stations at Honolulu, Midway and Guam to Manila. Japan will be reached by laying a cable from Guam to Yokohama. The cable to China will be laid from Manila to Shanghai.

Speaking of the proposed new cables, Mr. Mackay is quoted as follows: "We shall proceed at once with the manufacture and laying of these two cables, which will take several months. The Commercial Pacific Cable Company will then pierce the Far East at three points, the Philippines, China and Japan. With the cable which has just been completed to Newfoundland, plus a fifth cable to Europe, which will be laid this month, and the cable from Guam to Japan, and one from Manila to Shanghai, the company will have a system extending over two-thirds of the way around the globe.

"It was the earnest wish of President McKinley, while the Pacific cable was in contemplation, that in addition we should lay cables to China and Japan. The difficulties at that time seemed insuperable, including as they did diplomatic negotiations to secure landing rights in China and Japan, a survey of the hitherto unknown bed of that part of the Pacific Ocean and eastern seas where the new cables were projected, and the construction work, but the president was assured that every possible effort would be made to comply with his wishes. Among the obstacles which presented themselves more recently was a protest which Russia made against the laying of a cable to Japan as being a breach of neutrality."

Variable-speed Train-lighting System.

An electric train-lighting system in which the source of energy is a variable-speed generator carried on the train has been patented by William L. Bliss of New York and assigned by him to the Bliss Car Lighting Company of Milwaukee, Wis. In all there were 14 patents (Nos. 799,516 to 799,529) taken out on September 12th, the dates of their several applications ranging from April, 1904, to July, 1905.

In general the system consists of a variable-speed generator located on a unit of the train, preferably on the locomotive tender. A train-line passes through the cars, a local circuit being arranged on each of the cars. A storage battery and translating devices are connected to each local circuit. A motor-generator is also carried on each car and has its generator field winding connected in series with the battery. It is provided with a pair of armature windings, one of the windings being adapted to be connected in circuit with the field winding of the generator to introduce a counter electromotive force in that winding and the other being connected in the circuit of the translating device.

FOREIGN TRADE PROSPECTS.

Russian Discriminating Import Duties.

The recent announcement that the Russian government has ordered that the levying of discriminating import duties on a number of articles, the products of the United States, be discontinued, lends some interest to the figures below, presented by the Department of Commerce and Labor through its bureau of statistics, showing the total imports into Russia from the United States during the calendar years 1900-1904, inclusive, as well as the imports during the period 1900-1903 into Russia from the United States of the articles affected by the adverse tariff legislation.

The application of the higher discriminating rates dates back to the beginning of the year 1901, when, in retaliation of the countervailing duty imposed upon sugar of Russian origin in accordance with section 5 of the Dingley tariff, the Russian minister of finance ordered the application of the penal tariff rates to imports of manufactures of cast-iron, of hand tools, machinery, and numerous other articles classed under the general head of manufactures of iron and steel. These articles, which were subject until then to the same conventional rates as were paid by like articles coming from Germany and other European countries, became subject to rates from 30 to 50 per cent. higher.

It is interesting to note that the total imports into Russia from the United States, as shown by the official trade returns of the Russian government, show but little the effects of the adverse tariff legislation. Thus the total imports from this country are stated by the Russian returns as follows: 1900, $22,748,000; 1901, $17,984,000; 1902, $20,574,000; 1903, $32,531,000.

Preliminary figures for the year 1904, showing the imports from the United States into Russia over the European frontier only, are $32,163,000. The corresponding figures of the United States Bureau of Statistics, showing the total exports from this country to Russia during the same calendar years, are as follows: 1900, $8,664,270; 1901, $7,207,995; 1902, $13,835,953; 1903, $18,994,548; 1904, $17,823,856.

While the figures of the two governments, measuring the same trade movement for the same period, show wide discrepancies, neither of them discloses any serious effect of the above-named discriminations upon the growth of the general trade movement. The main reason for this phenomenon is that the bulk of exports into Russia from the United States is made up of raw cotton.

An analysis of the figures showing the imports from the United States of the various articles affected by the discriminating tariff legislation furthermore shows that these imports have, on the whole, increased during the period in question. Thus, the imports of manufactures of cast-iron increased from $19,955 in value during the year 1900 (which, for purposes of this comparison, may be taken as a normal year) to $45,722 in 1903. The imports of hand tools, which were $15,315 in value in 1900, increased to $64,532 in 1903. Those of machinery increased from $223,529 in 1900 to $338,694 in 1903, while the imports of the various articles under the general head of manufactures of iron and steel increased from $45,373 in 1900 to $363,555 in 1902, and fell off to $67,555 during the following year. The combined figures of imports from the United States of the articles subject to discriminating duties show an increase from $501,558 in 1900 to $951,106 in 1903.

Advancing Commerce in China.

The methods of advancing American commerce in China are discussed in an interesting letter by Baruch Cerf of San Francisco to the Department of Commerce and Labor in which he points out the necessity of an organization in China through which American commercial bodies, manufacturers and merchants can obtain full information, and be properly and promptly directed as to modes of procedure for meeting the representatives of prominent Chinese firms. American trade has been seriously handicapped in China in this respect, says Mr. Cerf, and he has given the matter much thought. As a result, he writes, he has arranged preliminaries for establishing a permanent exhibition at Shanghai, which shall not only be an exhibit but an active agency for the distribution of information for the benefit of American commerce. He has conferred with Chinese gentlemen of the highest repute, who will become associated with the venture. A few of the details taken from Mr. Cerf's plan are as follows:

To conduct this exhibit as a permanent commercial and industrial exhibit of American products, a bureau of information for the development of trade opportunities, and the medium of introduction of representatives and their specialties to the trade of China; to retain a staff of intelligent and educated employes of the highest class, conversant with the different dialects, who can associate with and explain the different exhibits to officials and merchants of the highest grade, thereby obtaining for American commerce a prestige which is invaluable; to properly distribute and circulate throughout the empire all advertising matter and to advise exhibitors as to the most effective mode of advertising suitable to that country; to issue a newspaper or advertising sheet, properly transcribed, advertising all exhibits and their uses, to be circulated free of charge among the merchants throughout the empire; to keep a directory (of which there is none in China) containing the names and addresses of Chinese merchants and the special lines they carry; to retain a staff of responsible, educated interpreters and traveling salesmen of high class for the benefit of exhibitors or their representatives; to assist Chinese merchants and prospective buyers in their correspondence with manufacturers; to gather statistics of imports and exports and to act as a neutral correspondent to exhibitors, furnishing such information as they may require to best serve their interests.

Special Agent Burrill, who is in China, writes from Shanghai: "I am certain that China presents a magnificent field for exploitation of American manufactures, and am convinced that only a continuance of practically a total disregard of American exporters for the requirements of the Chinese trade will prevent a steady growth of importations from the United States. This great commercial field is open to the United States, whose geographical advantages are supplemented by the friendship of the Chinese people and their preferences for Americans and American products, provided the manufacturers will do their part."

Foreign Postage Should Be Fully Prepaid.

A Chicago firm recently received a communication from Allen & Co. of Melbourne, Australia, in which it is stated that fully 50 per cent. of American letters are understamped. This has become a source of great irritation to all Australian merchants, and does not tend to help American houses in their quest for business. Australia and all foreign countries charge double for any shortage they may find in the postage of a letter, so a letter sent to Australia bearing a five-cent stamp that weighs even a hair over half an ounce, is delivered only upon payment of 10 cents by the unfortunate Australian. This is equally true of all foreign countries. So these letters should be subjected to much closer scrutiny than letters sent to any part of America. Similar complaint is often made in Great Britain and on the Continent of Europe in relation to letters from the United States. The subject is worthy of careful attention, for nothing is more irritating than the constant receipt of "postage-due" letters and packages of mail matter. One concern in Chicago has adopted the expedient of using a distinctively colored envelope—bright yellow—for its foreign letters. All yellow letters are especially weighed by the mailing department.

The Outlook in Japan.

Considering the existence of the Japanese-Russian war, the commercial operations of Japan during the first six months of the current year are remarkable. The value of merchandise imported in that period was nearly $143,000,000, an increase of about 60 per cent. over the corresponding six months of 1904. It is gratifying to know that the United States holds a leading position in the imports into Japan for the first six months of this year, this country having furnished more than 22 per cent., as compared with less than 15 per cent. during the first six months of 1904. For the period first mentioned the United States exported to Japan $888,791 worth of electrical machinery as against $684,607 for the corresponding period in 1904 and about $140,000 for the first six months of 1903.

Recent advices from Tokyo are to the effect that the Japanese authorities are considering the project of throwing open Talienwhan (Dalny) and Port Arthur and of permitting free commercial access to these ports. It is expected that this measure will be carried out in the near future. On July 1st there were opened to Japanese colonists and foreign trade the towns of Tashihkiao, Newchwangcheng, Haicheng, Ashantien, Liaoyang, Kaiping, Fengwhengcheng and Saimachi.

Imitation of American Goods.

An American traveling abroad inquiring into trade conditions, with special reference to the promotion of American commerce, writes to the Bureau of Manufactures that certain foreign manufacturers in England and on the Continent imitate American products and sell them under the title "American made." Some "American" articles sold in Europe and elsewhere, he says, are really of European make, but made after American patterns, and the English and French as well as the Germans and Austrians are doing more or less of this, both for the home markets and for exportation. Apparently quite large quantities of genuine American manufactures are being sent from England to Egypt, India, the Straits Settlements, China and Japan. He is further quoted as saying that considerable quantities of merchandise originally made in the United States reach France from England, the Netherlands and Belgium, being imported, however,

as products of those countries, thus securing in some cases the benefit of the minimum tariff rate which France does not accord to the United States. This, he says, may explain in part why our direct exports to France do not increase as rapidly as to England, the Netherlands and Belgium.

Foreign Trade Notes.

An electric railway to cost $105,000 is to be built at Goerz, Austria.

The electric plant of Friedland, Bohemia, is to be enlarged at an expense of $86,000.

The town of Kapfenberg (Steyermark), Austria, has voted $63,000 for the installation of electric lighting.

The city of Trient, Austria, contemplates the construction of waterworks on the Sarca River for the purpose of creating electric energy.

The city of Bonn, Germany, has issued $1,048,000 bonds for electric railways to be built.

At Reichelsheim, Grand Duchy of Hesse, Germany, an electric central power station is to be erected.

The Compania Madrilena Electrica in Madrid, Spain, has received a concession to construct an electric railway from Barquillo to Olavide.

The government of Sweden has authorized the city of Stockholm to issue a loan of $13,400,000 for purpose of public improvements.

The state of Jalisco, Mexico, offers a good market for agricultural machines and implements; also for electric machines and apparatus. The license tax for commercial travelers in the state has been abrogated.

Signor Frederick Fossi writes from Milan, Italy, that he will act as agent for persons in the United States who are desirous of exhibiting at the exposition to be held in Milan, Italy, in 1906, to celebrate the opening of the Simplon tunnel.

The new harbor works at Antwerp, Belgium, are estimated to cost $36,000,000. The state will bear $20,200,000 of the expense. For the various machines and equipment required in this undertaking contractors should be able to compete successfully. About $130,000 will be expended by the ministry of public works for harbor improvements in Blankenberghe.

More Equipment for the Indianapolis-Cincinnati Single-phase Railway.

Satisfaction has been so far expressed by the owners of the Indianapolis-Cincinnati single-phase railway in the general operation of the electrical equipment. This is best shown by the fact that they have just closed a contract with the Westinghouse Electric and Manufacturing Company for 14 new car equipments almost identical with the original ones which have already been described in the Western Electrician (February 18 and March 18, 1905). To determine upon the details of the controlling apparatus and other electrical equipment of these new cars, prominent officials of the Westinghouse company, together with Mr. A. D. Lundy of Sargent & Lundy, Chicago, who are the consulting engineers on the work, met in Indianapolis last week. Those from Pittsburg were L. A. Osborne, H. B. Davis, Clarence Renshaw and B. G. Lamme. T. P. Gaylord went from the Chicago office of the Westinghouse company.

The new cars are to operate on the Shelbyville division of the road, which will be completed by January 1st. This division is about 42 miles long and brings the total mileage of the system up to 100. A very good schedule is now being maintained by the single-phase cars between Indianapolis and Rushville, a distance of 42 miles. The time between these two places is one hour and 20 minutes, nearly 30 minutes of this being required to go the two or three miles within the limits of Indianapolis.

The Hutchison Acousticon.

An ingenious device known as the "acousticon" has been installed within the last few weeks in a number of public buildings in New York city, with a view to enable partially deaf persons to listen to speeches, sermons and music. The instrument is a combination of a telephone, a microphone and a megaphone, and it is asserted that any person who has not lost entirely the sensitiveness of the auditory nerve can be made to hear the most delicate audible sounds by its use.

FIG. 1. HUTCHISON ACOUSTICON.

The acousticon is the invention of Mr. M. R. Hutchison, and it is manufactured in New York city by the Hutchison Acoustic Company, the president of which concern, Mr. K. M. Turner, described the instrument to the New York correspondent of the Western Electrician.

The accompanying photographic reproductions illustrate the instrument and its method of installation. Fig. 1 shows a form of the acousticon with two transmitters and a receiver, adapted for desk or table use. Thus made, the device resembles a portable camera and collects and amplifies all the sounds in an ordinary room or office. Fig. 2 shows the interior of the Madison Avenue Baptist Church, New York city, with Rev. George F. Pentecost, D. D., in the pulpit, and an acousticon with four transmitters on the reading desk. A battery is concealed beneath, and ordinary telephone wires convey the sounds to the receivers in the pews in various parts of the church, there being at present some 20 receivers in weekly use. Fig. 3 represents the interior of the Hudson Theater, Broadway and Forty-fourth Street, New York city, with the transmitter in front of the footlights, and the wires leading to the batteries, and to seats in the boxes and orchestra. The wiring is not so conspicuous as shown in the picture, most of the connections being now taken through the various ventilating channels and brought up through the flooring to the seats. The wires can be taken to the most distant part of the building and even to adjacent and distant places over an ordinary telephone circuit.

Mr. Hutchison invented his instrument several years ago, but the early form was crude, and, being operated by a storage battery, was not adapted for extensive use. An improved and portable form of the acousticon, operated by a small dry battery, was exhibited at the Louisiana Purchase Exposition, in a shape adapted for individual use of deaf persons, and capable of being carried about the person like a small camera. Within the last few months the instrument has been adapted for use in public buildings, and any number of receivers up to 50 can be connected with the enlarged transmitters. This improvement was mainly effected at the suggestion of Dr. Pentecost, whose wife has been afflicted with deafness for 30 years, and during all that time had never heard her husband's sermons. One day last spring Mrs. Pentecost took her portable acousticon to church and was enabled to hear the service with some degree of satisfaction. Then the doctor asked why it could not be specially adapted for his church, with a result that the various improved forms have been devised.

The acousticon not only transmits and amplifies sounds, it also amplifies articulations. It reflects and transmits sounds on a compensating principle, intensifying the softer sounds and modulating the louder vibrations, so that the receivers deliver at the ear clear and distinct articulations. Different degrees of sound transposition to meet individual cases can be obtained. Any intelligent wireman can make the necessary connections in a building.

After being successfully installed in the Madison Avenue church, the acousticon was put in at the Broadway Theater, where in April last a company of deaf-mutes from the Wright Oral School were enabled to enjoy a comic-opera performance for the first time in their lives. Subsequently it was put in at the newly opened Hudson Theater, as above described. Since then acousticons have been installed in public buildings in various parts of the United States. At Chicago it has been put in at the First Baptist Church, All Souls' Church and the Union Park Congregational Church, and in theaters at Boston, Pittsburg and San Francisco. An installation including, 50 receivers, has been ordered for the Westminster Chapel, London, England.

Fig. 2. Test in Madison Avenue Baptist Church.

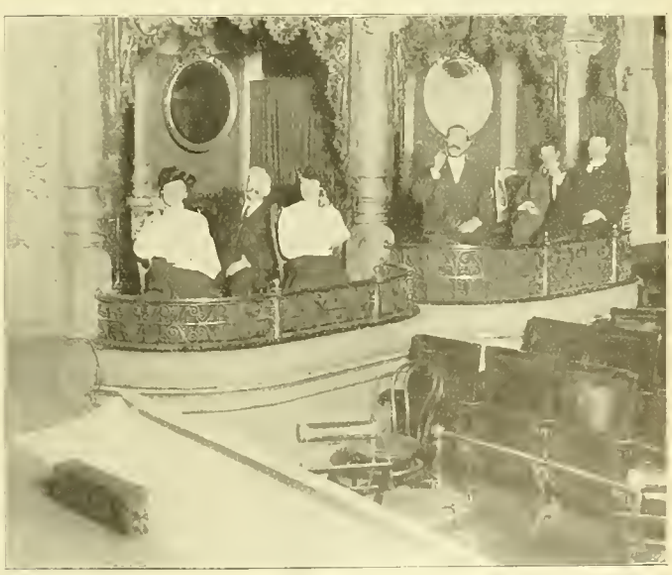


Fig. 3. Test in Hudson Theater.

THE HUTCHISON ACOUSTICON.

International Waterways Commission.

[*Continued from page 235.*]

geologist of New York estimates it at about 18 per cent.

"As the result of the third factor previously mentioned—the widening and contracting of the respective channels—the discrepancy in depth of water on the Falls is even greater. This difference is apparent in many ways. In winter time cakes of ice 18 inches thick touch the sill of the American Fall in passing over, while they flow freely over the Horseshoe Fall. The American cataract is too feeble to move the limestone rocks that lie at its foot, while the rocks from the Horseshoe Fall are moved and spun by the tremendous volume of the cataract. Another index is the rate of erosion and recession of the Falls, which is about three times as rapid on the Horseshoe as on the American Fall. In plotting the crest lines of the Falls, engineers can see the outlines of the American sill through the water with sufficient distinctness to survey it readily, but on the Horseshoe Fall the position of the sill can be determined only by other criteria.

"A competent hydraulic engineer, at the request of the state geologist, has calculated that the subtraction of 40,000 cubic feet per second (about 18 per cent.) from the Niagara River above Goat Island will draw the water down to the rock-bottom edge of the American Fall, leaving a miserable little film dribbling over the sill; and that the subtraction of 40,000 cubic feet more, or 80,000 cubic feet per second in all, will dry up the American channel completely, while the Canadian channel will still be an object of interest.

"Now let us see what preparations have been made to lead us to that lamentable result.

"In 1902 a syndicate applied to the commissioners of the Queen Victoria Niagara Falls Park for permission to erect a new power plant on the Canadian side. The three companies already installed there protested vigorously but unsuccessfully, and the new plant was authorized. In the account of the investigation conducted by the commissioners, which appears in their seventeenth annual report, the following figures appear:

"Water required for chartered developments now in operation on Canadian side—

	Cubic Feet Per Second.
Ontario Power Company	12,000
Toronto and Niagara Power Company	11,200
Canadian Niagara Power Company	8,900
Total	32,100
Four new developments suggested	29,996
	62,096

"American developments now in operation and arranged for call for the following volumes of water:

	Cubic Feet Per Second.
American Niagara Falls Power Company	8,600
Niagara Falls Hyd. & Mfg. Company	7,700
Total on American side	16,300
Total on Canadian side	62,096
	78,396

"The advisory engineer, Isham Randolph, continues: '78,396* cubic feet per second out of a total of 222,400 cubic feet per second, or an appropriation of 35¼ per cent. of the available water to develop power, leaving 144,006 cubic feet to continue the scenic effects of the cataract.'

"But by that time the 'scenic effects of the cataract,' so far as the American Fall is concerned, will have disappeared. The American channel will be dried up. Furthermore, Mr. Randolph has taken into account only a portion of the chartered developments on the American side. The American Niagara Falls Power Company can consume twice 8,600 cubic feet per second without exceeding its charter. The charter of the Niagara, Lockport and Ontario Power Company contains no limit. The same may be said of other existing charters.

"These facts show that the complete extinction of the American Fall and the serious reduction of the Canadian Fall are imminent. Such an event would be a national loss from which we may well ask you to devise some sort of protection. When power companies contend among themselves over the lowering of their water levels by rival companies, we deem it our duty, and it has been our consistent policy, to stand between them all and the public interests in the level of Niagara Falls themselves, which we regard of paramount importance.

"My argument for the preservation of the beauty of Niagara Falls thus far has been based solely on esthetic considerations—popular appreciation of their sublimity and national pride in them. There is another and more material phase of the question, however, which cannot be overlooked.

"The state of New York has invested in this reservation about $2,500,000, counting appropriations for purchase, improvements, maintenance and interest. Whatever impairs the value of Niagara Falls as a spectacle impairs the value of that investment.

"In the next place, about 800,000 persons visit Niagara Falls every year. It would be difficult to compute the amount of income which this brings to the railroads, hotels, merchants and other business people of the state. A single railroad, the New York Central, received $170,000 in fares during the three summer months of 1902 on account of its Niagara business alone. If these 800,000 visitors spent only $1.35 apiece within the state on account of Niagara Falls, the business on this account is a million dollars a year; and we believe that figure might be multiplied several times, and yet be within the limits of probability.

"It is no part of my duty to suggest to you the justice of some international agreement which will regulate the proportion of water to be diverted from the Niagara River to commercial uses on one side or the other, or preventing diversions from the Great Lakes through drainage or commercial canals which will injure the financial interests at this point. The latter are fully competent to take care of themselves. But we do most earnestly urge you to devise and recommend some international agreement by which the further abstraction of water from Niagara River for purely private enterprises shall be stopped at once. The Legislature of the state of New York has formally recommended such a course, and we believe that their resolution faithfully reflects the sentiment of the people at large.

"We do not interpose our objection to the construction of absolutely necessary public works, nor do we apprehend that the greatest danger to Niagara Falls is threatened by them. Commercial canals diverting waters to the Mississippi, Hudson or St. Lawrence rivers require small volumes of water compared with power plants. The Erie canal now takes from Lake Erie only 600 cubic feet per second for about 200 days in the year. Fourteen such canals could draw from the Great Lakes and not reduce the flow at Niagara as much as one power plant developing 100,000 horsepower.

"We believe that the Dominion of Canada and the United States have a common interest in the preservation of the falls of Niagara. The treaty of Ghent, which fixed the international boundary in the Niagara River, devolved upon both governments the moral duty of protecting them. No conservative effort on the part of one can avail anything without the co-operation of the other.

"We sincerely trust that the representatives of the Dominion of Canada and of the United States on your commission may be so impressed with the responsibility of each government to the other and of both to the world for the perpetuation of the grandeur of this scenic wonder, that your conferences will be crowned with a treaty which will protect forever the beauty of Niagara Falls."

Commissioner George H. Wilkes of Victoria Park was next heard. On behalf of the commissioners of the Canadian park, he presented a report made to them on the subject of a dam in the Upper Niagara by Superintendent James Wilson, who is an engineer of ability. In this report Superintendent Wilson refers to the project to dam the Niagara River near Buffalo, and states that, in his judgment, it would have a very important bearing upon the supply of water to the Niagara River, below the dam, and would in all probability materially affect not only the riparian rights of the commissioners along the bank of the river but also the supply of water to the hydro-electric industries licensed by the commissioners to use the waters of the river at Niagara Falls for power purposes. The report gave the outflow of Lake Erie as 220,000 cubic feet per second, or 82,500,000 gallons per minute, the volume varying from hour to hour with constantly changing elevation of the surface of Lake Erie at the outlet, caused by wet and dry seasons, precipitation, evaporation and windstorms. It was told that the surface elevation of Lake Erie at Buffalo had been raised eight feet and lowered from five to 5½ feet below mean level by the wind. If the raising of the lake levels was the only question involved, there would be no question about the beneficial results that would follow the construction of the dam. The project, however, has a wider influence. The works designed were described, and their effect was pointed out, and it was told that under such a wind as occurred in February, 1894, there would be only one foot of head upon the overfall dam and the length of the crest would also be reduced. Under such conditions there would be only about one-third of the normal flow from Lake Erie, and should all the gates be closed the flow would be restricted to one-twentieth. If this minimum elevation should occur during the navigation season, the vessel interests would use every effort to keep the gates closed in order to restore the level in Buffalo harbor. The Niagara River would be allowed to run practically dry, a condition that should not be permitted under any circumstances, particularly when the whole object of the scheme appears to be to save dredging the harbors on Lake Erie and to facilitate the making of a 21-foot channel from the United States side of the Niagara River to Lake Huron, the cost of which, if the water was raised, would be $1,375,000 less than under present conditions. Reference was made to the Chicago Drainage Canal as having lowered the surface of Lake Erie 4½ inches, the volume of the Niagara having been reduced 4½ per cent., and all the waters from Lake Huron to the sea via the St. Lawrence having been likewise despoiled.

"It is now proposed," said the report, "to further sacrifice the waters of the Niagara River and Falls by making them subordinate to the navigation interests on the Upper Lakes, to cut off the free use of the Niagara River by Canadian shipping and compel it to pass by way of the Erie Canal, which is state owned and not under the control of the central government, and to further jeopardize the flow down the St. Lawrence at seasons when inland and ocean navigation is in the greatest need of all the water which can possibly be had." For these and other reasons the proposed dam was opposed.

Attorney F. L. Lovelace presented data covering 15 years of observation of the water levels of the Niagara. He felt that any artificial interference with the natural levels of the river would be vastly detrimental to Niagara, where between $7,000,000 and $8,000,000 had been expended in factories on the lands of the company he represented, saying nothing about the large investments of the power companies. A disturbance of the water levels would interfere with the continuity of the electric power service on both sides of the river, and he mentioned that Niagara Falls, Buffalo and Lockport were dependent on the power service.

Hon. Arthur Schoellkopf presented an address prepared by Chief Engineer John L. Harper of the Niagara Falls Hydraulic Power and Manufacturing Company. The paper was accompanied by drawings and photographs. The variation of the water in the river was considered at length, and it was stated that any obstruction placed in the river would injure the company's interests. The troubles of the cold season were treated at length, the pictures telling better than words how that company had to fight the ice during recent years. The opinion was expressed that it would be impossible to build any form of dam at the outlet of Lake Erie that will not increase the fluctuations of the river. Attention was called to the fact that the electrochemical processes at Niagara depended upon a constant current supply for their efficiency.

Mr. Schoellkopf also presented an address as a citizen representing banking, hotel, paper and pulp, flour milling, brewing, real estate and other interests, also as the representative of the oldest power company at Niagara. Reference was made to the vast financial interests of Niagara, and it was stated that the Niagara Falls Hydraulic Power and Manufacturing Company had always co-operated with the state reservation commissioners in the preservation of Niagara.

Representing the Ontario Power Company, Attorney F. W. Hill promised his company would file a statement shortly. He further suggested that when the commission had decided upon its final report that it ask in consultation the engineers of the Niagara interests likely to be affected.

Superintendent Rothery of the International Railway Company portrayed his company's interest in the Niagara River and power by stating the company operated about 400 miles of track in Erie and Niagara counties and in Canada along the river bank.

Engineer Value of the Electrical Development Company of Ontario, Ltd., made a report for his company.

Patrick F King made an address for the companies he represented, after which the meeting adjourned.

*This figure is printed "81,396." His other figures show that he means "78,396."

Protection Against Potential Rises.

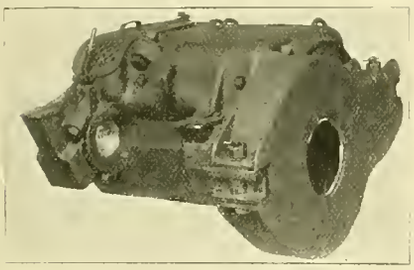
In the operation of high-potential systems of distribution of electrical energy certain conditions always tend toward the production of dangerous rises of potential in parts of the system. To relieve such strains on the insulation some adequate means must be provided. Apparatus to accomplish this is described in a paper by M. E. Dusangey, read before the Société Internationale des Electriciens. In the paper he describes types of apparatus used by Continental companies on systems working up to 30,000 volts.

In concluding his paper the author suggested the following arrangement of protective devices: Outside the station, protected from the weather, lightning arresters, of either the horn or magnetic blow-out type, are connected between each line and earth. Between this and the station spark-gaps are arranged in series between each wire and earth (by way of a high resistance) to act as an over-voltage discharger; this is arranged to operate at 50 per cent. excess pressure. Inside the station a continuous discharge of 0.2 to 0.5 of an ampere takes place by way of a high resistance to earth. Between this and the high-tension switches kicking coils are inserted, and again between the switches and machines similar kicking coils. Still another discharger of horn arresters and non-inductive resistances is connected in a delta between the switches and machine kicking coils.

Heavy Railway Motors of Recent Design.

With the reaching out of the electric railway comes an inevitable demand for heavier rolling stock and faster schedules. This in turn calls for larger, more powerful motors. To meet this requirement the Westinghouse Electric and Manufacturing Company has designed a new line of railway motors embodying wide departures and decided improvements over preceding types. The smallest motor of the new design has a capacity of 75 horsepower and the largest 200, with a number of sizes between.

Among the many excellent features which characterize these motors may be mentioned the diagonally divided field frame which makes every part

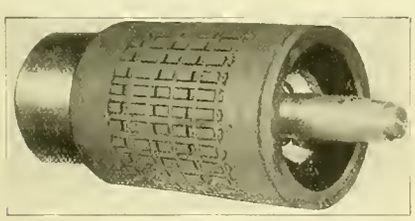


NEW 75-HORSEPOWER RAILWAY MOTOR.

accessible. The gear case is supported entirely at the ends so as to avoid the side strains which have been the source of so much trouble; housings for armature bearings clamped between the two halves of the frame; generously proportioned bearings with a very effective system of lubrication; armature and commutator assembled upon a single spider; bar-wound armature with split coils; commutators with many bars; low-current density in the brushes; bolted-in laminated poles; sealed field coils wound with strap; excellent commutation; high efficiency; low-operating temperature, and great mechanical strength.

Limitations are naturally placed on the size and construction of a motor by the amount of available space on the truck of the car; therefore the frame of square cross-section has been adopted as utilizing this space most advantageously. All motors in this line have cast-steel frames split at an angle of 45° with the horizontal. The axle bearings are carried by the lower half of the field frame and are divided at an agle of 35° with the perpendicular, so that the weight of the motor is supported almost entirely by the part of the frame extending over the axle rather than by the axle cap bolts. By lifting off the upper half of the field casting the armature may be removed from the frame without taking the motor from the truck; or the motor may be removed from the truck by simply taking off the gear case and axle caps. Three bales conveniently located make handling of the motor easy. Bolts with nuts and lock washers hold the two halves of the frame together and the axle caps in proper position.

Housings for the armature bearings are circular in form and are turned slightly larger in diameter than their seats in the frames, so that, when



ARMATURE OF NEW RAILWAY MOTOR.

clamped in place, all the advantages of a press fit are obtained. Finished shoulders on the housings prevent any lateral movement and also take the entire end thrust of the armature instead of imposing this severe strain on the clamping bolts. Two bolts through the frame at each end prevent the housing from turning.

The armature bearings are made of solid phosphor-bronze bushings finished all over with a three-thirty-second-inch lining of babbitt metal. If from neglect the bearing should become so hot as to melt the babbitt the armature would be supported on the brass shell and would not strike the poles. Both oil and waste lubrication are provided. The waste comes in contact with the bearings on the low-pressure side and is supplied with oil from separate pockets from below; in this way it is filtered before reaching the bearing. The amount of oil in the reservoirs may be gauged so that it may be kept at the proper level for economical service. With intelligent care these bearings will run 100,000 to 150,000 miles.

The axle bearings are similar in construction to those of the commutator, except that split bushings are used. Here also lubrication is by means of oil and waste, the oil being supplied from below. This is the same method which has given such universal satisfaction in steam-railway service. All bearings have generous dimensions and the large surfaces readily dissipate the frictional heat and insure cool running.

Pole pieces, built of punchings of soft steel, are bolted to the top, bottom and sides of the motor frame, which, being almost square in cross section, permits the use of flat field coils. These coils are wound of copper strap insulated between turns with treated asbestos ribbon and then carefully taped and given repeated dippings in specially prepared insulating compounds and varnishes, which make them moisture repelling and able to stand internal heat. Brass hangers hold the coils in place independently of the poles.

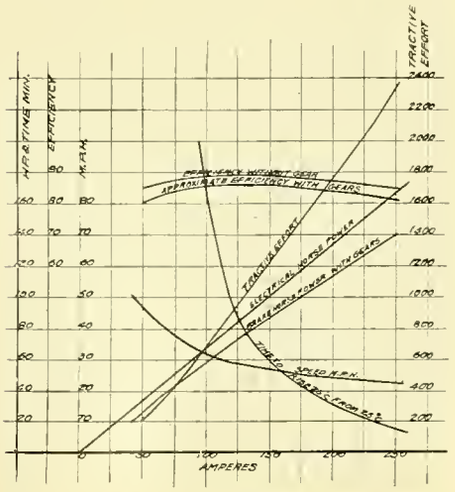
The armature core is built up of steel punchings keyed on a cast-steel spider which also carries the commutator. The shaft is forced into the finished armature and keyed thereto and may be removed should necessity arise without disturbing the windings or commutator. The armature coils are strap-wound and made in two parts. As the top coils are more liable to injury, this design makes it possible to remove the damaged part without disturbing any other part of the winding. The coils are liberally insulated with mica and sealed and further insulated by dipping in varnishes which are oil-proof and moisture-repelling. On each end the armature slots are made deeper and wider, thereby providing space for mica cells, which greatly reinforce the insulation at these points. As a further protection fiber strips are taped to the upper sides of the top coils. A bell-shaped flange at the pinion and a cylindrical flange on the commutator end form rigid supports for the windings. Counter-sunk bands of steel wire on the core hold the coils firm and secure. Openings through the spider and core allow a free passage of air, which is thrown forcibly against the field coils, thus maintaining a low temperature throughout the motor.

The commutators are made from a great number of hard-drawn copper bars with short necks, 'care-

NEW 200-HORSEPOWER RAILWAY MOTOR.

fully insulated from each other and held securely between insulated V rings. A liberal wearing depth insures long life. The excellent design of the motor windings, the great number of bars in the commutators and the even-wearing qualities of the insulation produce commutating characteristics of the highest merit.

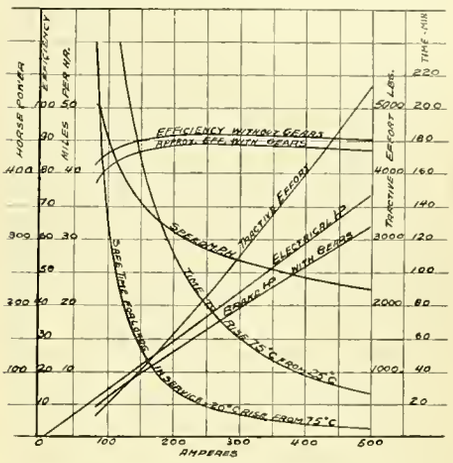
The brush-holders are of the sliding type with springs of phosphor bronze held in a harness which definitely fixes the radius of action of the spring tip and is so constructed as to practically eliminate friction between turns, making it possible to provide a large number of turns, which gives a very uniform pressure upon the brush over a considerable range without requiring adjustment. The tension of the spring may be adjusted without removing the holder from the motor. The brush-holder proper is bolted to an insulated guide and may be removed without disturbing the insulation



CURVES OF OPERATION OF 75-HORSEPOWER RAILWAY MOTOR.

or connections. Leads of flameproof flexible rubber-covered cable are brought out at the front of the motor over the commutator through insulating bushings. Access to the brushes and brush-holders is provided through a large opening in the frame over the commutator which extends well down the side, making inspection easy from the pit. A hole in the rear-end bell and an opening under the commutator provide means for inspecting the clearance between the armature and field poles.

Pinions used on these motors are machined from solid steel forgings and held on tapered seats by keys, nuts and lock washers. Gear cases are made of malleable iron and divided along the center line of armature and axle. They are supported only at the ends, which does away with all side strains



CURVES OF OPERATION OF 200-HORSEPOWER RAILWAY MOTOR.

which are responsible for so many broken gear cases. Nose suspension with safety lugs is used for all motors of this design.

The accompanying curves show results that have been obtained from a 75-horsepower motor and a 200-horsepower motor. The 75-horsepower motor was tested at 500 volts, with gear ratio 24 to 51 and 33-inch wheels. The continuous capacity is 80 amperes at 300 volts and 75 amperes at 400 volts.

The 200-horsepower motor was tested at 550 volts, the gear ratio being 25 to 58, with 36-inch wheels. The continuous capacity, when entirely closed, was 135 amperes at 350 volts; when entirely open 176 amperes at 350 volts.

Chicago Street-railway Situation.

The meeting of the Chicago traction representatives with the committee on local transportation of the City Council last week was adjourned, after considerable debate, until September 26th, at which time the traction companies agree to submit answers to a number of important questions put by the aldermen. The debate at last week's meeting indicated that the companies are seeking for a straight 20-year franchise.

The tangible results of the meeting were two offers, made by the Chicago City company, as a part of what it would agree to do in order to secure an extension of franchise. While the Union Traction representatives did not concur in these offers, they sat silent when the one involving them was made. They are understood to be bound by it. The two offers are: An exchange of transfers between the two companies outside of a fixed zone and a through routing of cars inside of that zone, so as to make a case of "one city, one fare:" an immediate rehabilitation of the service of the company on the lines of the recommendations in the Arnold report.

Opening of the Zambesi Bridge.

In the presence of the members of the British Association the great bridge over the Zambesi River on the Cape-to-Cairo railroad in South Africa was formally opened September 12th. Professor Darwin made the opening speech. He commented on the remarkable achievement which permitted a party traveling in electric-lighted saloon cars to visit a place which heroic explorers had spent months of fruitless endeavor to reach. Professor Darwin quoted the forecast written by his great-grandfather, Erasmus Darwin, in 1785:

> Soon shall thy arm, unconquered steam, afar
> Urge the slow barge and draw the flying car.

At the conclusion of his speech Professor Darwin touched an electric button which fused a wire stretched across the track of the bridge, and a locomotive decorated with Union Jacks passed over.

The Zambesi Bridge, the highest in the world, is of the cantilever type, 420 feet above low water, crossing the gorge at Victoria Falls. There are three spans, the width of the structure being 30 feet.

The Locomotion Problem in London.

[From the London correspondent of the Western Electrician.]

London, September 1.—The main report of the Royal Commission on London Traffic has now been published over a month, and it is unlikely that any of the seven subsequent reports yet to come will materially affect the propositions laid down therein. As stated in the Western Electrician (London letter) at the time, the main purport of the report is to recommend a large extension of tramways, the building of two new arterial thoroughfares (north to south and east to west) and the constitution of a traffic board for London. The commission was brought into being in February, 1903, and consisted of 14 members.

The report, as it is at present, merely makes suggestions as to what is necessary to bring about an ideal condition of means of locomotion in London without in way hinting as to how the difficulties which have hitherto prevented this being accomplished are to be removed. Two new main avenues are recommended, each 140 feet in width, with a series of first-class arterial streets 100 feet in width, second-class streets 80 feet wide, third-class streets 60 feet, and fourth-class streets 40 feet to 50 feet. Sunken roadways are also proposed at congested crossings. With the present price of property and land in London, the first question which arises is one of cost. No definite proposals are made for new streets except in relation to the two main thoroughfares, which, it is computed, will cost something approaching $150,000,000. Now, quite obviously, in the existing condition of legislation in the metropolis, such an undertaking as the construction of these thoroughfares could not be placed in the hands of private individuals. On the other hand, municipal indebtedness is almost a crisis, and the mere suggestion of the expenditure of such a huge sum has not even been taken seriously by the borough councils. And the London County Council, likewise burdened, as it is and will be for several years, with the task of converting the horse tramways of London—both north and south of the River Thames—to electric traction, is almost already so overweighted with capital commitments that it would seriously ponder ere putting upon itself this enormous additional responsibility. That London will eventually find itself equipped with the streets proposed is quite likely, for even at the present stage the trend of London street improvements has been towards this end, and it needed no commission to sit for many months in order to come to this conclusion. So much for street improvements from which, of course, electric tramways are inseparable.

Coming to tramways as distinct from street improvements the present position is this: There are some 204 miles of tramways at work in Greater London—something over one-half electric—and nearly 150 miles authorized but not yet in operation, the bulk of the whole being under the control of the London County Council. This compares very unfavorably with the other large cities in the United Kingdom, and to some extent has been due to the dilly-dally policy of the predecessors of the London County Council and the unfavorable conditions put upon the old companies under the Tramways Act of 1870. Outside of London proper and within the area of Greater London a large proportion of the tramways are worked by companies. The present want of communication across the bridges of the Thames, linking up the northern and southern districts, has been responsible for an enormous amount of congestion consequent upon the creation of many tramway "dead ends" on the outskirts of the central portion of London. The tramway accommodation, in the words of the report, "is glaringly defective, and it is difficult to appreciate how the state of things could have been tolerated so long."

The remedy proposed by the commission is the construction of 23 new routes of tramways in addition to the main avenues already mentioned, and the abolition of the local "veto," with a preferential right in favor of the London County Council and the city corporation. Here again, looking at the matter in a broad sense, one feels constrained to utter the same complaint, viz., that the commission in recommending the abolition of the "veto" has merely echoed sentiments which have been expressed by every tramway man, who is not a municipalist, for the last 10 years, probably, without indicating any way out of the difficulty. At present in London the London County Council, the city corporation and all the 26 borough councils have the right, under an act of Parliament and safeguarded by the standing orders of the Houses of Parliament, to veto any tramway scheme proposed concerning their areas. The borough councils can exercise and have exercised this veto against the City Council, even. Hence the total exclusion of the private promoter within London proper. The prospect of a modification of the present methods of legislation cannot be considered alluring, and it will be evident that much time and discussion must ensue before the recommendations of the commission in this direction can be expected to bear fruit.

One or two other matters may be briefly mentioned before dealing with the one practical recommendation in the report, viz., the creation of a traffic board of control. The opinion is expressed in the report that as, after expert evidence, it has been made abundantly clear that the cost of tube railways and shallow subway tramways or railways is about equal, preference should be given to the latter on the score of general convenience. It is pretty generally felt, however, that, with the gradual conversion of the suburban steam lines to electric traction and the progress that has been made with the group of tube railways controlled by Mr. Yerke's company, the Underground Electric Railways Company of London, very little further accommodation of this character is needed.

The recommendation as to the board of control is that there should be constituted by Parliament such a board, preferably consisting of three members, adequately paid, so that the whole of their time should be devoted to the work. The chief duty of the board should be the examination and co-ordination of schemes of locomotion before they are submitted to Parliament. The board also should make an annual report.

There yet remains to be published the report of the engineering experts who advised the commission—Sir John Wolfe Barry, Sir Benjamin Baker and Mr. William Barclay Parsons. But this will only relate to engineering details and therefore can hardly affect the criticism leveled at the main report of the commission. G.

Improved Electrolytic Process.

In electrolytic processes in which the reaction at one electrode is not the exact reverse of that at the other electrode there is a gradual and progressive change in the electrolyte. This is due to the fact that something is either added to or extracted from the electrolyte or formed or decomposed in it, thereby changing its composition or concentration. In such cases it may happen that the cumulative change thus produced in time interferes with the proper continuance of the desired electrolytic process.

The object of an invention recently patented by Carl Hering of Philadelphia is to provide means by which such objectionable cumulative change in the electrolyte may be prevented, thus enabling the desired process to be continued. This is accomplished by using an electrode of such nature and material as to combine chemically with the objectionable ingredient as it is formed in the electrolyte, thereby rendering it inert as far as the electrolyte is concerned, and thus preventing the latter from being contaminated. In many cases the objectionable ingredient, which is thus removed from the electrolyte is a useful product, and the process further contemplates the recovery of this ingredient by removing the electrode with which it has combined and passing the reverse current through it in a second electrolytic process.

As an instance of the numerous applications which may be made of the process may be cited that of the extraction from spent battery cells of the liquid depolarizer which has diffused through the porous cup or diaphragm of a battery into the compartment containing the exciting liquid. By using a suitable electrode the depolarizer may be made to combine with it and may be removed from the exciting solution and again recovered in a separate receptacle containing the depolarizer solution for the battery by passing a current in the reverse sense through the electrode while it is inserted in this depolarizing solution. It is sometimes advisable to separate the two plates by a porous partition while the depolarizer is thus being extracted in the process of regeneration; but this is not always necessary.

In the common form of primary battery, in which zinc in suphuric acid and carbon in chromic acid are employed, some of the chromic acid either as such or in the reduced form diffuses into the exciting liquid, and when the liquids are regenerated and used repeatedly this diffused depolarizer would soon accumulate to an objectionable extent. By the application of the process the excess of the depolarizing liquid which has diffused into the exciting liquid may be extracted by causing it to combine with a cathode of peroxide of lead during the first part of the process, when the free acid is being extracted from the solution—that is, when a peroxide-of-lead plate and a spongy lead plate are discharged therein. By what might be called a "primary-battery action" the spongy lead anode is oxidized by combining with sulphuric acid, and the peroxide-of-lead cathode is reduced by combining with the chromic acid, both forming insoluble combinations with the electrode, thus enabling these ingredients to be removed from the solutions by removing the electrodes. The peroxide of lead will also combine with the reduced chromium sulphate, apparently by first oxidizing that solution by a purely chemical reaction, and then combining electrochemically with the oxidized chromic acid. The chemical equations for all the parts of the process are given below. To recover this depolarizer the discharged electrode—as, for instance, the peroxide-of-lead plate in the above specific case—is removed from the solution and is placed in another vessel containing the depolarizing liquid and a reverse current is sent through it, making it the anode. The plate will then become peroxidized again, setting free the depolarizer in the solution from which it originally came. While this is being done the spongy lead plate, which combined with the sulphuric acid, is reduced aagin in the solution from which the zinc has been extracted—that is, it is made the cathode—thus giving off the sulphuric acid again in the free state. By this means both plates are simultaneously returned to their original condition and the respective solutions are purified, being kept separated by a porous diaphragm. While the acid is being set free from the sulphated spongy lead plates as cathodes, the peroxide-of-lead plates, which are then in the discharged depolarizing liquid, separated from the acid solution by a diaphragm, may be used to act as anodes for reoxidizing or regenerating the rest of the depolarizer after they have given off the chromium and the sulphuric acid with wbich they were combined.

The reactions which take place in the various steps of a typical application of the process are believed to be as follows: Taking for illustration the case of the exhausted solution of a zinc-sulphuric acid, chromic acid, carbon battery. This will generally be found to contain some unused sulphuric acid as well as chromic acid, besides the large quantities of zinc sulphate and chromium sulphate formed during the discharge of the battery. During the first part of the process the free sulphuric acid is taken up by both the spongy lead and the lead-peroxide plates according to the following reaction:

$$Pb + 2(H_2SO_4) + PbO_2 = PbSO_4 \text{ (on lead plate)} + 2(H_2O) + PbSO_4 \text{ (on peroxide plate)}.$$

If any unreduced depolarizer is present its combination with the peroxide-of-lead plate may be explained by the following equation:

$$Pb + H_2SO_4 + H_2CrO_4 + PbO_2 = PbSO_4 + 2(H_2O) + PbCrO_4.$$

A peroxide-of-lead plate, as soon as it is placed in the reduced depolarizer solution, tends to oxidize some of the reduced depolarizer. This seems to be a purely chemical or local action and can be explained by the following equation:

$$Cr_2(SO_4)_3 + 3PbO_2 + 2H_2CrO = 2H_2CrO_4 + 3PbSO_4.$$

The oxidized depolarizer thus formed then combines by what seems to be an electrochemical reaction with some more of the peroxide according to the preceding equation. It will thus be seen that the peroxide of lead seems to act both chemically (or by "local action," as it is sometimes called) and electrochemically.

The reaction taking place when the zinc is deposited is as follows, and it will be seen that one electrode—the cathode of mercury, for instance—receives the zinc in the form of an amalgam, while the SO_4, with which the zinc was in combination, combines with the other electrode (the anode):

$$Hg + ZnSO_4 + H_2O + Pb = Hg\ Zn + H_2O + PbSO_4.$$

From this it will be seen that no sulphuric acid is set free during the deposition of the zinc, and the extraction of the zinc may therefore be continued to any degree desired without an increased evolution of hydrogen.

As a logical outcome of the above actions it will be understood that the plate having on it lead sulphate may thereafter be treated by passing a current between it and a plate of lead peroxide immersed in an exhausted battery solution containing chromium salts in the green or reduced form, thus simultaneously regenerating the plates and oxidizing the chromium salts, as shown in the reaction:

$$3PbSO_4 + 8H_2O + Cr_2(SO_4)_3 + 3PbO_2 = 3Pb + 6H_2SO_4 + 2H_2CrO_4 + 3PbO_2.$$

Power Development in Western Michigan.

Under the Stone and Timber Act, representatives of M. B. Wheeler & Co. of Grand Rapids, Mich., have filed 15 entries of lands on the Manistee River in Manistee County at the government land office in Marquette. The lands are located in a solid block, and it is understood that the rapids of the river will be harnessed, a transmission plant built and the electric current generated furnished to Manistee, Mich., for power and lighting. Wheeler & Co. have secured franchises in Manistee for the uses of the streets for wires and poles, and similar franchises have been secured in other cities. Manistee's electric current is now generated at a plant owned by the estate of Louis Sands. The plant when installed 17 years ago was operated by the use of the waste slabs from the lumber mills as fuel. With the passing of the mills the price of slabs went up and the price of electric current was raised.

Wheeler & Co. are constructing also a dam on White River, from which they will furnish power to Muskegon.

The Marshalltown (Iowa) City Council is considering improvements in the city's lighting system. New machinery will probably be installed.

Central Station in St. Petersburg, Russia.

By A. de Courcy.

The central electric-lighting station which has been erected within recent years at St. Petersburg is the largest which exists in Russia at present. The current is used for public and private lighting throughout the city. A Belgian firm, with headquarters at St. Petersburg, controls the plant, and the electric outfit was supplied in part by the Compagnie Electricite et Hydraulique of Charlevoi, one of the leading Belgian electrical firms, and the remainder by the Swiss firm, Brown, Boveri & Co. The plant generates single-phase alternating current at a tension of 2,000 volts, which is distributed throughout the city by an extensive series of cables which leave the station in all directions. The total length of cable is nearly 200 miles. Most of the cable is laid underground, and is of the armored concentric form, with a high insulation. In the present case there are no secondary cable circuits or mains, seeing that a special transformer post is used at the point where the cable is branched into each building.

The St. Petersburg plant is laid out for a total capacity of 7,000 kilowatts, and when fully equipped was designed to contain 20 direct-coupled alternator groups, each of the latter to consist of a triple-expansion engine of the upright pattern, connected to a monophase alternator of 350 kilowatts. In the first place there were 14 of such groups installed in the main dynamo room, with seven groups to the right and the same number to the left of the central passage. Later on, there were added two other groups, this time using steam turbines of 1,000-horsepower capacity, which Brown, Boveri & Co. furnished. Under the central passage are the cables which lead from the machines to the switchboard in the front of the dynamo room. The latter is placed against the front wall of the building, and the machine cables are brought to it by conduits lying under the flooring.

Each of the alternators has an exciter mounted on the end of the shaft and lying next the middle passage. One of the most interesting features of the St. Petersburg station is the very complete switchboard which has lately been installed to handle the alternators, exciters and the great number of feeder cables. It was put in after discarding a small board which had been in the station from the start, but which proved insufficient for different reasons. It is to be remarked that in the present plant one pole of the high-tension cables of the outer circuits is connected to earth. This method had been required by the constructor who furnished the cables, in order to protect it against accidents, especially against the breaking down of the concentric cable, owing to capacity effect which might arise when the current was thrown on. The present switchboard was laid out to handle the whole output for which the station was designed, with apparatus necessary for 20 alternators carrying 35 feeders of 200 amperes capacity each. Seeing that one pole of the entire high-tension circuit is connected to ground, there is but one insulated pole brought to the switchboard in this case. The main part of the board is mounted in a galley about 10 feet above the main floor of the station. One insulated circuit is carried to it from each of the alternators. The ground cables of the machines have independent switches. There are three skeleton frames lying parallel to the wall of the building. The rear one is used for the feeders, while the two frames lying toward the front of the gallery serve for the machines. To secure a double insulation the frames of the board are mounted on a large platform of channel iron, and the whole weight, 45 tons, of board and platform is carried on 120 high-quality insulators, placed on the floor of the gallery. Cleaning or inspection of the insulators is easy in this case.

Below the main gallery and on a level with the station floor are two frames for the fuses of the machines and feeders. Here are also placed the rheostats, and their operating shafts pass up to the panels in the gallery. The under part of this board also serves for taking different measurements. One point to be noted is the arrangement of the bus-bars of the alternators in the principal switchboard. A double set of bars has been adopted here, according to an improved scheme. The bus-bars are divided into 10 sections by switches. Normally, each set is connected across to the bars of the feeder switchboard in the rear by short bars, which contain also the registering ammeters and wattmeters. Sectioning the bars in this way allows of doing repair work, etc., on any of the parts without any danger, by opening the proper switches, and there is also an especial advantage, that of using a set of reserve bus-bars, which is one of the characteristics of the new system. In usual working there is only one set of bars in use, while another set acts as a reserve. On switching in one or more feeder cables to the circuit these are first put on the reserve bus-bars. One of the reserve alternators of the station is then used to gradually raise the voltage on the reserve bars until they have the normal voltage. By using a synchronizing apparatus this machine is now thrown in parallel on the main circuit. Thus the two systems of bus-bars now run in parallel and the feeder can be thrown on to the main bars by another set of switches. After this is done the reserve alternator is stopped. To take the feeder out of the circuit this operation is reversed. In this way either the whole feeder system or any part of it can be thrown into circuit gradually.

Besides, the reserve bar is of great advantage for carrying out all kinds of tests in the station without disturbing the working circuits. It can be used to make tests upon certain of the alternators and also to check up feeders in the recently installed parts of the circuit. In the latter case the circuit in question is first run at a low voltage and then can be gradually raised until it has the standard voltage of the station should the readings show that all is going well.

The switchboard for the machine is divided into two halves which correspond to the sets of alternators lying on either side of the station, with a middle passage leading to the feeder switchboard in the rear. The alternator board contains on the left the apparatus for the corresponding 10 machines, and on the right the apparatus for the second set. For each of the 20 alternators the board carries, on the marble panel forming the front, one voltmeter and three-way circular switch, one phase lamp with double switch; also a plug for a portable phase voltmeter and the handles of the two main switches, which latter are mounted in the rear on the frame. Oil switches are adopted here, as they are non-sparking and take but little room. In fact they can now mount one switch above the other, as there is no danger from sparking. The two sets of main bus-bars run above the switches at a convenient height. Below the main switches are the instrument switches, and a shelf projection contains the operating devices for the exciter resistances and the exciter ammeters. Each exciter rheostat can be regulated separately, but a second method is to be noted, as all the exciter rheostats can be worked at once by a second hand-wheel and shaft. Thus by working a single wheel the whole station current can be cut down or suppressed by means of the exciter.

The feeder frame lies back of the other board at four feet distance. The apparatus is placed on the side away from the wall. Movable gauge screens here replace the marble panels. The bus-bars run across the upper part of the board along with their sectioning switches at intervals. Each of the branch circuits going from the bus bar to the outside circuit is provided with a double set of oil switches mounted one above the other, as in the above case. From the switches a cable leads below the board to the feeder fuses of the different cables leaving the station. Before the fuses comes a transformer for the ammeter. All the ammeters of the feeders are mounted in line upon a marble-faced projection forming a table. In this way are placed the apparatus and instruments for 30 double feeders which are provided for in the switchboard. Besides the main bus-bars the frame contains 120 switches and 30 ammeters with their transformers. In the middle of the board there is a separate panel containing two static voltmeters with switches in their circuits. These instruments are used to give a permanent control of the state of the insulation between the insulated gallery and the earth, and also between the iron framework and each of the two sets of bus-bars. To balance any eventual increase of tension which might be produced by capacity effects in the cable system, each of the sections of the feeder bus-bars have spark-gaps in the shape of a double-horn lighting arrester in order to correct the tension between cables and conduits.

The Atchison Railway, Light and Power Company of Atchison, Kan., has amended its charter, increasing its capital from $300,000 to $900,000, and will build interurban lines to surrounding towns.

Interurban Mileage Made Interchangeable in Three States.

Twenty-nine interurban electric railways in Indiana, Ohio and Michigan, with a total mileage of about 17,000 miles, have made arrangements for the use of interurban coupon-ticket books. For months the managers of Ohio and Indiana interurbans have been struggling with the interchangeable coupon-ticket proposition, trying to reach a basis of agreement. Not all of the Indiana roads are now in the agreement, but others are expected to use the interchangeable books in a short time.

A book containing 240 five-cent coupons, worth $12, is to be sold for $10, giving a reduction of 16⅔ per cent. in fares from the regular rates. Indiana roads in the agreement will place them on sale at all their stations, as well as at the Traction Terminal Station in Indianapolis. The coupons will not be accepted as fares within the limits of Indianapolis, and no fewer than two coupons will be detached by a conductor. Every interurban railway out of Indianapolis will use the books at once, except the Indianapolis and Northwestern. The Plainfield line, which is coming to be spoken of by interurban men as a "suburban" rather than an interurban line, will probably not sell tickets in any form.

Outside of the roads running into Indianapolis the only Indiana lines that will use the books are the Richmond Street and Interurban, and the Fort Wayne, Van Wert and Lima, which runs into Ohio. Most of the 29 lines are in Ohio. Two are in Michigan. The coupons will be good on limited trains between points scheduled as stops for such trains on the payment of excess fare.

Electric-light Plant for Mussoorie, India.

An electric-light plant is to be erected in Mussoorie, British India. Bids are invited for the following materials: Steel pipes, water turbines, alternating-current dynamos, switchboards and instruments, transformers, induction motors, pumps, tools and implements for the workshops. The foregoing are to be supplied and erected by the successful bidder, but the following simply supplied: Plain copper conducting wires, insulators, arc and incandescent lamps, telephone plant, tools, sundry materials. The conditions may be obtained from the city engineer, C. H. Chanan, municipal office, Mussoorie, upon deposit of 75 rupees (about ($25), which sum will be returned upon presentation of bona-fide bids. Sealed offers in the prescribed form, bearing the heading "Tender for electric-lighting and waterworks scheme," are to be in the hands of the chairman of the Municipal Board, Mussoorie, U. P., India, by October 23d.

Niagara Power for New York Central.

The Niagara, Lockport and Ontario Power Company, which is to supply the power with which to operate trains on the New York Central lines when they are electrified, has opened offices in Rochester. The company is to supply the power west of Utica. The company is not to do a retail business in the various cities along the line, the Rochester office being opened simply for the convenience of employes. Robert E. Drake, a director of the company, is credited with the statement that the West Shore right-of-way is to be used for the most part across Monroe County. The Niagara, Lockport and Ontario Company is to begin supplying power to the West Shore before next June at Syracuse, Rochester and Niagara Falls. No power is to be delivered on the main line of the Central, which indicates that only the West Shore (controlled by the New York Central) is to be electrified at present.

Chicago-Indianapolis Electric Railway

That Indianapolis and Chicago will be connected by an important interurban trunk line is now assured, it is said. W. S. Reed of Chicago, formerly of Indianapolis, has purchased the Chicago Electric Traction Company. Mr. Reed formed the syndicate which purchased the holdings of the Chicago and Southern Traction Company. The two companies will be combined, and it is promised that an electric trunk line will be built from Chicago to Lafayette, Ind., by way of Kankakee, Ill. At Lafayette connection will be made with the Indianapolis and Northwestern for Indianapolis. The line will be 117 miles long. W. H. Conrad, formerly of the Chicago Electric Traction Company, will be general manager of the new line, it is announced.

Through the efforts of the Chamber of Commerce of Chico, Cal., the business men of that city have agreed to purchase a tract of 10 acres of land in Chico on which the Northern Electric Railway Company agrees to erect machine shops, car barns and headquarters for the company.

Alleged Independent Telephone Consolidation.

[Special correspondence of the Western Electrician.]

Cleveland, September 18.—The visit of a party of Independent telephone men from St. Louis, Kansas City, Indianapolis and other places to the principal telephone centers in the Central West seems to have set the daily newspapers all agog, and they have been printing fantastic stories of giant mergers and combinations. While it may be said they were on the right track, they overdid the thing by quite a little.

There is no question as to the fact that the Independent people are arranging to place themselves in a better position, but at the present time, at least, this will not be done by a giant merger of all the companies, such as has been suggested. President James B. Hoge of the National-Interstate Telephone Association said today that there would probably be something done in the way of grouping the local exchanges, but that definite plans had not yet been decided upon. By this is meant a plan by which all the companies in a county or certain defined territory will be grouped under one management. This would render the operation better and more satisfactory and the management less expensive.

So far as the long-distance lines are concerned, Mr. Hoge said that some plan would be worked out for securing closer and better traffic arrangements, but that telephone people are not sure that a merger of the companies owning them would be the right thing just yet. But the lines can be connected directly, so that messages may be sent direct, as if all the lines were owned by one company, and, through a perfected system, the matter of settlement for such business would resolve itself into a question of bookkeeping. The Independent people have all along contended that standardization in every branch of the business would be the method by which they would win success in the long-distance business.

What they desire more than anything else is the extension of long-distance wires into new territory, and this is only a question of time. The development has now gone further than even most telephone men know, unless they have given it close attention. The assertion may be safely made that before long the wires will extend across the continent and from Canada to Mexico.

Although the plans have not been decided upon for either the local or long-distance companies, the matter of finances is not standing in the way. Whenever arrangements have been completed for a move in any direction, the money will be at hand. To this time, this has stood in the way of the Independent people, but confidence has been established and the bugbear has vanished. It may be said that this has all been arranged and only awaits any plans that may be matured.

An informal dinner was tendered to the visiting telephone men at the Colonial Hotel, Cleveland, this evening. President Dickson of the Cuyahoga Telephone Company and James B. Hoge, president of the National-Interstate Telephone Association, acted as hosts. A number of local bankers and business men were present. The visiting party consisted of Breckenridge Jones, C. M. Foster, H. L. Reber, W. R. McCanne, James Harrison and W. F. Molker, St. Louis; H. P. Sale, E. I. Lewis and M. P. Broker, Indianapolis; O. C. Snider, Kansas City. Preceding the dinner, these men made an inspection of the plant and lines of the Cuyahoga Telephone Company.

It is said that Adolphus Busch of St. Louis and J. J. Heim of Kansas City, both wealthy brewers, and a number of Pittsburg men affiliated with Standard Oil interests are taking much interest in the Independent telephone movement and probably will aid in financing any plan that may be formulated for the closer affiliation of companies, that will result in a uniform service. C.

New Central Union Offices.

The Central Union Telephone Company occupies the greater portion of eight of the 10 floors of the new fireproof building in Indianapolis built by the Indianapolis Gas Company. The executive offices are on the eighth floor, which is divided into five suites, occupied respectively by the president, general manager, attorney, traffic engineer and general contract agent. The auditing department occupies the entire sixth floor, while the purchasing department and extra clerical force of the traffic department divide the second floor. The Indiana division superintendent has offices on the third floor, the secretary and treasurer on the fourth, the engineer on the ninth and the Indiana contract and equipment department on the tenth. All departments are connected by a private branch telephone exchange, which has 15 trunk lines running to the Indianapolis exchange.

Indiana Telephone Items.

Three new telephone companies filed articles of incorporation during the last week: The Home Telephone Company of Flora, with a capital stock of $5,000, Harry E. Soesbe, H. E. Studebaker and Joseph Studebaker, incorporators; the Home Telephone Company of Hancock County, with headquarters in Greenfield, A. F. Reevey, M. E. Dobbins, S. A. Wray, incorporators, and the Citizens' Telephone Company of Hancock and Henry Counties, with a capital stock of $1,000, W. B. Thompson, Henry Griffith and others, incorporators.

Three more Indiana telephone companies are said to have joined the Central Union Telephone Company. Through a sub-license deal practically all of Ripley County and portions of Franklin and Decatur counties will hereafter have long-distance service through Bell instruments and over Central Union toll lines. About 1,000 subscribers are involved in the arrangement. The companies in the deal are the Batesville Telephone Company, the Versailles Telephone Company and the Osgood Telephone Company. The Central Union company also says it has entered into a sub-license contract with the Dunkirk, Redkey and Pennville telephone companies, which will add 1,000 or more subscribers to the list in Jay County. The territory controlled by these companies lies south and east of that of the United Telephone Company, which became a Central Union sub-licensee last May.

Members of the Independent Telephone Association of Indiana from the Eighth District, comprising the counties of Wayne, Henry, Fayette, Union, Franklin and Rush, held their first district meeting in Cambridge City during the last week. There are 20 or more companies represented, and a general and profitable exchange of ideas and experiences was had. This is the first district meeting under the plan of organization adopted at the meeting of the state association organized at Winona on July 12th, and the officials are greatly encouraged with the interest manifested.

Disappointed in its attempt to get its franchise amended so as to permit it to enter into a combination with the Bell Telephone Company, the Citizens' Telephone Company of Kokomo has served notice of an increase of 25 cents a month on residence telephones, also that subscribers will be required to pay quarterly in advance. Subscribers are displeased at the prospect of an increase, and are asking the City Council to make an investigation. There is little hope that the company can be induced to withdraw the new rate, because the franchise under which it operates grants the right to charge $1.50 a month for residence telephones. It is believed, however, that a rescinding of the order requiring the payment quarterly in advance can be forced.

All of the overhead wires of the telegraph, telephone and electric light companies in South Bend have been forced underground in the downtown district with the exception of the Western Union and the long-distance telephone people. An ordinance imposes a fine of from $25 to $100 for each day since June that the ordinance is not respected, and the city attorney has brought suit against both companies to enforce the ordinance and collect the penalty.

H. B. Sale, vice-president and general manager of the Indianapolis Telephone Company, and the New Long-distance Telephone Company, in company with a number of western telephone men and capitalists, are making a tour of the East and the South for the purpose of considering means for extending and improving Independent long-distance service under a mutual arrangement. It is not proposed to merge the property interests of the interested lines, but simply to enter into a mutual commercial arrangement whereby service may be extended between the different cities of the country. One of the chief objects of the Independent men is to get into New York and other large cities which are not included in the present service. Another object of the tour is to inspect the plants and secure ideas, and exchange information about operating methods, etc. S.

Telephone News from the Northwest.

The Sioux City Automatic Telephone Company seeks admission to Vermilion, S. D., for toll-line service.

R. W. Crawford, manager of the Rhinelander Mutual Telephone Company, Rhinelander, Wis., has resigned to accept the position of district manager at Stevens Point.

The International Telephone Company has been granted a franchise for local service at International Falls, Minn., after considerable discussion and amendment.

The Valley Telephone and Telegraph Company of Green Bay, Wis., and the Fox River Valley Telephone Company of Appleton, Wis., have consolidated.

The local telephone exchange at Pierre, S. D., has been sold to the long-distance line, the Dakota Central Telephone Company.

The Hallock Telephone Company has been granted a franchise for a local exchange at Bronson, Minn., and will install it at once.

The Great Western Telephone Company of Chamberlain, S. D., has been incorporated with $25,000 capital stock, to build a line from Presho, S. D., to the west along the Milwaukee railroad. The company has a line from Chamberlain to Presho.

The Great Northern Telephone Company has established an exchange at Mondak, Mont.

A franchise will shortly be asked at Omaha, Neb., by an Independent telephone company.

The Iowa Telephone Company has let the contract for the erection of a $20,000 exchange building at Dubuque, Iowa, to Griggs, Cain & Co. of that city. R.

The Telephone on the Pacific Slope.

The Alameda Home Telephone Company, which is expecting to secure a franchise to cover Oakland, Cal., will begin work in November if the city authorities take action in time. Work will be commenced promptly when all legal obstacles are removed. The local service will be supplemented by long-distance lines later and by connection with the San Francisco system when that is built. The Oakland Home Telephone Company, which was granted a franchise about three years years ago to install an automatic system, has interposed an appeal that it be granted further opportunity to complete its lines. The automatic telephone system in operation in Los Angeles will be investigated by a committee of the Oakland City Council before action is taken.

The superintendent of the Pacific States Telephone Company's exchange at Auburn, Cal., is arranging for a farmers' line of telephones in the Rock Creek district. Local and long-distance connections will be given by the company.

W. C. Ross, superintendent of construction for the United States Long-distance Telephone Company, has started the construction of a telephone line at Tucson, Ariz., which will extend to San Diego, Cal.

The Fresno (Cal.) city trustees have adopted the report of the franchise committee denying the application of P. Kerr Higgins for a franchise for the Home Telephone Company.

The Home Telephone Company of San Diego, Cal., has made connection with Coronado by submarine cable and is connecting up subscribers at the latter place.

The Pacific States Telephone and Telegraph Company has planned extensive improvements for its service in and around Ukiah, Cal.

The trustees of Calistoga, Cal., have adopted an ordinance granting a telephone franchise to C. M. Hoover.

Fred M. Hess will at once construct a telephone system at Bishop, Cal., under the franchise recently secured. A.

TELEPHONE MEN.

C. V. Aspinwall of Burlington, Iowa, has resigned as general manager of the Mississippi Valley Telephone Company. A. C. Reid will act temporarily as his successor.

W. F. Fox, superintendent of long-distance service of the Northwestern Telephone Exchange Company of Minneapolis, Minn., died at his home in Minneapolis on September 11th, after an illness of several months.

A. J. Lathouse, superintendent of the Columbus (Ohio) Citizens' Telephone Company, has resigned to enter the business of constructing telephone exchanges and electric-light plants, a company having been formed by him for that purpose.

NEW COMPANIES.

The Rose Hill Telephone Company of Dublin County, N. C., has been chartered with $10,000 capital stock.

The Kewanee Long-distance Telephone Company of Kewanee, Ill., has been incorporated, capitalized at $100,000. The incorporators are W. I. Hibbs, F. M. Ashe and A. C. Shoemaker.

The Hartwood and Fredericksburg Telephone Company, with headquarters at Hartwood, Va., has been chartered with $4,000 capital by P. W. Irvin of Falmount, who is secretary and treasurer. A telephone line will be built.

Recently incorporated telephone companies include the following: Clark County Telephone Company, Ashland, Kan.; Numa Mutual Telephone Association, Numa, Iowa; Eastern Utah Telephone Company, Price, Utah; Shawnee Independent Telephone Company, Silver Lake, Kan.

A project is on foot to equip Windham, Me., and adjacent towns with an Independent telephone service. A corporation has been organized to be known as the Windham Telephone and Telegraph Company. Its capital stock is placed at $10,000 and the directors are J. Hacker Hall, Thomas M. Douglass, Hiram C. Hawkes, Frank H. Haskell, William M. Cram, Fred L. Haskell and A. Howard Ayer.

Lighting Attachment for Automatic Telephones.

Charles D. Reeve of Grand Rapids, Mich., has invented an attachment for automatic telephones. It is a device to light the dial so the figures may be seen in a dark room on a dark day or at night. To use the device the dial is made a little deeper than those at present in use, and instead of figures being cast on the dial itself, they are printed on a transparent film attached to the face of the dial. Behind this film is placed a small electric lamp, which is supplied with current from a dry battery or other source. In one style the act of lifting the receiver from the hook closes the electrical circuit and lights the lamp, brilliantly illuminating the figures from behind. After operating the dial, pressing the call button extinguishes the light. In another style the lamp is lighted and extinguished by a separate button.

GENERAL TELEPHONE NEWS.

P. C. Higgins has filed a new application for a telephone franchise with the City Council of Stockton, Cal. In case the local franchise is granted it is the intention of the Home Telephone Company to use Stockton for a distributing point for the San Joaquin Valley. It is estimated that the entire system would cost from $300,000 to $400,000.

J. C. Monteith, representing E. L. Barber & Co. of Wauseon, Ohio, has purchased a block of 201 shares of the stock of the Henderson Telephone and Telegraph Company, Henderson, Ky., which, it is said, makes it certain that the plant will be operated for at least three years longer on an Independent basis. The old minority is now in possession of 374 shares.

The Eastern Utah Telephone Company has been incorporated by R. G. Miller and his associates with a capital stock of $50,000. Enough money has been paid in to start work on the Carbon County lines, which are to be built to Winter Quarters, Scofield and Clear Creek by the way of Colton, Castle Gate and Helper. An exchange is to be maintained at Price.

At the annual meeting of the Interstate Independent Telephone and Telegraph Company, held in Aurora, Ill., on September 11th, the seventeenth regular quarterly dividend of one per cent. was declared on the entire capital stock of the company. The report for the fiscal year ended June 30th also showed an increase of nearly $20,000 in the surplus above fixed charges, including interest and dividends, which was considered very satisfactory.

Suits brought by the city of Chicago attacking the Chicago Telephone Company's right to make its present charges for service have been expedited so that an early decision can be obtained from the Supreme Court. There are two of these suits. One is an information in quo warranto filed by State's Attorney Healy a few days ago, and another the mandamus suit begun two years ago. In each of these cases Judge Mack overruled a demurrer filed by the city and the latter at once took an appeal. The quo warranto suit goes at once to the Supreme Court and the mandamus to the Appellate Court. As the same points are made in both, however, a decision in either, if it goes to the merits, and is not on points of pleading, will settle matters.

MANUFACTURERS AND DEALERS.

The Electric Appliance Company of Chicago has issued a small folder upon the subject of the Eaco No. 36 telephone. The folder furnishes a careful description of the apparatus.

The Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y., reports having closed contracts for switchboards for Litchfield, Mich.; Georgetown, Texas; Paola, Kan.; Simpsonville, Ky.; Finchville, Ky.; Waddy, Ky.; Toledo, Ohio; Branchport, N. Y.; Philadelphia (for use at Scranton), Pa.; Lewiston, Idaho; Alpena, Mich.; Bristol, Tenn.; Des Moines, Iowa; Rochester, N. Y.; Walhalla, S. C.; Apalachicola, Fla.; Bristol, Fla.; Herman, Neb.; Aurora (for use at Peoria), Ill.; Newark, Ohio; Cadiz, Ky.; Bartonsville, Ky.; Donnybrook, N. D.; Sherman, Texas.

The Premier Electric Company, composed of well-known and experienced Chicago men, was organized during the month of August. It has bought the braiding plant of the McDermid Manufacturing Company at 118-132 West Jackson Boulevard, and will continue the manufacture of the Premier B B switchboard cord. Other varieties of cords employed in the telephone and electrical fields, such as receiver cords, desk-set cords, yardage cord, etc., will also be manufactured upon an extensive scale. W. J. Burton, vice-president and manager of the new company, is the inventor of the Premier B B switchboard cord and has had several years' experience in the manufacture of telephone cords. He will do his best to please all patrons.

CORRESPONDENCE.

Great Britain.

London, September 6.—The opening of the first generating station of the Yorkshire Electric Power Company was made the occasion for holding a small exhibition at the power house of electric mining and mill machinery. The power company has an area of over 1,000 square miles, which abounds in factories and small towns, to which a cheap supply of electric power must be of inestimable advantage. Many agreements have already been entered into, and it is a matter for regret that the necessary capital for launching the undertaking was not forthcoming sooner. The feature of the power house is the employment of the Curtis turbine, there being at present installed only two 2,000-kilowatt generating sets. These are of the four-stage type and run at 1,000 revolutions per minute. The power house has been designed somewhat on American lines. Eventually there will be four generating stations scattered about the area, the one first opened being in the "thickest" portion.

Sir William Preece, late chief engineer to the General Post Office, read an interesting paper before the British Association in South Africa on "Wireless Telegraphy." He stated that the Post Office has developed a system of diplex working by which two messages can be sent in the same direction at the same time. The admiralty is now using the Marconi system, with improvements by Captain Jackson, R. N., and for the right of using the system the Marconi company has been paid $10,000. Sir William concluded, after briefly touching upon the history and progress of wireless telegraphy in many lands, that the sea is the domain of wireless telegraphy, where even yet it is not reliable for continuous periods or for long distances. For war purposes wireless telegraphy is imperative whatever its cost.

An echo of the recent fight in Parliament for the big electric power bill in London is the announcement by one of the leading electric-supply companies of a reduction in its tariff, which will give a supply to a customer at as low as 2¼ cents per unit, according to load factor.

The Lancashire and Yorkshire Railway Company, which has converted some of its steam lines to electric traction, still suffers from the competition of electric tramways. In consequence a service of steam motor carriages has been established upon another of its steam lines, and stoppages are made at definite spots between the stations for the purpose of picking up and setting down passengers.

The number of tramway accidents which occur, owing to the brakes failing to act in consequence of the greasy condition of the rails, seems to be rather on the increase of late. Following the Ramsgate accident, where a car was precipitated off a cliff onto the seashore, a similar occurrence took place on a hill at Glasgow. It is interesting, therefore, to note that the Board of Trade is paying especial attention to the brakes of cars when authorizing new routes. At Plymouth a short time ago a special brake was asked for, which would prevent a car running downhill backwards. The officials have cudgeled their brains and evolved a satisfactory piece of apparatus.

For some time past efforts have been made to incorporate University College, London, with the London University, but the sum of money necessary to complete the transfer has been forthcoming but slowly. Yesterday it was announced that a member of the Stock Exchange, through Mr. Edgar Speyer, had given $500,000 to London charities, and from this sum the necessary amount, viz., $80,000, is to be taken for completing the transfer.

The difficulties of the Torquay corporation with regard to its electric-tramway scheme are not yet over. It may be remembered that when the Dolter Electric Traction Company proposed the construction of electric tramways in Torquay the corporation threatened to exercise its veto unless the company entered into an agreement to take its electrical energy from the municipal works. This was agreed to and the work put in hand. When the question of the supply of electrical energy came up for consideration it was found that the existing electricity works were not large enough for the extra supply and that it was not convenient to extend them. Hence a new power house was contemplated and a loan applied for. But in view of the past unsatisfactory results obtained in Torquay the Local Government Board refused to sanction such a large sum of money being spent. The tramway company thereupon threatened to sue for breach of contract if the current was not forthcoming in time for its requirements. So matters have proceeded for some months, and fortunately the parties have met in an amicable spirit and some sort of compromise is likely to be reached. The present proposal is to ask leave to borrow a small sum to erect temporary buildings in which to install sufficient plant for the tramways. G.

Dominion of Canada.

Ottawa, Ont., September 16.—The Newfoundland government has completed the laying of a cable from Canso, Nova Scotia, to Fort Aux Basque, Newfoundland, connecting with all land lines on the Island of Newfoundland. This will give the Canadian Pacific Railway Company's telegraph a direct connection with all parts of the island, and it is now open for business.

The city of Kingston, Ont., has conducted its electric and gas plants as a municipal utility for a year and has a surplus of $15,000 after spending some $6,000 on needed repairs.

The power company recently organized at Montreal for the construction of an electric power plant at Kaministiquia Falls, near Fort William, Ont., will rush the building of the works as rapidly as possible. The company has let contracts to the Canadian General Electric Company for the generators, exciters, switchboards, etc., the total cost being, it is understood, in the neighborhood of $200,000.

It is announced that negotiations are being conducted for the sale of the franchise of the St. Catherines, Pelham and Welland Electric railway to the Toronto and Niagara Power Transmission Company. This will give the Toronto and Niagara a route out of St. Catherines and into Welland, and a spur from Fonthill to Fenwick will be constructed also.

Some remarkable figures relating to Ontario's power problem are presented, whereby it is pointed out that one syndicate has secured the right to develop 125,000 horsepower at Niagara Falls. The sale of this energy at between $15 and $16 per horsepower per annum would produce a revenue of $2,000,000, or equal to four per cent. on a capitalization of $50,000,000. As a matter of fact, however, the syndicate is making contracts for the sale of power in Toronto and to suburban railways out of that city at figures which, if maintained at a corresponding level all the way through, will give a revenue of from $5,000,000 to $7,000,000 a year. This great revenue, it is alleged, will be earned by a plant the actual cost of which is estimated at less than $10,000,000.

As a result of the recent dangerous electric fire in Montreal, which burned out a whole light and power circuit at the power house of the Montreal Light, Heat and Power Company, the latter company has entered suit against S. Carsley of the Central Electric Company for $150,000 damages, alleging that the fire was caused by one of the Central company's wires falling onto its 10,000-volt wire.

Sir Sandford Fleming, who represented New Zealand at the Pacific cable conference at London, has returned to Ottawa. He would like to see the cable used for free press dispatches. Some steps toward convincing the Australian public of the practical benefit of such a course will be taken before the contract of the Eastern Extension Telegraph Company with the newspapers of Australia, for the supply of news, has expired.

Winnipeg, Man., September 16.—The building of the electric railway to run from Chilliwack to New Westminster has been commenced. The right-of-way has been secured from the owners of the farms along the route, they being anxious to have the road. The total cost of building the road will be about $750,000.

A Toronto company has a proposition before the Brandon City Council for building and installing an electric street-railway system.

Manager C. E. A. Carr of the London (Ont.) Electric Street Railway Company has resigned his position to accept a position in Cleveland, Ohio.

MacKenzie & Mann, the heads of the syndicate which owns the Toronto, Winnipeg, London and St. John electric street railways, and many other railway properties, have just undertaken the construction of the waterworks and drainage system for the city of Monterey, Mexico, whose tramways (as well as those of the City of Mexico) they are electrifying.

The British Columbia Electric Railway Company's new road to be built at North Vancouver will cost $200,000. Particulars may be had from R. H. Sperling, Vancouver, B. C.

The Canadian Pipe Company of Vancouver, B. C., has just completed an order for the electric-light and power company of the city of Revelstoke, which exceeds anything of its kind in Canada. The pipe is eight feet in diameter, built with couplings and made with 57 staves, two by six, out of clear and thoroughly kiln-dried lumber, and serves under a pressure of 20 pounds to the square inch. The flume which had been used for the purpose for which the pipe is now intended collapsed during the month of July, and the city was in darkness. The city has also purchased a 2,000-light alternator from the Canadian General Electric Company of Toronto, Ont., including switchboard and exciter.

The Cataract Electric Company of Orangeville, Ont., has been incorporated with a capital of $50,000 to supply electricity for light and power purposes. J. M. Deagle and E. A. Deagle of Caledon, Ont., are among the directors.

A proposition to develop a waterpower on the White Mud River for generating electrical energy for the supply of light and power is now being considered by the municipality of Neepawa, Man. Engineer Archibald has submitted a plan of the

proposed work, which he estimates will cost $40,000, and produce 400 horsepower.

The Canadian Metal Company is arranging to install an electric-light plant at Frank, N. W. T., and will shortly be in the market for the necessary engines and plant.

The Canadian Pacific Railway Company is putting in a new switchboard for lighting purposes at Brandon, Man. The contract was awarded to the Hill Electric Switch Company of Montreal. H.

New York.

New York City, September 16.—An accident which killed at least 12 persons and injured nearly 50 others occurred at the beginning of the rush-hour traffic on Monday morning on the Ninth Avenue elevated line at the Fifty-third Street curve. The cause was a misplaced switch, and the alleged negligence of the motorman. The motorman has disappeared and the State Railroad Commission has already commenced an investigation into the whole matter. The electrical equipment of the road was in no way responsible for the accident, except that it has been plausibly argued that if cars of the latest pattern had been in use, they would have been less likely to leave the tracks.

The question of municipal ownership is already beginning to loom up largely as a political issue in the coming mayoralty campaign, and though there is not likely to be an out-and-out municipalization candidate, or at least no such candidate of any great standing, there is no question that all platforms will agree upon the need of regulating public-franchise privileges to some extent. On this point Comptroller Edward Grout is renewing his contention that the controller's department should have the first and final word as to franchise terms and conditions but at a meeting yesterday at the Board of Estimate it was resolved that franchise matters should be referred to the borough presidents; and they actually did refer a franchise of the Port Chester railroad, which has been laid on the table for several months, to President Haffen, of the Bronx Borough.

The Evening Telegram has printed a long, comprehensive article on local transit relief, and summarizes the various plans and proposals which have been recorded in this column from time to time. The Telegram predicts that it will be at least five years before the supply of transit facilities catches up with the demand, so that overcrowded cars will have to be patiently endured until 1910. The article also analyzes the various tunnel enterprises now under construction, and reports good progress on all of them except as regards the removal of outstanding legal obstacles.

The rapid-transit commissioners, who held a meeting yesterday, are prepared to apply, on the opening of the October terms of court, for the necessary legal papers to enable them to advertise the contracts for the contemplated new subways on Lexington, Third, Seventh and Eighth avenues and their connections. A time extention until September 11, 1906, has been granted for the completion of the Brooklyn subway addition.

The Supreme Court has enjoined the New York City Interborough Railway Company from continuing to construct a surface electric line on the Southern Boulevard, a pleasant residential thoroughfare in the Bronx, the opposition proving that the necessary owners' consents had not been substantiated.

The Evening Journal is making some political capital out of statements that certain non-union employes have been robbing the Interborough Rapid Transit Company to the extent of $10,000 a month by an ingenious method of taking the tickets out of the "choppers" and reselling them through the ticket agents.

It is promised, or rather anticipated by local residents, that the subway extension to Inwood and Kingsbridge will be opened on October 1st. Kingsbridge is also looking forward to the electric service to be installed on the New York Central Railroad, and some slight real estate speculation is in progress.

The Board of Estimate has received from the franchise bureau a report on an application of the Union Railway Company for extension lines in the Bronx. In this long document Harry P. Nichols, principal assistant engineer of the finance department, criticises the Union company's routes and warns the board against allowing any conditions that may be likely to lead to traffic regulations getting beyond the control either of the city or of the traction company. He says that there is a point in Brooklyn where at certain times of the day as many as 583 cars are supposed to pass in an hour, or at the rate of ten per minute. Mr. Nichols also criticises certain structural details of the Union company's plans, and the result is that only two out of 22 extensions have been recommended for acceptation. This is almost the first time on record that any minor franchise application has been submitted to such thorough official criticism, but it is promised that this is to be the method of dealing with all future applications.

Alderman Malone of Brooklyn has discovered that the plans of the South Brooklyn subway are not designed to benefit the populous residential section which he represents, and he has accordingly addressed a long letter to the rapid-transit commissioners, calling for modifications, so that a proper connection shall be ensured between Brooklyn and Manhattan from his district.

The Lackawanna railroad advertises that with the opening of its new Twenty-third Street terminal an electric cab and carriage service will be available for its passengers at reasonable rates. The terminal, which is, of course, a ferry terminal, is scheduled to be opened next Wednesday.

The Fifth Avenue Coach Company is to put on its Washington Square to Eighty-eighth Street route a gasoline-electric motor omnibus service at a ten-cent fare. The new omnibus has been designed by the General Electric Company, and is fitted with a 40-horsepower four-cylinder engine, two 45-ampere motors, storage batteries and electric lights.

Mention was made in this correspondence a few weeks ago of some traction activity in that part of Long Island opposite the Blackwell's Island bridge. Yesterday, at Albany, the Long Island and Manhattan Railroad Company was incorporated, with a capital of $10,000,000, and granted a comprehensive charter for a system of lines to extend from the Manhattan end of the bridge to Flushing, College Point, Roslyn, and even to Oyster Bay. The names on the directorate do not reveal any connection between this scheme and any existing traction company, and even Ralph Peters, president of the Long Island Railroad, does not recognize any of the men stated to be behind the new concern.

There are various ordinances being provided for the testing of consumers' electric meters, but since the creation of the Greater city not more than a dozen meters have even been tested, and there is no machinery provided for this purpose nor any inspecting force. Lighting Commissioner Oakley is now trying to arrange for the inspection of meters at the electrical laboratory of Columbia University.

Lambert Schmidt and associates of Weehawken, N. J., have incorporated the Schmidt-Wilcks Electric Company, with a capital of $100,000.

D. W. W.

Southeastern States.

Charlotte, N. C., September 16.—Louis B. Magid of Tallulah Falls, Ga., has purchased the valuable waterpower of the same name at Tallulah Falls, and may develop it electrically. The available energy is about 35,000 horsepower.

The Hatton Shoals Power Company has been organized at Anderson, S. C., with $150,000 capital and proposes to generate electric power on the Tugalee River, 16 miles from the town, for a number of cotton milling plants about Anderson.

The Winyah Traction Company of Georgetown, S. C., has perfected organization with J. B. Steele at its head. The capital is $50,000 and the purpose is to build electric lines in Georgetown.

The Belton (S. C.) Power Company has completed a big dam on Saluda River, where electrical energy will be developed for running the Belton cotton mills, also for street lighting in the town and for other purposes. The company has a capitalization of $300,000.

The Anthony Shoal Power and Mill Company has been bought by John H. Fitzpatrick of Washington, Ga., who proposes immediate development of the same, and possibly the construction of an electric line from Washington to Elberton, Ga., later. Power will be used for manufacturing purposes.

The town council of Louisburg, N. C., has appointed a committee to negotiate for the establishment of a municipal lighting plant.

The Greensboro (N. C.) Electric Company is reported to have contracted with the American Suburban Corporation to build an electric railway through the suburban property of the above-named land concern, near Greensboro.

The Catawba Power Company, Charlotte, N. C., reports that there are more demands for power than it can readily fill at this time, and new machinery is being installed as rapidly as possible to complete the development of the immediately available power for transmission.

The electric railway from Southern Pines to Pinehurst, N. C., has been bought by the Aberdeen and Asheboro railroad. It is not known what disposition will be made of the property by the new owners.

The town commissioners of Mooresville, N. C., have been negotiating with persons desiring to establish an electric-light plant.

Interest is being revived in the building of an electric railway from Stoneville to Spray, N. C., or Leaksville, cotton-mill towns. L.

Michigan.

Detroit, September 16.—The employes of the Detroit, Ypsilanti, Ann Arbor and Jackson electric railway have been having trouble in regard to wages, the company offering 21 cents an hour, while the men wanted 25 cents. The question was referred to a board of arbitration composed of representative men, who have decided the rate shall be 23½ cents an hour.

A new electric railway is now practically assured for western Michigan which will connect the towns of Holland, South Haven, Coloma and Saugatuck. Franchises have been secured for part of the route. The line, if built, will open up a large summer-resort region as well as a rich fruit district. It is stated that the line between Coloma and Saugatuck will be complete before winter.

The Toledo and Ann Arbor electric railway between these cities is fast nearing completion. The distance is 50 miles. All the heavy grading for bridges and abutments is now finished and ground has been broken for a fine power house to be erected at Petersburg. The schedule calls for hourly service and a running time of two hours. The line will not be put in operation until spring.

The village of Wyandotte has granted the Detroit United railway the right to lay a double track through that town, provided, however, the towns of Ford, Ecorse and River Rouge grant the same privilege.

Although the officers of the Detroit United railway have repeatedly stated that their company would not use any line or tracks built by the city of Detroit as a test for municipal ownership, the council has passed a resolution directing the corporation counsel to negotiate with the street-railway officials to this end. It is purposed to build a double line of track on Griswold Street to enable suburban traffic to keep off the congested city lines. This improvement is greatly needed by the Detroit United, and a request was made by it some time ago for permission to build such a line.

W.

Ohio.

Cleveland, September 16.—By November 1st it is estimated that the new machinery will all be installed in the East Side plant of the Columbus Public Service Company at Columbus, and the capacity of the lighting and power department will be about doubled. The plant will be of 2,300 kilowatts capacity. Eighteen months ago the company started out with two plants, one on the East Side and the other on the North Side. Last June it was seen that enlargements must be made and financial arrangements were made to meet the emergency. The hot-water heating department has also been enlarged. This is one of the largest combined lighting, power and hot-water heating companies in this section, and its progress is being noted with interest by all who are in any way connected with the electric or heating work.

Mayor Finch of Toledo, in an effort to advance his municipal-ownership theory, has furnished the City Council with estimates intended to show that arc lights can be maintained at a cost of $58 a year, whereas $83 a year is now being paid to the Toledo Railways and Light Company.

The Cleveland, Berea and Southern Railway Company of Cleveland has been incorporated with a nominal capital stock of $1,000 by C. C. Downs, W. G. Benedict and others. This is the company that is to build the road for which C. H. Hubbell was granted a franchise by the Cuyahoga County commissioners a few days ago. He is now endeavoring to get this franchise extended to the county line, having decided to build more of a road than at first contemplated.

The Toledo, Fostoria and Findlay line has been practically completed between Fostoria and Pemberville, as has the Western Ohio's extension from Lima to Fostoria. When they are in running order it will be possible to make the trip through from Cleveland to Cincinnati by electric line, the Lake Shore touching Pemberville.

J. N. Bick, railroad contractor, began work on an electric line to connect Toledo and Ottawa Beach a few days ago. It is said that the Everett-Moore people are back of the project, but this is not definitely known.

A resolution has been passed by the directors of the Hamilton Gas and Electric Company of Hamilton to spend $250,000 in the improvement of the plant.

The earnings of the Western Ohio are showing up in a great encouraging way, and it is believed that within a comparatively short time they will be such as to provide a good dividend. There is still talk of selling this road to the Elkins-Widener syndicate, but so far as known negotiations are not under way for the deal. O. M. C.

Indiana.

Indianapolis, September 16.—The Valparaiso Lighting Company has filed articles of incorporation, with authorized capital of $150,000. The company proposes to establish a plant to supply the citizens of Valparaiso and other towns of the county with light, heat and power. C. H. Geist, C. B. Kelsey and Edward Clifford are the incorporators.

The Local Electric Company of Jasonville is pushing the construction of an electric-light plant. It is expected to furnish light and power to the citizens of Jasonville within a few weeks.

The county commissioners of Clay County have granted 50-year franchises to two traction companies. One to the Wabash Valley Traction Company, which is to pass through the southern part of Clay County, touching Clay City, Saline City and Cory, and another to the Indianapolis and Ohio Valley Traction Company, for the construction of an electric line through Clay County, touching the towns of Bowling Green, Center Point, Patricksburg and Hoosierville. It is proposed to extend the road to Bloomington, where it is to connect with the main line from Indianapolis.

The Indiana Northern Traction Company, of which J. A. Barry is general manager, has announced that it has financed the interurban line connecting Wabash and Warsaw. The Indiana

Central Traction Company, of which V. J. Drayer of Dayton, O., is the head, has filed a mortgage for $800,000, to protect a bond issue for a line between the same cities. The roads will almost parallel each other, but will touch different towns. The Indiana Northern now operates the line from Marion to Wabash.

Officials of the Indianapolis, Columbus and Southern Traction Company deny the report that they are connected with the proposed Wabash and Southern traction line from Terre Haute to Columbus.

The auditing departments of the Richmond Street and Interurban Traction Company and the Martinsville line have been merged with the auditing department of the Indianapolis and Eastern Traction Company, with headquarters in the Traction Terminal Building in Indianapolis, and Willard Parry as auditor.

The official opening of the Louisville and Southern Indiana Traction Company's road between Jeffersonville and Louisville took place on September 12th, when a number of invited guests were taken in interurban cars from Louisville to Jeffersonville, then to New Albany and up the picturesque Silver Hills, where a cold luncheon was served. The company proposes to extend the line from Silver Hills to French Lick and West Baden Springs, 50 miles; to Corydon, 20 miles, and to Elizabeth, 15 miles.

The Indianapolis and Northern Traction Company has put on two extra freight cars to handle freight from all points between Indianapolis and Kokomo. The service is appreciated by the Kokomo merchants, as goods can be ordered from any point on the Indiana Union Traction Company's lines and be received in a very short time.

The plan of the Randall-Morgan syndicate of Philadelphia for consolidating the interurban properties it is acquiring is indicated by the establishment of central headquarters in the terminal station at Indianapolis, for the operation of the lines now in its control. One man will act as cashier for the three lines already secured by the syndicate. J. E. Stevenson has been appointed master mechanic and W. B. Jeffry chief engineer.

The promoters of the Fort Wayne and Chicago Traction Company, whose line is to extend from Fort Wayne to South Bend, through intervening towns, assert that they have financed the road, and that it will be built at once. The company's headquarters will be in Fort Wayne.

Articles of incorporation have been filed by the Indianapolis, Vincennes and Evansville Electric Railway Company, with home offices at Evansville. This is the beginning of a new traction line in southeastern Indiana, running from Evansville through Vincennes and up to Indianapolis, piercing the coal fields of Sullivan, Greene and Vigo counties, and for this reason the road is to be constructed with the freight carrying idea predominating to a greater extent than most interurban companies. The capital stock of the new company is placed at $100,000. The incorporators are: Cyrus E. Davis, Z. B. East, J. L. Ebner, William A. Cullop, C. M. Cooper, W. N. Mathews and others.

The Evansville and Mt. Vernon Traction Company has at last been granted a franchise to enter the city of Evansville. The grading on the road has been completed for some time, but the council held up the franchise until it could be made satisfactory to the people of the city.

A new and modern freight station has been completed at Lebanon by the Northwestern Traction Company, and is now ready for use. The company proposes to build similar stations at Frankfort and Lafayette, and when completed the road will be equipped with modern freight buildings at all of its principal points.

A. N. Dukes of Peru says that the Peru and Warsaw Electric Railway Company has issued and sold $1,000,000 worth of bonds, and that work on the road will begin at once. This company has leased the old Peru-Chili line of the Wabash, which the traction company will electrify and place in service. The steam track will form part of the Peru-Warsaw interurban.

J. Levering Jones of Philadelphia was in Fort Wayne last week and approved all the contracts let during the previous week for the construction of a new power house for the Fort Wayne and Wabash Valley Traction Company in Fort Wayne. It is to be fitted up by the Westinghouse company, which, it is said, bought the St. Louis Exposition electric plant, and will place it there. It will have a capacity to furnish power within a radius of 150 miles. S. S.

Pacific Slope.

San Francisco, September 15.—The Ocean Shore Railway Company has received bids on its inquiry for power-house, sub-station and car equipment. The specifications call for two 2,000-kilowatt, three-phase 2,300-volt 25-cycle generators, each direct-connected to a vertical cross-compound condensing engine. There is an alternative of three 1,500-kilowatt generators and three engines. Seven 1,000-kilowatt transformers will be required to step up to 30,000 volts. The sub-station equipment consists of 10 500-kilowatt rotary transformer units to supply direct current for the line at 550 to 650 volts, and 30 250-kilowatt static transformers. Forty four-motor 125-horsepower car equipments were called for. Water-tube boilers to carry a pressure of 175 pounds are specified. Oil fuel is to be used. The power house will be located a mile north of Half Moon Bay, which is almost midway on the 83-mile line extending from San Francisco to Santa Cruz. Quick deliveries will be required, and the road will be in operation next year.

The Northern Electric Company, H. A. Butters, president, has closed a contract with the Westinghouse Electric and Manufacturing Company for three 400-kilowatt motor-generator sets for the three sub-stations on its new road in course of construction between Chico and Oroville, Cal. The lowering transformers will be installed by the electric power company which secures the contract for supplying current for operating the road. The company will soon order three 55-foot heavy electric cars, nine feet two inches in width. They will be similar to the steel-frame cars on the new Long Beach line at Los Angeles. M. C. B. trucks and couplers will be used.

The Standard Lumber Company of Sonora, Cal., will install a generator so as to supply the town with electric lights during the dry season when the water-power electric plant is likely to be shut down for lack of water.

E. W. Hall, representing the purchasers of the electric-light plant at Eugene, Ore., will take charge of the system. The machinery will be overhauled and day circuits installed, giving a 24-hour service.

The Eel River Power and Irrigation Company's bid for a franchise for an electric transmission line from Potter Valley to Ukiah, Cal., was accepted by the supervisors. The hydraulic development is going on rapidly, and the plant will be completed on time.

The Oregon Railway and Navigation Company has organized, at Wallowa, Ore., two independent electric companies to build lines to connect with the railroad terminus at Elgin and tap the "Inland Empire" via the Grande Ronde route. It is now a race with the forces of W. J. Cook, who is backed by Portland people, and who went there two months ago to promote an electric railroad from Joseph to Elgin, to secure first entry into the Lake Joseph region.

An electric-light plant has been completed at Harrington, Wash., by Bordie & Show, who have good prospects for business.

It is reported from Hanford, Cal., that the San Joaquin Electric Power Company has decided to extend its electric-power lines a distance of 17 miles to Corcoran.

The California Gas and Electric Corporation will move its 40,000-volt pole lines so as to skirt the city of Oakland, instead of passing through the principal streets. Plans have been prepared for placing other overhead wires in underground conduits. A.

PERSONAL.

James Murdock of Lafayette, Ind., a prominent figure in street-railway development in Indiana, has sailed for Europe, and will visit his old home in Ireland.

Prof. H. H. Higbie, instructor of electrical engineering at the University of Michigan, was married to Miss Helen Burch in Brooklyn, N. Y., on September 14th.

J. C. Forster, vice-president of the Detroit (Mich.) Trolley Wheel and Electric Equipment Company, has returned to business after being confined eight weeks at his home with rheumatism.

The death recently at Austin, Texas, of Rudolph Eggeling, assistant superintendent of the Austin Electric Railway Company, is recorded. He had been in poor health for some time. He leaves a wife and six children.

Mr. George A. Gray, vice-president of the Thomas G. Grier Company of Chicago, was married on September 20th to Miss Margaret Beatrice Spofford of Melrose Park. Mr. and Mrs. Gray, who will live in Maywood, will be at home after October 15th. At present they are enjoying their wedding journey in Minnesota. Mr. Gray has many friends in the electrical fraternity, who will extend their hearty congratulations.

As is customary each year, the Chanute medals have been awarded by the Western Society of Engineers for the best papers presented during the year in electrical, civil and mechanical engineering. In electrical engineering the medal was given this year to George A. Damon of Chicago for his paper on "The Opportunities in the Electrical Business;" in civil engineering to W. A. Shaw of Chicago for the paper descriptive of part of the intercepting sewers of Chicago, and in mechanical engineering to A. Bement of Chicago for his paper on "Some Boiler Performance with Chain-grate Stokers."

James B. Yeakle of Baltimore, who was recently elected president of the Old Time Telegraphers and Historical Association, holds the position of superintendent of the fire-alarm telegraph system in that city. Mr. Yeakle was born in Frederick, Md., in 1842. He began his telegraph career in 1860 as a messenger boy. He learned to telegraph, and early during the Civil War his services were required in the vicinity of his home town. He subsequently went with the Baltimore and Ohio railroad. In the latter part of 1864 he became operator for the American Telegraph Company in Baltimore. In 1869 he went to New York, accepting employment with the Franklin Telegraph Company, later going with the French Cable Company. Upon the consolidation of the cable companies he returned to Baltimore, where he has since continuously resided. During the period from 1876 to 1879 he was in the employment of the Atlantic and Pacific Telegraph Company, subsequently becoming manager of the American Union Telegraph Company. After this he became general manager of the American District Telegraph Company in Baltimore and held the position continuously for nearly 21 years. In 1902 he was appointed to his present position after a competitive examination.

John W. Chipman, formerly secretary and general manager of the Indianapolis and Eastern Electric Railway Company, and one of the best-known interurban men of Indiana, died suddenly at Boston, Mass., recently. Mr. Chipman had been in failing health during the last year, and spent the greater portion of the summer in Maine, with a view to improving his health. He was born in Youngsville, Pa., in 1846, and had lived in Indianapolis since 1877. Mr. Chipman had been connected with various railroad enterprises for a number of years. In 1901 he interested Frank M. Fauvre, C. E. Coffin, M. B. Wilson and others with himself in the formation of the Indianapolis and Eastern Company, which constructed a line, first between Indianapolis and Greenfield, and thence to Dublin, connecting with the Richmond street and interurban line. He retained his connection with the road until a few months ago, when control of the company passed into the Widener-Elkins syndicate. Mr. Chipman then went to the east for the summer vacation, and died in Boston on his return trip home.

Eugene Holcomb has recently been appointed manager of the newly created foreign department of the Allis-Chalmers Company. He takes charge of all the foreign agencies and foreign selling representatives of the company. With the engineering possibilities and projects in South America in particular Mr. Holcomb is thoroughly familiar, having spent a number of years in that country. For the last three years he has had immediate charge of the Westinghouse companies' interests in Argentina, with headquarters in Buenos Ayres. Mr. Holcomb received his early training in the steam engine and electrical industry on the Pacific Coast and in the Middle West, selling his electric-light and contracting interests in Illinois to take up foreign work with the Westinghouse companies. His knowledge and experience in the engineering fields of this country and the engineering projects he has carried through abroad make Mr. Holcomb a valuable acquisition to the Allis-Chalmers Company. His headquarters will be at the general offices of the company at Milwaukee, Wis.

EUGENE HOLCOMB.

ELECTRIC LIGHTING

Proposals to furnish light and water for the city of Clinton, Mo., will be received until October 17th by the water and light committee, S. T. Neill, chairman.

The mayor of Grand Island, Neb., will secure an electrical engineer to prepare and submit plans for an electric-lighting plant for the city, to operate in connection with the waterworks. Later, it is said, bonds will be issued and the plant built.

The Collinsville Gas, Electric and Refrigerator Company of Collinsville, Ill., which proposes to operate a light, heat, power and cold-storage plant, has been incorporated with a capital of $50,000. C. E. Slocum, J. H. Siegel and W. E. Hadley are the incorporators.

Resolutions were read in the City Council at Covington, Ky., a few nights ago directing that the city clerk advertise the issue of $75,000 bonds for a municipal light plant and directing that a committee be appointed to select a site for the plant. Both were referred to committees.

The Western Gas and Electric Company has sold to N. W. Halsey & Co. and Howard, Simmons & Co. an issue of $1,400,000 of first and refunding mortgage five-per cent gold bonds. The company owns and operates plants in Joliet, Aurora, Elgin and La Grange, Ill., and other intermediate towns and villages. The surplus over bond interest in the year ended June 30th was $143,350.

ELECTRIC RAILWAYS

The Kansas City-Western Railway Company, formerly the Kansas City-Leavenworth Railway Company, has filed a mortgage for $5,000,000 and will build additional electric line in the vicinity of Kansas City, Mo.

The Bishop-Sherwin syndicate of Cleveland, Ohio, has contracted to sell to Stone & Webster of Boston a majority of the stock of the Northern Texas Traction Company at 75. Stone & Webster agree to take all that is offered to them at that price.

The capital stock of the company is $2,500,000 and an annual dividend of 3 per cent has been paid since August 1, 1903. The authorized bond issue is $2,500,000, of which $2,185,000 has been issued. The remainder was reserved for additional improvements. Stone & Webster own the local railroad and lighting plants in Dallas. The Northern Texas will add 30 miles of track between Dallas and Fort Worth, 27½ miles of track in Fort Worth and about 10 miles at Dallas.

The sub-committee on electric tramways of the Engineering Standards Committee of London has issued a report on trolley groove and wire. Without restricting engineers to the use of any particular design of wheel, the committee suggests that overhead work be so arranged as to permit of employing the following standard trolley-wheel groove: Width, 1⅜ inches; depth, three-fourths inch; radius, 7.32 inches; angle, 65 degrees. The figures recommended as the minimum tensile breaking strengths, in tons per square inch, for standard trolley wires are: Up to and including 00 S. W. G., not less than 24; above 00 S. W. G., not less than 22.

POWER TRANSMISSION.

The Helena (Mont.) Power Transmission Company has let the contract for the electrical equipment at its new dam to the Westinghouse Electric and Manufacturing Company of Pittsburg. The contract for the steam auxiliary equipment at Butte was let to the General Electric Company of Schenectady, N. Y.

The Penn Iron Mining Company, with lands on both sides of the Menominee River, near Sturgeon Falls, Mich., has completed plans for utilizing the power of the river. A dam is to be erected at once. A normal horsepower of 2,400 will be generated for the operation of mining machinery. It is expected that the plant will afford a maximum of 3,500 horsepower. The dam must be completed early as the water is now at its lowest mark and work would be delayed in the spring by high water.

TELEGRAPH.

The quarterly report of the Western Union Telegraph Company shows net revenues for the quarter ended June 30th of $1,701,007. From this was deducted $1,217,021, representing a 1¼ per cent dividend, and $331,300, interest on bonded debt. The remainder was added to the surplus, making a total surplus on June 30th of $15,974,209. The net revenue for the quarter ending September 30th is estimated to be about $1,900,000. The annual meeting of the stockholders will be held on October 11th.

The general administration of telegraphs of Mexico has ordered the construction of an extensive net of telegraph lines in Lower California, touching every principal city or town of that territory. Further, in view of the good results obtained by the system of space telegraphy which has been installed in Cabo Haro and Santa Rosalia, it is resolved to put in new installations in different places on the coast of Lower California, in combination with other stations which will be established in Sonora and Sinaloa.

PUBLICATIONS.

New price lists on Habirshaw red-core wires and cables and Habirshaw National Code wires and cables have recently been issued by the India Rubber and Gutta Percha Insulating Company, whose works are at Yonkers, N. Y.

The Buckeye Electric Company of Cleveland, Ohio, has published a few "Lamp Limericks." The folder which contains the "limericks" should do a great deal to "boost" Buckeye lamps, for the jingles are not without cleverness and humor.

The Wagner Electric Manufacturing Company of St. Louis has issued in the form of an attractive pamphlet the paper read by G. Percy Cole before the Ohio Electric Light Association at Put-in-Bay, Ohio, last month. The title of the paper is "Recent Developments in Single-phase Alternating-current Motors."

A monograph upon "Radium, Radioactive Substances and Aluminum, with Experimental Research" has been written by Myron Metzenbaum of Cleveland, Ohio. The results of the investigations described in the pamphlet constituting an exhibit in the Building of Mines and Metallurgy at the St. Louis Exposition. Some interesting pictures taken by radium, thorium and zirconium rays are shown.

As is well known, the Western Electric Company of Chicago manufactures a very satisfactory series enclosed alternating-current arc-lighting system, making nearly everything for the system, including transformers, regulators, switchboard, lamps, etc. The company has just issued a new bulletin devoted to its series enclosed arc system which describes in detail all the several parts of the system. The material in the bulletin makes very good reading for those who wish to become familiar with the features of this apparatus. There is contained also a list of installations of the system which have already been made, besides several diagrams of connections for various-sized circuits.

The Crowe Name Plate and Engraving Company of Chicago has issued a useful catalogue setting forth its interesting product, which consists of raised letter plates, signs, tablets, sunken letter plates, light labels, etc. This company has been doing business less than two years and it is therefore with pardonable pride that it points to the excellent class of patronage which it has, shown by the numerous illustrations of name plates, principally designed for attachment to machinery, contained in the catalogue.

Catalogue No. 13 of the Faries Manufacturing Company of Decatur, Ill., is the latest publication of this company and shows a complete line of its patent adjustable electric lampholders, shades, portable fixtures and fittings. The catalogue is issued in the attractive and complete style characteristic of the advertising literature of this company and is a useful book to all dealing in the lines with which it treats. The Faries line of goods is widely and favorably known and the manufacturer has enjoyed a steady and rapidly increasing business.

SOCIETIES AND SCHOOLS.

Information from Duluth, Minn., is to the effect that the annual meeting of the Lake Superior Mining Institute will be held October 17th and 18th on the Menominee Range. No programme has been arranged and the trip has not been definitely planned, but it will probably cover the main points of interest.

The call for the next annual meeting of the American Mining Congress has been issued. The meeting will open on November 14th at El Paso, Texas, and will be in session a week. According to the call of the convention, each city, chamber of commerce, state, county and mining organization in the country can appoint delegates.

A meeting of the Western Association of Electrical Inspectors will be held in Chicago on October 5th and 6th. The meeting will be called at 10 a. m. in rooms 1232-4-6 National Life Building, 163 LaSalle Street. Matters of importance are to be considered and a large attendance of members is desired. W. S. Boyd, 382 Ohio Street, Chicago, is secretary.

Secretary R. W. Pope has issued a new directory of membership of the American Institute of Electrical Engineers revised to July 1, 1905. The total membership is 3,594, consisting of two honorary members, 482 members and 3,110 associates. Counting all classes, New York has 1,095 members; Pennsylvania, 353; Massachusetts, 268; Illinois, 206; Ohio, 183; New Jersey, 133; Great Britain, 129; California, 117, and Canada, 116.

The Technological Museum in Vienna, which has already carried on for some years past with much success a secondary school for the instruction of foremen electricians and managers for engineering establishments, will open, in October, a school for training the drivers of motor vehicles to which workmen possessed of a fair amount of practical skill will be admitted. Instruction will not only be given in the rudiments of statics and dynamics, but they will also have the opportunity of studying the construction of motors of all kinds, and will be made familiar with the main principles of electricity.

The fall term at Armour Institute of Technology opened last Monday with a freshman class of more than 200. The number of applicants a week before opening was so great that it was impossible to take any more into the Scientific Academy. Eleven new appointments have been made on the faculty, all with the rank of instructor, as follows: Mathematics, A. E. Joslyn, J. E. Lind; modern languages, A. R. Zorn; experimental engineering, E. S. Libbey, A. H. Anderson, W. F. Dietzch; fire-protection engineering, J. Finnegan; chemistry, E. E. Jones, W. O. Walker; mechanical drawing, W. G. Smith; pattern making, N. P. Peterson.

Quite a number of changes have been made in the instructional staff of the engineering department of Purdue University this year. C. P. Matthews, M. E., Ph. D., for several years professor of electrical engineering at Purdue, has been appointed director of the electrical laboratory and in charge of the school of electrical engineering; W. O. Teague, B. S., Massachusetts Institute of Technology, has been appointed assistant professor of experimental engineering, in charge of the engineering laboratory; Albert Smith, B. S., Dartmouth, C. E., Thayer School of Engineering, has been appointed assistant professor of civil engineering. G. A. Young, B. S., M. E., assistant professor of mechanical engineering, will hereafter be responsible for the direction of the work in thermodynamics; F. R. Swift, B. S., for two years instructor at Massachusetts Institute of Technology, has been appointed instructor in mechanical engineering; O. C. Klipsch, B. S., Purdue University, has been appointed instructor in mechanical engineering; Arthur B. Smith, B. Sc., University of Nebraska, has been appointed instructor in telephone engineering; Parker E. Marean, A. M., B. S., Harvard University, has been appointed research assistant to W. F. M. Goss, succeeding Aldrich Durant, who has been appointed an assistant at Harvard University.

The library committee of the American Institute of Electrical Engineers, of which W. D. Weaver is chairman, has issued a catalogue of periodical publications in the library of the Institute. An important feature of the plan of the library is a collection of records, briefs, etc., relating to electrical patent litigation—a class of literature which is obviously of the highest value with relation to the history of electrical invention. Members are urgently requested to assist in adding to this section of the library either from their own collections or by bringing the subject to the attention of lawyers and former litigants possessing material of the kind. In several cases members who do not wish to part with such publications at the present time have inserted a clause in their wills making the Institute the ultimate beneficiary.

MISCELLANEOUS.

As an experiment, City Electrician Carroll of Chicago has been ordered to place 100 street signs at street intersections in various parts of the city. The signs are to be perpendicular, placed on the electric-light poles or on special posts to be placed on the corners. If the new signs are approved by the citizens similars ones will be installed all over the city.

A few days ago at Omaha, Neb., the Union Pacific Railway Company gave a practical test of gasoline-motor car No. 2, built by that company for actual service, before a large number of interested eastern railway officials. The car ran from Omaha to Valley, Neb., and return, carrying 57 persons, reaching a maximum speed of 52 miles an hour.

In the case of the Westinghouse Electric and Manufacturing Company, complainant, vs. the Diamond Meter Company, defendant, Judge Humphrey in the United States Circuit Court, Southern District of Illinois, has issued, until final hearing and disposition of the case, an injunction restraining further infringement of claims 1 and 2 of United States patent No. 511,559 and claims 1, 2, 3, 4 of United States patent No. 511,560.

A report in favor of the John A. Roebling's Sons Company has been made by ex-Judge Parker, who was appointed as referee to take testimony in the suit brought by the Roeblings against the city of New York. The finding compels the city to pay to the company $231,622, the balance due the bridge-building concern for constructing the Williamsburg Bridge across the East River. The money was held back by the city because the company was 175 days behind in completing the contract, but the referee says the city was responsible for the delay by being slow in providing a proper storage yard for material when the work under contract was to begin.

A report from Lexington, Ky., is to the effect that Chandler Brothers, representing the Randall-Morgan interests, have about concluded negotiations that will result in the merging of a number of important Kentucky enterprises. The interests concerned are the Lexington street-railway, gas and electric plants; street railway, gas and electric plants at Frankfort, Blue Grass Traction Company with roads from Lexington to Georgetown and to Paris; Central Kentucky Traction Company, now building a line from Lexington to Versailles and a number of other companies that hold franchises from Lexington to other towns. It is said that Senator George B. Davis of Detroit thought out the plan of merging these interests, but that he has since sold his rights to others.

In Los Angeles, Cal., where the city's water supply, taken from the Los Angeles River, is barely sufficient for necessities, the authorities propose to undertake one of the largest water projects ever undertaken by any city. The plan is to turn the course of Owens River and bring its snow water to Los Angeles from the Sierra Nevada, 240 miles distant. The electors of the city have provided a bond issue of $1,500,000 for options and the preliminary work, the whole undertaking being estimated to cost $23,000,000. The project involves the building of concrete and steel conduits and the tunneling of the mountain range, but it will make available a daily capacity of 260,000,000 gallons. The water will have a fall of 4,000 feet, which will give it sufficient head for fire and power purposes, and will flow the entire distance by gravity alone.

What is probably one of the biggest schemes ever proposed for the development of South America is now being taken in hand. The port of Buenos Ayres, being too shallow to admit big

steamers, a concession was recently granted to Arturo Castano for the construction of a new port in the Bay of Samborombon, 50 miles toward the Atlantic along the Rio de La Plata. It is said the scheme involves an expenditure of over $38,000,000. Most of this amount has already been underwritten in Paris. Separate subsidiary companies are now being formed for reclamation works, the construction of a canal and a big system of railways, which will radiate inland in all directions and connect existing lines with Buenos Ayres. One of the companies will be for furnishing electric lighting and power, over which, it is said, the General Electric Company will assume control.

It is reported that the island of Heligoland in the North Sea, has lost a considerable area through the collapse of the sandy cliffs which surround its shores, and through a definite sinking on its south side. Engineers have been at work in a continuous endeavor to safeguard the island from demolition, and considerable work has been performed in filling crevices in the rocks, while breakwaters have been built to break the force of the sea. It has been found, however, that the very sea floor on which these are constructed is without stability, and it is believed that the work can only serve to delay the encroachment of the sea on the friable cliffs. The island now has a circumference of a little less than three miles, as against 3¾ in 1890. It is interesting to note that on this island is installed one of the largest electric lighthouses in the world, an illustrated description of which was printed in the Western Electrician of July 23, 1904.

TRADE NEWS

Sealed proposals will be received until October 5th for furnishing and delivering in Chicago, Ill., 55,000 incandescent electric lamps for government use. Proposals should be indorsed "Proposal for incandescent electric lamps," and addressed to M. C. Martin, chief quartermaster, United States Army, Chicago.

The partnership lately existing between Albert H. Harriman and Albert A. Wilkins, who were doing business at Middleton, Mass., under the name of the Eagle Lamp Company, was dissolved on July 12, 1905. The business is now carried on under the same name by Albert A. Wilkins alone, who has assumed all the liabilities and debts of the above-named partnership.

Kendrick & Davis of Lebanon, N. H., manufacturers of the K. & D. and Porter & Kent battery motors and dynamos, have just issued their new catalogue, No. 7. This catalogue contains a description of the various products of the company and will doubtless prove of interest to all users of battery motors and dynamos and similar products. The firm is making preparations for an active trade in electrical holiday novelties.

The Bureau of Supplies and Accounts, Navy Department, is inviting sealed proposals until October 30, for furnishing eastern navy yards with the following supplies: Schedule 134, battery cells, steel conduit, wire and miscellaneous electrical supplies. On October 10th the bureau will open sealed bids for furnishing southern navy yards with the following: Schedule 137, incandescent lamps, conduit fittings, bell wire, insulating tape. Blank proposals will be furnished on application to the bureau, and those for eastern navy yards can also be obtained at the navy pay office in New York.

Referring to the new trademark law, Foreé Bain & May of 947-949 Monadnock Building, Chicago, call the attention of manufacturers to the opportunity of selecting and registering a suitable trade name. They say: "A trademark becomes an asset of the business and usually increases in value as the business grows in extent and age. It is a means whereby the results of advertising become cumulative, which inures to the benefit and profit of the owner. In many instances the trademark becomes the most valuable asset of the manufacturer. 'Sapolio,' 'Vaseline,' 'Uneeda' and 'Okonite' are striking examples of this statement. These trademarks probably could not be purchased for $1,000,000 each."

The Evansville Battery and Electric Company of Evansville, Ind., has been incorporated to manufacture storage batteries of the type covered by the patents of H. C. Porter of Chicago, well known in storage-battery circles as an inventor and engineer. Mr. Porter is vice-president and general manager of the new Evansville company, which has a paid-up capital of $100,000. He has been out of the business for a couple of years owing to poor health, but is now practically recovered and has organized the new company, which has a factory in operation and will soon be turning out cells for all purposes, particularly in large sizes. Mr. Porter is a believer in the operation of street railways by storage-battery cars, and says that he is prepared to make a practical demonstration at his own expense for the benefit of any street-railway man who is seriously interested.

The election of Mr. Walter H. Whiteside as president of the Allis-Chalmers Company is an indication that the change in the presidency will not mean a change in the policy of the company, for Mr. Whiteside has been, during the absence in Europe since April last of his predecessor in office, in full charge of the operations of the organization with the title of vice-president and general manager. Mr. Whiteside joined the Allis-Chalmers interests in July, 1904, when he accepted the position of general manager of sales. He came at a time when the company, which had just taken over the Bullock Electric Manufacturing Company, needed the injection of a vigorous and energetic personality into its sales force. The task with which Mr. Whiteside was confronted was one which would have baffled any man with less determination, less energy and less force of character. It was not merely that he had to become familiar with all the intricacies of the company's varied products—and they cover a larger area of human activity than that of any other great manufacturing corporation—but the new interests and the old had to be consolidated. The sales organization had to be enlarged and its efficiency increased. With what success Mr. Whiteside has met in his efforts, the increase in the volume of the company's business, and the crowded shops, and the reopening of the old South Foundry at Milwaukee can testify.

BUSINESS.

Among recent Illinois incorporations is the Macomb Electric Construction Company of Macomb, Ill., which will also deal in electric supplies. The company is capitalized at $10,000 and the incorporators are W. I. Savidge, S. E. Purdum and C. M. Erwin.

The season's lamp "boom" is now on, according to the Electric Appliance Company of Chicago. But the company adds that, owing to the convenience of its new and well-filled storerooms, it is entirely able to keep pace with the rush, and all orders are filled promptly from Chicago stock on the day of receipt.

S. R. Fralick of the Benjamin Electric Manufacturing Company, Chicago, is on a two weeks' trip, going as far east as Pittsburg, in the interests of the company's well-known line. Mr. Fralick has been engaged for some time past on the company's new catalogue, which will be ready for distribution October 1st. It will be a much enlarged publication and will show a number of new specialties that will be of interest to the lighting trade.

The Reliance Instrument Company of 60-68 West Van Buren Street, Chicago, manufacturer of the Reliance switchboard instruments, has lately largely increased its facilities and floor space and will be especially fitted to do wattmeter repair work of all kinds, including repairing and calibrating of burned-out meters for either inductive or non-inductive loads. The company has been engaged in repair work on all kinds of instruments, but will now be enabled to do wattmeter repair work on a much larger scale and in a prompt manner.

J. W. Duntley, president of the Chicago Pneumatic Tool Company, has returned from Europe, where the last six weeks were spent in the interest of the foreign business. While abroad the Fraserburgh and Berlin factories were started up and manufacturing arrangements perfected in Russia. All factories are now running, with sufficient business to keep them constantly occupied for several months, and the outlook generally is the most satisfactory of any period in the history of the company. Mr. Duntley states the foreign business promises during the next few years to rival the American business. The American factories are all running to their maximum capacity night and day, and although a number of the latest improved automatic machines have recently been installed, further improvements must be made. Mr. Duntley brought home with him several large orders. The bulk of the orders for electric drills are coming from fields heretofore impossible to interest in the air tools. While in England and on the Continent several tests were made, with the result that the sample tools demonstrated by Mr. Duntley accomplished the work in a satisfactory manner.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) September 12, 1905.

799,035. Reversing Mechanism for Motors. Abe L. Cushman, Concord, N. H., assignor of one-half to Benjamin A. Kimball, Concord, N. H. Application filed May 31, 1904.

A power-controlling member, a reversing device for the motor and means connecting the power-controlling member with the reversing device for operating the latter without reversing the current to the reversing device, when the power-controlling member is in an off position with reference to the motor are the essential features.

799,049. Lightning Arrester. Peter C. Hewitt, New York, N. Y., assignor to the Cooper Hewitt Electric Company, New York, N. Y. Application filed May 16, 1902.

Combined with an electric circuit carrying a current of predetermined normal potential is a lightning arrester comprising a pair of electrodes, at least one of which is of vaporizable material inclosed in a hermetically sealed tube or container. A vapor in the tube has an initial resistance incapable of being overcome by the normal line potential but capable of being broken down by an abnormal potential.

799,050. Circuit Controller. Peter C. Hewitt, New York, N. Y., assignor to the Cooper Hewitt Electric Company, New York, N. Y. Application filed March 7, 1903.

An inclosed gas or vapor is included in the system, the method of starting or stopping the flow of electrical energy consisting in rendering the gas conducting or non-conducting at will with respect to the applied energy.

799,051. Vapor Circuit-breaker. Peter C. Hewitt, New York, N. Y., assignor to the Cooper Hewitt Electric Company, New York, N. Y. Application filed March 20, 1903.

Associated with an electric circuit requiring protection from currents of abnormal or dangerous value, the circuit being adapted to carry a current of definite value, is a circuit-breaker consisting of an inclosed gas or vapor having a density suited to the current of definite value. Means automatically increase the density to a limit prohibiting current flow when an abnormal or dangerous current is thrown upon the circuit.

799,052. Circuit Controller. Peter C. Hewitt, New York, N. Y., assignor to the Cooper Hewitt Electric Company, New York, N. Y. Application filed August 10, 1903.

A device for preventing abnormal discharges at the contact plates of a circuit interrupter, comprises an inclosed gas or vapor having terminals connected in shunt upon the circuit interrupter. (See cut on next page.)

799,053. Method of Controlling Electric Circuits. Peter C. Hewitt, New York, N. Y., assignor to the Cooper Hewitt Electric Company, New York, N. Y. Application filed August 10, 1903.

The method of protecting translating devices in an electric circuit consists in transmitting the normal current in such circuit through a gas or vapor conductor, adapting the density of the gas or vapor to the normal current in the circuit, and opposing to an abnormal or dangerous current a vapor density which prohibits the passage thereof.

799,061. Electrolytic Apparatus and Electrodes Therefor. Carl Kellner, Hallein, Austria-Hungary. Application filed July 7, 1896.

An electrode comprising a carrier of insulating material has wound upon it a conductive wire to form two active faces each presenting the wire to the solution to be electrolyzed. One face acts as anode and the other as cathode, and a suitable frame supports the electrode at its edges.

799,105. Revolving Electric Furnace. Ernesto Stassano, Rome, Italy. Application filed April 9, 1902.

An electric furnace with a circular closed chamber has its axis inclined at an angle to the vertical. Means are provided also for rotating the chamber, for feeding an anode and a cathode toward one another within the chamber. Other means cool the outer ends of the anode and cathode.

799,110. Cover for Third Rails. William G. Taylor, Forest City, Pa. Application filed December 3, 1904.

In a third-rail system are a support for the rail and an insulating cover upon the rail, the cover bearing upon one base flange and the top of the rail and having a continuous air passage therein.

799,136. Electrically Controlled Motor. Henry Bezer, Westfield, N. J. Application filed September 4, 1901.

A number of prime movers are adapted to receive reciprocating movement from a motive medium. A valve mechanism controls the motive medium for all prime movers, electromagnetic controlling means being provided for such valve mechanism. A circuit-controlling device is actuated by the prime movers and controlls the electromagnetic means and therchy controlls the motive medium for all prime movers.

799,137. Transmitter Arm. Jules A. Birsfield, Rochester, N. Y., assignor to the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. Application filed February 13, 1905.

The mechanical features of a device for holding a transmitter are described in the patent.

799,146. Circuit-changing Apparatus. Merritt S. Conner, Chicago, Ill., assignor to the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. Application filed March 17, 1904.

In a compound unitary relay are two cores terminating in pole pieces. An energizing winding is provided for each core and an armature is associated with each core. Circuit-changing springs associated with one armature are normally tending to engage each other. Means associated with the second armature normally associate the armature with the first armature to disconnect the springs from each other. Other means, upon energization of the corresponding winding, release the second armature from the first armature whereby the springs may again engage each other.

799,160. Switching Appliance for Telephone Exchanges. Carl M. Hedman, Chicago, Ill., assignor to the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. Application filed May 22, 1902.

Details are described.

799,177. Power-transmission System. Victor Martinetto, Chicago, Ill., assignor of one-half to Harry L. Barth, Chicago, Ill. Application filed February 18, 1904. Renewed February 13, 1905.

Combined with a source of alternating current are an inducing winding supplied thereby, an induced winding and an additional winding substantially out of inductive relation with the inducing winding, but whose field cooperates with the field of the inducing winding to effect torque and mechanically connected with the induced winding so that the axes of magnetization of the induced winding and the additional winding are angularly displaced. The induced winding has connections for supplying the additional winding with current substantially in phase, in effect, with that in the induced winding.

799,191. Electrical Attachment Plug. Bert E. Salisbury, Syracuse, N. Y., assignor to Pass & Seymour, Solvay, N. Y. Application filed July 20, 1904.

A metallic protecting cap for the attachment plug has a central cord hole and an annular groove. In combination therewith are a bushing of insulating material fitted to the cord hole, and a lining of flexible insulating material is arranged within the cap and with its margin in the groove.

799,205. Telephone-receiver Casing. Axel R. Thollander, Chicago, Ill. Application filed November 10, 1904.

In a telephone-receiver casing are a barrel having internal screw threads at the front end, a cup having a reduced tubular portion screwed into the end of the barrel forming a section of the casing and having an inner shoulder, packing disks on the shoulder, a clamping ring for the diaphragm screwed on the front end of the cup and an earpiece screwed into the clamping ring.

799,213. Trolley Catcher and Retriever. Charles F. Wilson, New York, N. Y. Application filed January 24, 1905.

A spring-actuated spool of the retriever winds up the slack of the trolley cord.

799,219. Electric Incandescent Lamp Having Second-class Conductors. Wilhelm Boehm, Berlin, Germany. Application filed June 23, 1900.

An incandescent body in the lamp consists of second-class conductors and of a single body of suitable material and of convenient size. Means are provided whereby the body may be utilized both as a heater and as a regulating resistance for the incandescent lamp.

799,237. Telegraphy. Sterns F. Jones, New York, N. Y., assignor of one-half to the Postal Telegraph-cable Company, New York, N. Y. Application filed April 6, 1905.

Means for transmitting signals consist of a source of short and rapid current alternations and a suitable transmitter for throwing the alternations onto the line in groups of varying length and sequence. At the receiving station a suitable relay is placed in a balanced separate circuit together with means for inductively connecting the circuit with the main and branch lines.

799,238. Sextuplex Telegraphy. Sterns F. Jones, New York, N. Y., assignor of one-half to the Postal Telegraph-cable Company, New York, N. Y. Application filed April 7, 1905.

A sextuplex arrangement of apparatus consists of three relays, one or more of which are polarized. An associated transmitting system includes a pole-changing transmitter, an ampere-changing transmitter and a transmitter controlling a source of short and rapid alternating-current impulses. Means are supplied whereby outgoing signals are rendered neutral upon the home-relay system. A separate circuit for one relay has means for inductively connecting the relay with the main and artificial lines. (See cut.)

799,239. Telegraphy. Sterns F. Jones, New York, N. Y., assignor of one-half to the Postal Telegraph-cable Company, New York, N. Y. Application filed April 19, 1905.

Combined with a telegraph line are means for transmitting and receiving signals by varying a continuous current and means for simultaneously transmitting and receiving signals by dividing an alternating current into groups of varying lengths. The apparatus consists of a source of alternating-current impulses, a transmitter, and a suitable receiving instrument inductively connected with the line at one station. At a second station are a suitable receiving instrument, an inductance, a condenser, a branch circuit and a transmitting device connected to include and exclude the inductance with respect to the main line.

799,240. Telegraphy. Sterns F. Jones, New York, N. Y., assignor of one-half to the Postal Telegraph-cable Company, New York, N. Y. Application filed April 21, 1905.

Means for exchanging signals between separated points by varying a continuous current and means for simultaneously exchanging signals between separated points by groups of alternating-current impulses form the basis of the patent.

799,245. Self-propelled Vehicle. Hermann Lemp, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 31, 1904.

A type of electric automobile is described.

799,264. Motor Suspension for Electric Motors. Edward D. Priest, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 11, 1905.

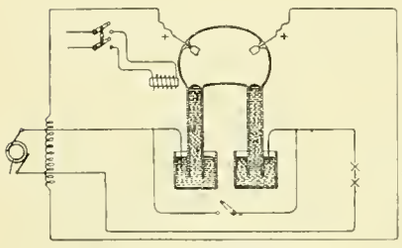
In combination with a driving axle are a pair of motors geared thereto, a supporting bearing upon the axle for one of the motors and a flexible connection between the motors.

799,305. Magneto-electric Generator. Robert C. Crouch and James A. Titzel, Sr., Newcastle, Pa. Application filed November 19, 1904.

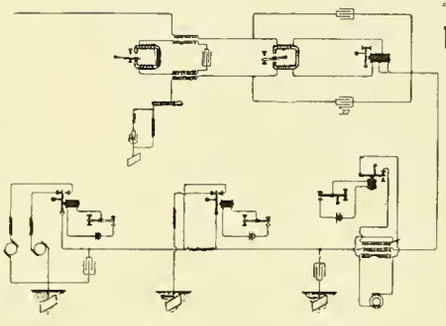
In a magneto-electric generator are a magnetic member of substantially U shape, generator coils acted upon inductively by the magnetic member and a receptacle mounted upon the magnetic member and provided with rolling bodies of magnetic material.

799,346. Calling Device for Automatic Telephone Exchanges. Frank A. Lundquist and John K. Norstrom, Chicago, Ill., assignors to M. E. Richardson, trustee, Sterling, Kan. Application filed August 27, 1900.

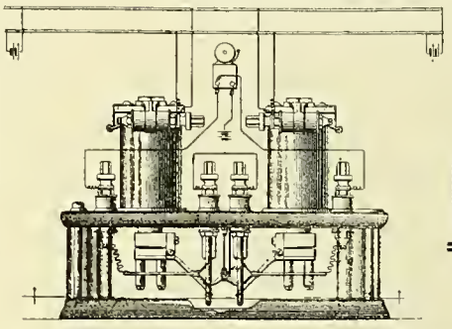
A series of indicators are loosely mounted on a shaft, with means whereby the manual movement of one of the indicators will also move the shaft. A spring is arranged to return the shaft and the moved indicator to their normal positions, and other means cause the return movement of the indicator to make a series of electrical contacts.



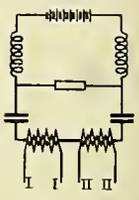
NO. 799,052.—CIRCUIT CONTROLLER.



NO. 799,238.—SEXTUPLEX TELEGRAPHY.



NO. 799,452.—RELAY.



NO. 799,554.—TELEPHONE RELAY.

799,368. Electric Sparking Ignition System for Gas Engines, and Starting Switch Therefor. Vincent G. Apple, Dayton, Ohio. Application filed November 9, 1903.

Details are described.

799,377. Cut-out for Electric Heaters. Johannes Härdén, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 1, 1904.

In a liquid receptacle is an electric heater carried upon a supporting base. Resilient connecting means are between the vessel and the base, and a cut-out is operated by the connecting means and controlled by the weight within the vessel.

799,393. Circuit-breaker for Explosive Engines. Ralph M. Lovejoy, Meredith, N. H. Application filed January 30, 1905.

A contact lever is studded with contact points, some of which are insulated from the lever and others in electrical communication therewith. A part engages with and disengages from the contact points.

799,420. Lamp Socket. Julius C. Tournier, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 27, 1903.

An insulating base provided with lamp terminals and a key for controlling the circuit mounted upon the base has also a metal shaft having its outer end of irregular cross section incased in insulating material. A metallic thumb piece is clenched upon the insulating material.

799,422. Watchman's Recording and Alarm System. Albert E. Waggoner, Grand Rapids, Mich. Application filed July 13, 1903.

Associated with a watchman's clock are a ticker, a magneto-generator to operate the clock and having a shaft operated by a key, a key to operate the generator, a call box to operate the ticker and a lever connected to the call box to operate it and normally located to cover the end of the shaft.

799,423. Transformer. William L. Waters, Milwaukee, Wis. Application filed April 28, 1905.

Combined with an inclosing casing containing oil are a transformer core and windings immersed in the oil and supported within the casing, cooling coils surrounding the core and windings from the top to the bottom and means connected with the coils for causing circulation of cooling air therethrough.

799,431. Motor Starter. Charles E. Ashury, Jeffersonville, Ind. Application filed October 6, 1904.

In a motor starter are a swinging frame, a spring drum mounted to rotate in the frame, gear and ratchet teeth on the periphery of the drum and a gear wheel on one side of the drum. A gear wheel is adapted for connection with the motor shaft and with which the first-named gear wheel is designed to engage.

799,441. Process for Purifying Tantalum Metal. Werner V. Bolton, Charlottenburg, Germany, assignor to Siemens & Halske Aktiengesellschaft, Berlin, Germany. Application filed October 12, 1904.

Tantalum is purified by fusing the impure metal in an inert environment whereby the impurities are driven off and the metal left free.

799,451. Starting Apparatus for Vapor Electric Lamps. Clyde J. Coleman, Rockaway, N. J., assignor of one-half to Sidney Aronstein, New York, N. Y. Application filed February 7, 1904.

Associated with a mercury-vapor lamp are exteriorly located electrically controlled power-developing means, auxiliary power-developing means, interiorly located projecting means controllable by the power means and the auxiliary power means and means controllable by the circuit of the lamp for discontinuing the energization of the power means but not of the auxiliary power means by the establishment of the lighting circuit.

799,452. Relay. William W. Coleman, Edgewood Park, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed April 7, 1905.

An interlocking relay for controlling the operation of railway signals comprises electromagnets and coacting armatures, and an interlocking means comprising a member arranged in the path of movement of the armatures and adapted to lock one of the armatures coincidentally with the release of the other due to the presence in or absence of current from the respective magnets. (See cut.)

799,516 to 799,529. inclusive. William L. Bliss, New York, N. Y., assignor to the Bliss Electric Car Lighting Company, Milwaukee, Wis.

For explanation regarding these patents see page 238 of this issue.

799,554. Telephone Relay. Béla Gáti, Budapest, Austria-Hungary. Application filed February 9, 1904.

The circuit includes a non-metallic resistance the resistance of which decreases with increase of current flowing through it. A second circuit, condensers in the second circuit connected also to the first circuit, a source of potential variation adapted to act inductively on the second circuit and a receiving apparatus for the electrical variations in the second circuit resulting from the variations in the first circuit are the other features. (See cut.)

799,555. Telegraphy. Béla Gáti, Budapest, Austria-Hungary. Application filed May 9, 1904.

Apparatus for space-telegraphy comprises a coherer in which is a small gap with a fluid between the terminals. A circuit in connection with the terminals of the coherer includes a source of electric current and a relay. Additional ionizing means are adapted constantly to act on the fluid in the gap, but with insufficient intensity to produce ionization. Means whereby electric waves can be made to act on the fluid in the gap for producing ionization are provided.

799,567. Multiplex Telegraphy. George L. Hogan, London, England. Application filed August 11, 1902.

A source of electric energy gives a current composed of rapidly-succeeding impulses, while separate conducting means for conveying the current and means under the control of the current consisting of an electromagnet with rocking armature in connection with each set of instruments are adapted to connect and disconnect the sets of instruments in pairs in rapid succession to and from the signal-conveying means.

799,585. Electric Generator for Telephone Systems. Enos B. Willix and John Young, Mount Vernon, Iowa. Application filed Febraury 25, 1905.

A revolving armature, a commutator or collector ring in connection with the armature, a reversible collector brush bearing upon the commutator and an auxiliary brush adapted to bear upon the commutator when the collector brush is in one of its alternative positions are the patentable features.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on September 18, 1905:

389,601. Mechanical Telephone System. A. B. Rosebrugh, Toronto, Ontario, Canada.
389,626. Electric Time Recorder. A. Wirsching, Brooklyn, N. Y.
389,638. Electrical Distribution by Secondary Batteries. T. P. Conant, New York, N. Y.
389,640. Rheotome Mechanism for Medical Batteries. H. B. Cox, Cincinnati, Ohio.
389,658. Armature Winding for Dynamo-electric Machines. W. H. Knight, New York, N. Y.
389,676. Cell for Electric Batteries. S. L. Trippe, St. Louis, Mo.
389,692. System of Electrical Gas Lighting and Extinguishing. H. T. Downs, Saratoga Springs, N. Y.
389,729. Electrical Heating Apparatus. J. Wiest, York, Pa.
389,758. Ground Detector for Electric-light Circuits. A. W. Morrell, Indianapolis, Ind.
389,764. Electrotherapeutic Cap. N. P. Rutter, Waltham, Mass.
389,779. Direct-welding Dynamo-electric machine. E. Thompson, Lynn, Mass.
389,781. Process of Electrolyzing Sewage and Sea Water. W. Webster, Jr., Lee Park, County of Kent, England.
389,795. Means for Distributing Electric Energy. S. Z. DeFerrenti, London, England.
389,799. Automatic Circuit-maker and Breaker. W. W. Estabrook, Boston, Mass.
389,812. Dynamo-electric Machine. T. H. Hicks, Detroit, Mich.
389,822. Electric-railway System. J. D. Nicholson and W. J. McElroy, Pittsburg, Pa., and T. J. McIntighe, New York, N. Y.
389,838. Means for Distributing Electric Energy. S. Z. DeFerrenti, London, England.
389,839. Telegraphic Call for Messengers, etc. B. Dubinski, St. Louis, Mo.
389,853. Safety Apparatus for Elevators. C. E. Ongley, New York, N. Y.
389,857. Electric Fare Register. E. A. Scales, Lowell, Mass.

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The Practical Operation of a Modern Railway Sub-station.

By Sydney W. Ashe.

Part I.

The purpose of this article is to consider from a practical viewpoint the operation of a modern interurban railway sub-station. This consideration is restricted to sub-stations in which high-tension alternating current is received and converted into low-tension direct current.

The primary apparatus with which such a sub-station may be equipped so as thoroughly to perform its function and still afford maximum protection to the station operators and also to the converting apparatus may be enumerated as follows:

Step-down transformers.
Rotary converters.
Oil switches.
Rotary starting devices.
Synchronizing mechanisms.
Local storage battery for the operation of all oil switches and protecting mechanisms.
Circuit-breakers.
Reverse-current relays.
Time-limit relays.
Motor-generator sets.
Switchboard devices for operating rotaries.
Transformer blowers with direct-connected motors.
System of feeder control and apparatus for the general illumination of building.

These devices could be considered under three heads—conversion apparatus, automatic devices and the manually operated mechanisms—but it is better to consider them as a unit, describing the details of each as it presents itself. As many of the devices are operated by a local storage battery it is perhaps best to consider this first.

Local Storage Battery.

The sub-station is usually equipped with a local storage battery for the operation of oil switches, reverse-current relays (tripping coils), signal lamps and for energizing the field coils of switchboard instruments. These batteries have an ampere-hour capacity of from 30 to 40 ampere-hours and a rated voltage when charged of 125 volts. The reason a local storage battery is employed for such purposes in preference to the low-tension railway circuits is that in case of failure of power at central station it would be possible to operate all switching devices in the station. It is true that oil switches could be tripped mechanically, but it is undesirable, as it would take too much time; and the operator, to trip the switch, would have to leave his operating board. The latter would be exceedingly unwise in case of trouble.

Furthermore, the operation of some of the relays, such as the reverse-current relays, is affected materially by a change of voltage, and where railway circuits will readily fluctuate 50 volts or more it is obvious that the maintenance of such apparatus would be rather difficult. In case "central station" should temporarily shut down, the storage batteries, if charged, could easily operate the switching devices for about 24 hours at a minimum. If "central station" should go out of service at night the illuminated crystals on the switchboard panel would enable the operator to clear his operating board and be ready to synchronize his machine when the power was again "cut in."

The signal lamps and instrument coils in a medium-sized station require a constant battery discharge of about five amperes; the opening of a circuit-breaker takes about half an ampere for a short interval, and the opening of an oil switch requires about 25 to 30 amperes.

The switchboard crystals previously mentioned are illuminated by lamps from the storage-battery circuit, a green crystal indicating when an oil switch has been opened and a red crystal indicating when an oil switch has been closed. Signal lamps are also arranged to indicate when a circuit-breaker is opened. This is convenient on a large board, as it would be otherwise impossible from the middle of the board to discern which circuit-breaker had opened, as the breakers are usually enclosed on three sides with a brick enclosure.

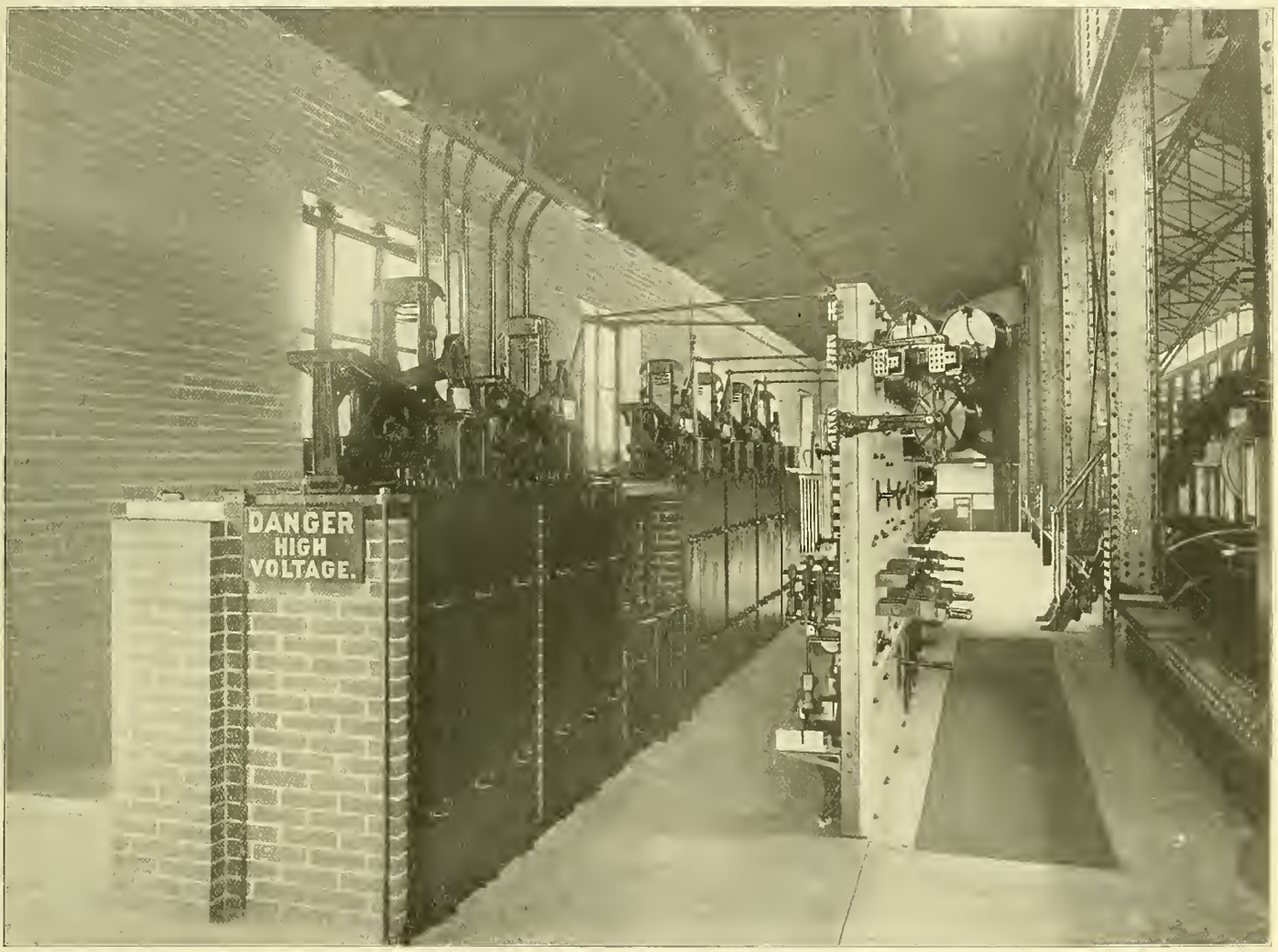


FIG. 1. OPERATING BOARD AND OIL SWITCHES IN A MODERN RAILWAYSUB-STATION.

Circuits.

There are usually three distinct circuits to be considered in a sub-station layout, the incoming high-tension feeders conveying alternating current, the outgoing feeders carrying low-tension direct current and the local storage-battery circuit previously mentioned. There are also auxiliary circuits in the station for the operation of lights, cranes, motors, etc.

Fig. 2, on the next page, is a complete wiring diagram, in elementary form, of a model sub-station layout. This represents General Electric practice.

Current usually enters the sub-station through high-tension three-phase lead-sheathed cables terminating in a bell, in which are connected the house feeders. This bell is filled with an insulating compound to keep all moisture from entering between the end of the lead sheathing and the cables proper. The house feeders go direct to oil switches (Fig. 7, Westinghouse design), passing through these to a high-tension bus (Fig. 3). Several high-tension feeders may thus be connected

in multiple to the same bus, each feeder being protected by an oil switch. These switches are equipped with time-limit overload relays which open the switches when a severe overload has been upon the feeders for a predetermined number of seconds. From the high-tension bus, feeders pass through single-pole switches to the transformer oil switches. These switches are likewise protected with time-limit overload relays. From the oil switches the feeders pass to the high-tension side of step-down transformers, the low-tension side of the transformers being connected direct to the rotary alternating-current brush-holders.

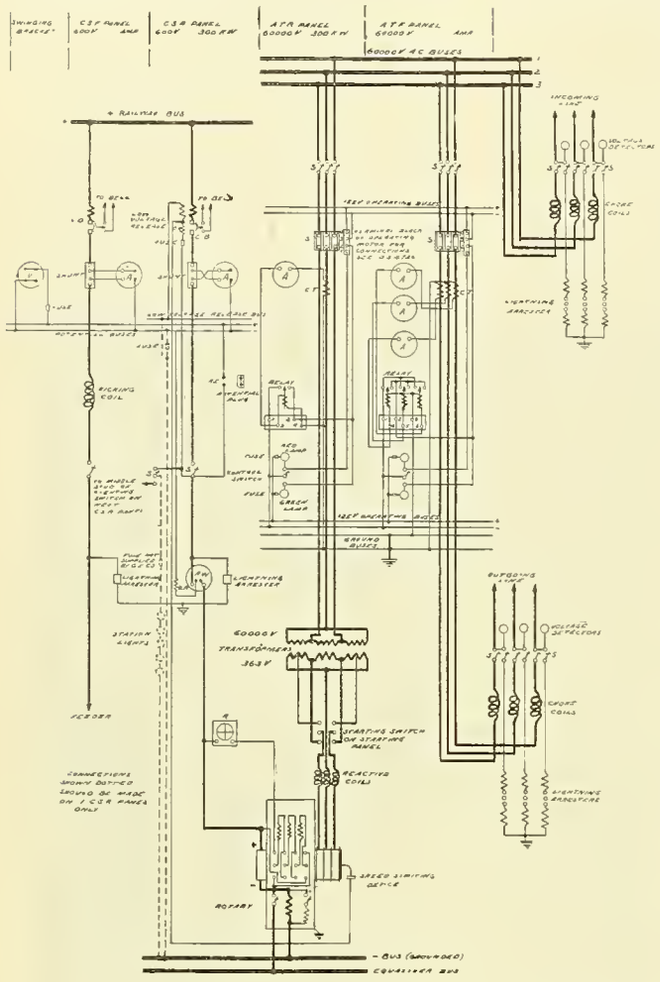


Fig. 2. Diagram of Connections.

By means of the transformer oil switches it is possible to control independently each rotary circuit. When machines are synchronized from the high-tension side these switches are closed at the instant of synchronism. Considering the low-tension side of a rotary, the negative armature terminal and the negative field terminal are tied together and grounded to the ground bus through a single-pole switch. Where rotaries are compounded an additional switch is provided for connecting the compound coils of the rotary in multiple with the coils of the other rotaries, an equalizer bus being provided for the purpose. The positive armature and field terminals of the rotary are carried to the operating board (Fig. 5 and Fig. 6).

Here it is possible to connect the positive feeder to the positive bus through the medium of a circuit-breaker and a single-pole switch. The circuit-breaker is provided with an overload relay and a reverse-current relay. The overload relay should be blocked where an oil switch is used on the alternating-current side of the rotary, providing the oil switch is equipped with a time-limit overload coil. The function of the reverse current relay is to trip the breaker if the voltage of the rotary should become slightly lower than the bus, a sudden rush of current taking place tending to motorize the rotary. These relays trip at about 15 per cent., supposedly, of the normal full-load reverse current of the rotary. They are usually set, however, about 25 per cent. of full load, in practice, as they would otherwise be too sensitive.

From the direct-current bus the current passes through a circuit-breaker and a single-pole switch to the rail feeder, passing out of the station to the individual rail sections. The feeder circuit-breakers are protected with a straight overload relay. With this arrangement it is possible for an excessive overload or a short-circuit to occur on an individual rail section, opening the feeder breaker, taking the power off that section without interfering with the operation of the rotaries. Sometimes, however, the short circuit or overload is so great as to open the oil switches on the rotary, throwing the machine out of step.

The positive field switch of the rotary is arranged on the switchboard panel, so that when the field has been properly built up and the rotary is operating at about normal speed, the field, if separately excited, may be made self-exciting by throwing this two-way switch over to the positive-rotary armature-switch circuit. The stud of the two-way switch is usually connected to the stud of the positive switch.

(See small single-pole switch, Fig. 5 and Fig. 6.)

All of the controlling relays may be operated from a common benchboard, but usually the negative switches are separated from the positive switches and have auxiliary apparatus such as starting sets (where provided) separate, so as to be operated by the rotary tender. Indicating instruments and synchronizing mechanisms are also provided. Local battery circuits are arranged for the tripping of oil switches, circuit-breakers, etc., as previously mentioned. Fig. 5 is a front view of a direct-current panel showing the recording wattmeter, the positive rotary armature switch, the rotary field switch, the field rheostat, the circuit-breaker, with overload release and tripping coil. Also the switchboard instruments are shown. Fig. 6 is a rear view of the same board showing the positive bus with special V-shaped clamp, ammeter shunts and chains connecting to spindle of field rheostat. Rheostats are seldom mounted on the board, due to their cumbersomeness, heat generated and weight. A complete station equipment of operating board and oil switches may be noticed in Fig. 1.

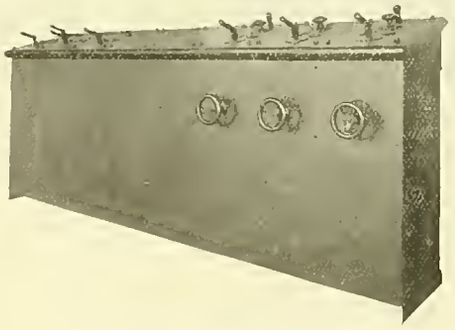


FIG. 4. BENCH BOARD FOR SYNCHRONIZING ROTARIES IN MODERN SUB-STATION.

Starting the Rotary.

There are various methods used for starting rotary converters, each possessing its relative merits. However, as an example the case of a 1,500-kilowatt rotary, started from a separate direct-current starting set, will be discussed.

Where a high-tension service fluctuates, as all high-tension circuits sometimes do, it often becomes a rather difficult matter to synchronize machines quickly. Ordinarily a machine can be synchronized in two minutes, and in cases of trouble it can be done in a minute and one-half. This includes closing all switches, rotary starting from rest, and operating starting set. For a 1,500-kilowatt rotary, which is likely to be started in a hurry, a three-phase induction motor of 150 kilowatts, operated from the low-tension side of three 50-kilowatt transformers, is direct connected to a 100-kilowatt direct-current shunt-wound generator. To operate the rotary with this system it is better to build up the excitation of the rotary field simultaneously with the generator field, care being taken to see that the rotary has negligible resistance in its field rheostat and that the starting dynamo has maximum resistance in its field rheostat. The reason for this is obvious.

Fig. 3. High-tension Bus-bars.

When the fields of both machines are built up the armature of the rotary converter is closed upon the armature of the starting set through a five-point resistance. With a 1,500-kilowatt rotary, if the voltage of the excited shunt generator of the starting set be 750 volts, the sudden rush of current into the rotary armature will amount to about 400 amperes. With the General Electric board the five-point switch controlling the resistance should not be moved from the first notch until the speed of the rotary has increased to such a point that the current passing through the armature falls to 100 amperes. The second notch on the switch may then be closed and the motion continued, waiting each time till the current falls to 100 amperes.

When the rotary has reached normal speed and all the armature resistance has been cut out the field switch may be quickly thrown, shifting the positive field terminal from the starting set to the rotary so that the machine will be operating as a shunt motor with a rheostat in series with the field coils. Adjusting the field rheostat of the rotary and lowering the voltage of the starting set to about 50 volts above that of the direct-current bus, arrangements should be made to synchronize. Some stations still cling to the old method of using lamps to synchronize their machines, but the use of a synchroscope is far more preferable. With this instrument it is possible to synchronize with the greatest accuracy. It not only indicates whether the machine is in step but also indicates whether the rotary is moving too fast or too slow with respect to the service. With the General Electric switchboard two plugs are provided for synchronizing, one to be placed in a receptacle on the switchboard panel of one of the rotaries operating and the other to be placed in a receptacle on the switchboard panel of the rotary starting. At the instant of synchronism, with the pointer of the synchroscope

moving slowly over the dial, the oil switch on the transformer circuit must be closed. As a short time interval elapses before the switch closes, it is far more preferable to close the auxiliary battery starting switch on the operating board when the pointer of the synchroscope is approaching zero and is about 10 degrees off from the mark. The actual number of degrees depends entirely upon how rapidly the pointer is moving. If the switch on the operating board be closed at the instant the pointer is over the zero mark instead of before, as previously stated, the machine may be several degrees out of synchronism before the motor on the oil switch can close the circuit. With a little practice it is possible to synchronize with a synchroscope perfectly.

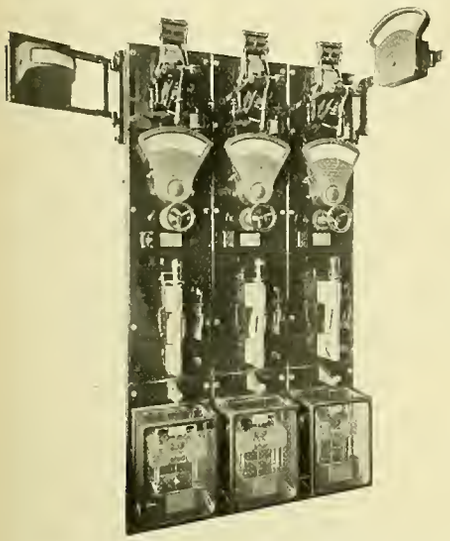


Fig. 5. Front View of Direct-current Machine Panels.

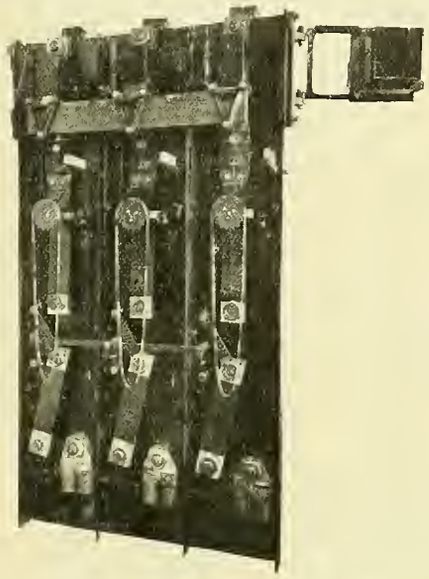


Fig. 6. Rear View of Direct-current Machine Panels.

MODERN RAILWAY SUB-STATION PRACTICE.

When the rotary has been synchronized the starting set may be disconnected from the circuit. The circuit-breaker on the starting set is usually arranged to trip the instant the transformer oil switch is thrown. This prevents the pumping effect caused by running a machine from the direct current as well as the alternating current simultaneously, and also protects the starting set if the machine should be out of step when the oil-switch is closed. If the machine is not in step when the oil switch is closed, what is termed making a "bad shot" will occur. On such an occasion the amount of damage which will result is hard to estimate. The commutator will flash over and a ball of fire and smoke will come from the machine accompanied with a dull roar. After one such occurrence an operator is usually quite careful. When the rotary is synchronized it may be connected to the direct-current bus. The Westinghouse bench-board for synchronizing rotaries is shown in Fig. 4.

[*To be concluded.*]

American Railway Mechanical and Electrical Association.

[Special dispatch to the Western Electrician.]

Philadelphia, September 26.—With an attendance of about 150, the American Railway Mechanical and Electrical Association, affiliated with the American Street Railway Association, finished its 1905 convention here today. The convention was begun yesterday, and all the papers given in the list published in the Western Electrician last week were read. Today these officers were elected:

President—H. H. Adams, superintendent of motive power, United Railways and Electric Company, Baltimore.

First vice-president—Fred G. Simmons, superintendent of construction and maintenance of way, Milwaukee Electric Railway and Light Company.

Second vice-president—J. S. Doyle, master mechanic, Interborough Rapid Transit Company, New York.

Third vice-president—Paul Winsor, chief engineer, Boston Elevated Railway Company.

Secretary and treasurer—S. Walter Mower, Detroit United Railways.

Executive committee—W. S. Twining, chief engineer, Philadelphia Rapid Transit Company; Fred Bushnell, chief engineer, Rhode Island Company, Providence, R. I.; W. Boardman Reed, engineer maintenance of way and buildings, New York City Railway Company; A. D. Campbell, master mechanic, Seattle Electric Company.

M. L. G.

[A full report of the conventions of the American Street Railway Association and subsidiary organizations will be given in the Western Electrician next week.]

Central-station Census Statistics.

A report on central electric-light and power stations for the year ended June 30, 1902, has just been published by the Bureau of the Census under the supervision of Mr. W. M. Steuart, chief statistician for manufactures. It is the third of a series of reports on the operation and utilization of electric current, the text being prepared by Mr. T. C. Martin of New York.

In 1902 there were in the United States 3,620 central electric stations, with a cost of construction and equipment of $504,740,352. This is a remarkable growth, since in 1881 there were only eight stations in operation. Employed were 6,996 salaried officials and clerks with salaries amounting to $5,663,580, and 23,330 wage-earners with wages amounting to $14,983,112. The gross income was $85,700,605, comprising $84,186,605 from sale of current and $1,514,000 from other sources. Total expenses were $68,081,375. The total output of stations for the year in kilowatt-hours was 2,507,051,115. The number of arc lamps was 385,698 and of incandescent lamps 18,194,044.

There has been a striking change in the character of service in these stations. In the earlier days of the industry nearly all the stations were installed for the purpose of furnishing current for arc lighting, while today the bulk of current is supplied for incandescent lighting, motor power and miscellaneous service. The last includes charging telephone exchanges, batteries for boats and automobiles, pumping, hot water, steam and electric heating, electric current, and nickel plating and electroplating.

Private stations form by far the larger portion of the industry, constituting 77.5 per cent. of the total number of stations in operation during 1902. Their income from sale of current was $78,735,500, or 91.9 per cent. of gross income, the expenses of operation 92.3 per cent. of the total, while they gave employment to 89.4 per cent. of the total number of wage-earners engaged in the industry, and paid 90.5 per cent. of the total amount of annual wages. The primary power-plant equipment of these stations formed 91.3 per cent. of the total horsepower of all stations, while their generating equipments formed 90.6 per cent. of the total horsepower of all dynamos. The kilowatt-hour output of private stations formed 92.2 per cent. of the total, and the arc lamps in such stations formed 86.8 per cent. of the total number wired for operation.

The largest number of stations was in Illinois, followed by Pennsylvania, New York, Ohio, Michigan, Indiana, Iowa and Wisconsin in the order named. No other state reached the 150 mark. The New England states were well supplied with stations. Massachusetts reported the largest number, then came Maine, Vermont, New Hampshire and Connecticut. Among the southern states Texas led, with Kentucky, Tennessee and Georgia following. Of the western states, California reported the largest number of stations; Colorado, Washington, Oregon and Montana being next in order. Of the 1,892 places reported at the twelfth census as having a population of 2,500 and over, 1,511 had one or more central electric-lighting stations. Of the places with a smaller population, 1,960 had similar stations.

The whole aspect of central-station current supply in its relation to population has in reality been utterly changed by the development of polyphase power-transmission plants. There are at least a thousand such plants, with lines frequently 15 or 20 miles long, in many cases 40 or 50 miles, often 60 or 90 miles, and sometimes even 150 or 200 miles. These transmission enterprises are peculiarly typical of the far-western states, but are by no means concentrated there, being scattered all over the Union.

The total capital stock and funded debt authorized amounted to $743,296,266, but the amount issued was considerably less, being $627,515,875. Of the total amount authorized $435,178,372, or 58.5 per cent., was capitalized stock, and $308,117,894, or 41.5 per cent., was funded debt. Of the total authorized capital stock, $372,951,952, or 85.7 per cent., had been issued at the end of the year covered by the report. Of the capital stock issued, $23,871,671, or 6.4 per cent., was preferred stock and $349,080,281, or 93.6 per cent., was common stock.

Although the practice of supplying current for motive power and other uses had grown rapidly, the supplying of current for light was still preponderatingly the business of both private and municipal stations. Of the total income $70,138,147, or 81.8 per cent., was directly derivable from lighting. The private stations obtained 80.5 per cent. and the municipal stations 96.9 per cent. of their income from this source. This income from sale of current for lighting purposes was derived from 385,698 arc lamps and 18,194,044 incandescent lamps. The average income per lamp for arc lights in private stations and used for commercial or other private lighting was $48.88; used for public lighting, $83.20. In municipal stations for commercial or other private lighting it was $40.46; for public lighting, $69.98. The incandescent lamps in private stations in commercial use earned an average income of $2.40 per lamp; in public service, $6.06. In municipal stations these lamps earned $1.92 in commercial service and $5.93 in public service.

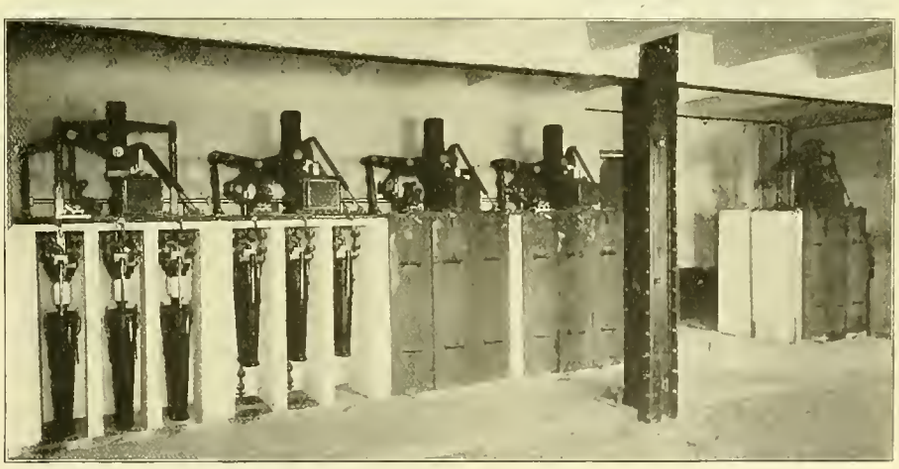


FIG. 7. OIL SWITCHES IN MODERN RAILWAY SUB-STATION.

The power-plant equipment showed 5,930 steam engines with 1,379,941 horsepower, and 1,390 water wheels with 438,472 horsepower, and the generating plant equipment 3,823 direct-current constant-voltage dynamos with 442,446 horsepower; 3,539 direct-current constant-amperage dynamos with 195,531 horsepower, and 5,122 alternating and polyphase-current dynamos with 987,003 horsepower. The line construction had 107,263 miles of mains and 17,880 miles of feeders. For the service-line equipment, meters, lamps and motors are the important items. There were 582,689 meters, 575,004 of these were mechanical and 7,685 chemical. The aggre-

gate of arc lamps of all classes was 385,698, of which 334,903, or 86.8 per cent., were operated from private stations and 50,795, or 13.2 per cent. from municipal stations. In addition to these 385,698 arc lamps connected to the circuits of central stations, the street railways operating electric-lighting stations reported 33,863 arcs, making the total for the United States 419,561.

The average output of current per day for all stations was 6,960,783 kilowatt-hours, making a total for the year of 2,507,051,115. For private stations the output was 2,311,146,676 kilowatt-hours, and for municipal stations 195,904,439. Among the private stations the totals for New York are at the head of the list; among the municipal, Illinois.

Power-station Load Factor as a Factor in the Cost of Operation.[1]

By Lawrence P. Crecelius.

Any method that will tend to smooth up the load curve is indeed worthy of consideration, as an increase in the load factor means a corresponding decrease in the cost of power per car-mile. This becomes very apparent when we compare the amount of station apparatus which is required to carry the peaks with that which is required to carry the average, and the manifest inefficiency of this arrangement when the load factor is small. The load factor is the ratio between the average load and the maximum, and, therefore, represents the ratio between the amount of station apparatus required for the average and that required to do the peaks. Further, since the morning and evening peaks are both three and four hours, respectively, in duration, we find that from 45 per cent. to 60

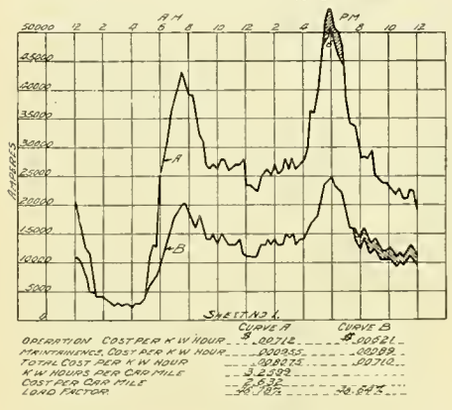


FIG. 1. CURVES OF TOTAL LOAD ON FOUR STATIONS AND LOAD ON ONE 13,950-KILOWATT STATION.

per cent. of the station apparatus of a system is idle for 17 hours or more.

The United Railways system of St. Louis has in operation four power stations at the time of writing. Two of the larger stations, one of 13,950 kilowatts and one of 7,000 kilowatts capacity, are kept in operation continuously, and constitute the main central stations. The two smaller stations are operated on swing watches on week days, that is, operated during the peak hours only. Bus wires have been run from the larger stations to both of the smaller ones, and there connected through circuit-breakers and double-throw switches to either one of the two feeder busses with which the smaller

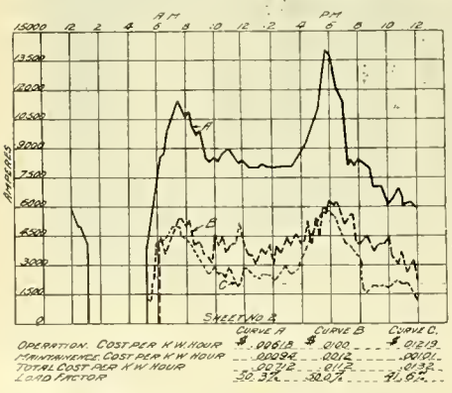


FIG. 2. CURVES OF STATION PERFORMANCE.

stations have been supplied. Installing double-throw switches on both the feeders and bus wires in these stations makes it possible to operate them on one bus, to which any number of feeder sections can be connected, and at the same time operate the bus wires, independent of the station on the other bus to which the rest of the feeder sections can be connected. During the rush hours the bus wires are connected to the same bus on which the stations are operated, thereby becoming equalizer wires. The amount of copper in the bus wires is just sufficient to carry the load of the smaller stations during the lighter part of the day, allowing a reasonable drop in potential.

The resulting economy of operation in this case more than justifies the expenditure of a good many dollars and cents in the bus wires, and also the resulting increase in the cost per kilowatt-hour of the power generated under this arrangement in the smaller stations, as may be seen by referring to the load curves.

Of the following load diagrams, Fig. 1 shows two curves. The upper curve represents the total load of all the power stations for a period of 24 hours. The second curve represents the load on the 13,950-kilowatt station before the installation of the bus wires. Under the curves are shown the cost of operation and maintenance per kilowatt-

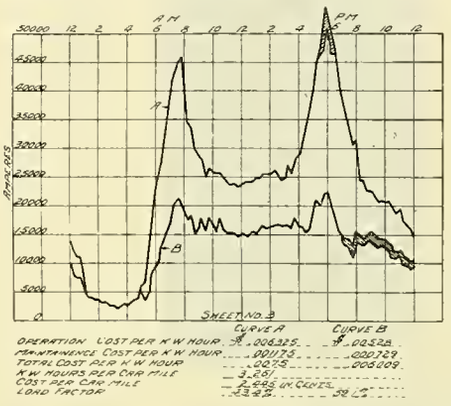


FIG. 3. OUTPUT OF STATIONS UNDER NEW ARRANGEMENT.

hour, the cost per car-mile, the kilowatt-hours per car-mile and the load factor.

Fig. 2 represents the performances of the other stations on the same day. Figs. 3 and 4 are carried out on the same order, and represent the output of each of the stations under the new arrangement, after the installation of the bus wires. The summary of the above is as follows: By plotting a curve which is the sum of the load of both the main stations, we can arrive at a curve, the load factor of which is nearly the correct factor to work by, as obviously the effect of the load factors of

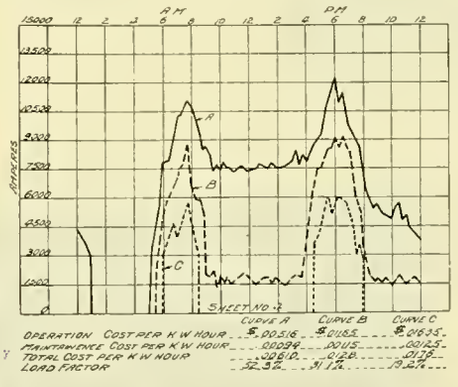


FIG. 4. OUTPUT OF STATIONS UNDER NEW ARRANGEMENT.

the smaller stations will have little bearing upon the total cost of operation as compared with that of the larger stations. Nevertheless, the shutting down of these stations during the lighter part of the day, thus operating them at an absolute disregard toward economy, does influence the load factor of the main-station curves very materially, and ultimately effecting a saving. This is clearly shown in Fig. 5. Fig. 5 represents the sum curves of the two main stations when working under both conditions. Curve (A) represents the load of the main stations for the same day on which all four stations were in operation all day. Curve (B) represents the load of the same stations when taking the load of the smaller stations during the lighter part of the day. Thus it is found that in bringing up the load factor of the sum curves of the main stations from 50.23 per cent. in the first case to 57.7 per cent. in the second, that a saving of 0.000575 of a cent per kilowatt-hour has been made on the total power cost. And on a basis of 310,000 kilowatt-hours per day, which is about the average output of the stations of this system during the summer months, this would represent a saving of $178 per day when operating under these conditions. All of the above figures, giving the cost of operation and maintenance per kilowatt-hour, were taken from a report received monthly from the auditing department, while the curves were plotted from readings taken daily; therefore, it is possible that the cost of power per kilowatt-hour for the specific days shown on the curve sheets may have been a trifle more or less than given.

The curves show the use of a storage battery to level the evening peak. The charge and discharge of the battery are shown by shaded areas above and below the load line. It has been found that since the installation of the battery, which is located in the business district of the city, where the traffic is very congested, the service has been increased to a marked degree during the rush hours.

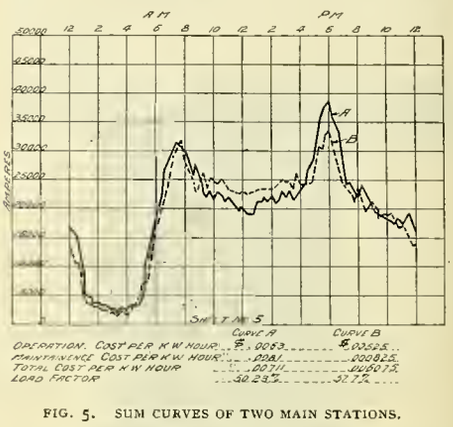


FIG. 5. SUM CURVES OF TWO MAIN STATIONS.

Also a large reduction in the amount of copper required to handle the sections located in this district from the four stations has been effected. This, together with the fact that a battery can always be called upon in cases of emergency to take hold of the load, points to the advantages to be derived in using storage batteries to smooth up the load curve when conditions warrant their use.

There is still a tendency among power men to regard batteries with suspicion and distrust, owing partly to the enormous cost of a complete battery installation, and partly to the rapid depreciation of a battery when overloaded. Nevertheless, the use of storage batteries abroad, with their attendant economical results, by leveling load curves, has gradually led to the adoption of them here, until now we find that in every modern installation they form an integral part of the power equipment.

Colorado Electric Light, Power and Railway Association.

The third annual convention of the Colorado Electric Light, Power and Railway Association, held in Glenwood Springs on September 18th, 19th and 20th, was a successful meeting. Sessions were held each day in the Hotel Colorado. The association is composed of 26 active members and 33 associates, and about two-thirds of these were represented at the convention.

President J. A. Beeler of Denver delivered his address at the first session, which was followed by routine business.

At the following sessions a number of good papers were read, and these papers and the discussions which followed proved of interest and value to the members. A valuable feature of the programme was the Question Box, which was divided into sections, and brought out answers to live questions on management, boilers and engines, lightning arresters, transformers, line construction, meters, etc.

F. W. FRUEAUFF.

Papers were read and discussed as follows: "Notes on an Up-to-date Sub-station," by A. M. Ballou; "A New High-candlepower Incandescent Lamp," by C. B. Mahaffey; "The Application of Electric Power to Gold Dredging," by J. F. Dostal; "Isolated Plants," by H. L. Wolfenden; "Getting New Business," by R. L. Goodale; "The Mercury Arc Rectifier," by G. N. Robinson.

Following is a list of the officers and committees elected for the ensuing year:

President—F. W. Frueauff, Denver Gas and Electric Company, Denver.

Vice-president—William Mayher, Greeley Power and Electric Company, Greeley.

Secretary and treasurer—George B. Tripp, Colorado Springs Electric Company, Colorado Springs.

Executive committee—F. W. Frueauff, William Mayher, George B. Tripp, J. A. Beeler of the Denver City Tramway Company, Denver, and J. F. Vail of the Pueblo and Suburban Traction and Lighting Company, Pueblo.

Finance committee—D. S. Harper, Las Animas Light, Power and Manufacturing Company, Trinidad; P. R. Stout, Gilpin County Light, Heat and

1. Abstract of a paper read before the American Railway Mechanical and Electrical Association at Philadelphia September 25, 1905. Mr. Crecelius is chief electrician of the United Railways Company of St. Louis.

Power Company, Central City; H. N. Gilbert Pueblo.

Membership committee—J. J. Cooper, Mountain Electric Company, Denver; J. E. O. Blackall, Continental Oil Company, Denver; B. K. Sweeney, New York Insulated Wire Company, Denver.

Advisory committee—William T. Wallace, Colorado Light and Power Company, Canon City; E. J. Temple, Boulder Electric Light and Power Company, Boulder; R. L. Goodale, Colorado Springs Electric Company, Colorado Springs; A. M. Ballou, Denver City Tramway Company. Denver; W. J. Barker, Denver Gas and Electric Company, Denver.

Following is a list of the active members of the association:

Durango Light and Power Company, Durango; Larimer Light and Power Company, Fort Collins; Las Animas Electric Company, Las Animas; Colorado Springs Electric Company, Colorado Springs; Leadville Gas and Electric Company, Leadville; Boulder Electric Light and Power Company, Boulder; Pueblo and Suburban Traction and Lighting Company, Pueblo; Las Animas Light, Power and Manufacturing Company, Trinidad; Arkansas Valley Electric Company, Florence; Gilpin County Light, Heat and Power Company, Central City; Denver Gas and Electric Company, Denver; Denver City Tramway Company, Denver; La Junta Electric Company, La Junta; Greeley Power and Light Company, Greeley; Crested Butte Water and Power Company, Crested Butte; Roaring Fork Electric Light and Power Company, Aspen; Loveland Light, Heat and Power Company, Loveland; Lamar Electric Company, Lamar; Colorado Springs and Interurban Railway Company, Colorado Springs; Montrose Electric Light and Power Company, Montrose; Grand Junction Electric and Gas Company, Grand Junction; Glenwood Light and Water Company, Glenwood Springs; Gold Belt Consolidated Electric Company. (Cripple Creek District), Denver; Telluride Electric Light and Power Company, Telluride; Colorado Light and Power Company, Canon City; Consolidated Gem Mines Company, Idaho Springs.

International Brotherhood of Electrical Workers.

The ninth biennial convention of the International Brotherhood of Electrical Workers opened in Germania Hall, Louisville, Ky., on September 18th, to last over a week. The important work for this convention was to change the constitution on many salient points. The main object now is to simplify the constitution and to reduce the 100 or more different classifications of workmen to two—that is, inside and outside workmen. As every change was discussed at length, and as each class of workmen desires to get as much recognition as possible under the new constitution, the work was tedious and long. The changes in the constitution were discussed on the floor of the convention, where 325 delegates were sitting with about 600 votes on every measure proposed.

The delegate body at the convention, which numbered about 325, was representative in character. Grand President F. J. McNulty of Washington, D. C., called the convention to order, and after a welcoming address by Mayor C. F. Grainger, who was introduced by F. J. Weaver, president of the Louisville local union, the president delivered his address. Mr. McNulty outlined the hazard of the electrical worker and said the men are underpaid. He recommended an amendment to the constitution providing that no local union may walk out on a strike without the presence of one of the members of the international executive board, and an effort on his part to bring about a settlement of the differences between the employer and the employes. The president also recommended that the death benefit be increased from $100, as it is at present, to about $150. He advised a national sick-benefit fund also.

More organizers than are at work at present were recommended by Mr. McNulty, who said that there are now only seven organizers for all unions, and this is not enough. The organizers are paid a regular salary and devote their entire time to the formation of new locals.

An important amendment discussed and adopted by the association was one which provides for district councils, which will form a body between the local unions and the international body. The object of the amendment is to provide a central body for the local unions in certain districts, these district councils to be governed by and amenable to the international body only. The action of the convention does not make the amendment a law, as its entire action must be submitted to the rank and file of the organization before it becomes effective. The question of district councils has long been a matter of discussion in the local unions, and came before the convention on that account. It is expected that this part of the new constitution will be accepted by the rank and file by a large majority.

On Friday of last week the delegates declared in favor of drawing the color line in their order, this being the first time that the order has ever gone on record as discriminating against the negro. The decision was reached only after a long debate, when the issue was presented squarely to the convention. The question of color was presented when a proposed amendment to the constitution, changing the method of examination of applicants for admission into the union, was brought up by the constitution committee. The question put before the convention was: "Will we discriminate against the negro?" It was argued at some length, and finally the international body went on record as opposing the admission of negroes.

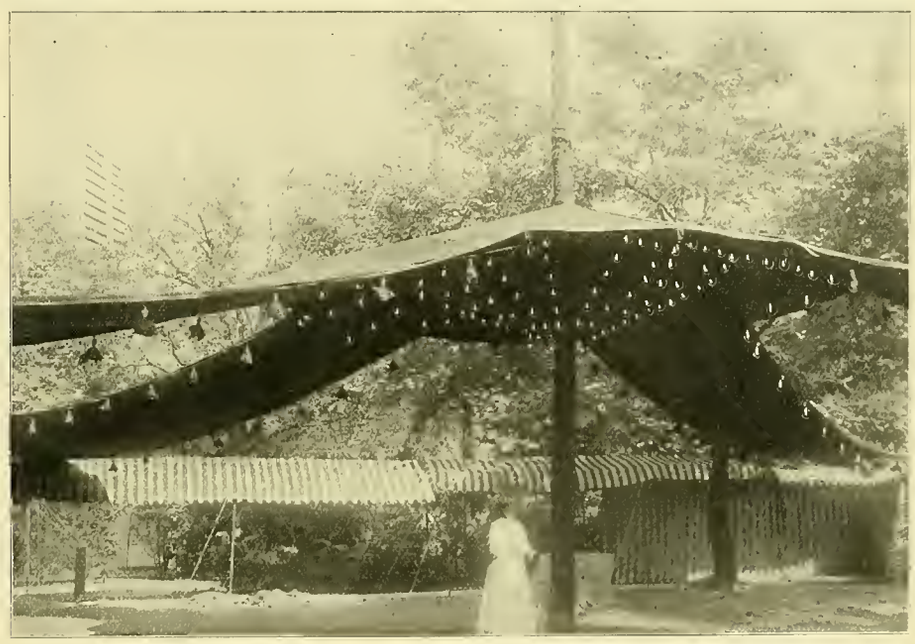
No examination of applicants for admission to local unions will be required in the future, the convention having so amended the constitution that the section authorizing an examination is practically eliminated. The examination will still be held, but it will consist of such questions that all electrical workers can answer, and none will have any trouble getting into the union. The change in this section of the constitution means that all men who work with electricity and who are qualified to fill positions may be members of the unions. The amendment was adopted only after a long and interesting debate.

One of the chief questions yet to be settled is that of changing the international headquarters from Washington, D. C., where it has been for six years, to a more central location.

Electrical Decorations at a Wedding Feast.

By Orrin E. Dunlap

On Wednesday, September 6th, Miss Beatrice Schoellkopf, only daughter of Mr. and Mrs. Arthur Schoellkopf of Niagara Falls, N. Y., and Mr. Julius Schwill of Chicago were married at the First Presbyterian Church in Niagara Falls. Following the ceremony, a reception, supper and dance were given at the beautiful home of the Schoellkopfs at the corner of Main Street and Pine Avenue. A feature of this post-nuptial celebration was one of the best electrical displays Niagara Falls has ever witnessed. As Mr. Schoellkopf is at the head of the Niagara Falls Hydraulic Power and Manufacturing Company, it was quite appropriate that the brilliance of electrical effects, properly arranged, should add to the eclat of his daughter's wedding. Mr. Benjamin F. Lee, electrical superintendent of the company mentioned, took charge of the illumination and gave his personal supervision to the work of installation. Thousands of lamps, ranging from one to 16 candlepower, were installed in the house and about the grounds, even the spacious barn coming in for attention.



UMBRELLA-SHAPED ELECTRICALLY ILLUMINATED DECORATION AT WEDDING RECEPTION.

In the reception hall 50 new lamps were placed, while the music room had 15 lamps tastefully arranged. On the west side of the house a double tent, 40 by 130 feet in size, was erected, the inner tent being of pink and white cheesecloth in stripes, the outer tent being of heavy canvas, to ward off any possible storm. To afford illumination in the tent 229 16-candlepower lamps were tastefully festooned, the other decoration being smilax. On the tall flagstaff on the lawn 90 eight-candlepower lamps were run in rope form, while on the ring at the top of the pole 18 16-candlepower lamps made a ring of light that was attractive.

On the lawn at the south side of the house a huge umbrella, 20 feet in diameter and standing 12 feet clear of the ground, was erected. Its color was a bright red, and running from it were four canopies of the same color. This unique creation was graced with nearly 200 16-candlepower lamps in red. The effect was striking and beautiful—much more so than the accompanying photographic representation would lead one to believe.

Hundreds of extra cedar trees had been set about the grounds, marking, in hedge-like form, the sides of all the walks, and through these were hung hundreds of incandescent lamps that made the walks brilliant. Mr. Lee, however, reached his best as a decorator when he strung between 1,500 and 2,000 one-candlepower lamps through the flower-beds on the grounds, all the beds being in bloom. These tiny lamps were in colors, and matched the natural colors of the flowers. A miniature representation of the Falls of Niagara stood on the east side of the lawn, where it was fed from a city water main. This miniature representation of Niagara was the creation of Superintendent Ross Coddington and Mr. Harry Crowie of the Niagara Falls Hydraulic Power and Manufacturing Company. It was set in a mass of evergreens, and as the varied-colored lamps cast their glow on the tumbling waters, the spectacle was a pretty one.

Underwriters' View of Electrical Conditions in Minneapolis.

The committee on fire protection engineering, of the Western Underwriters, has just made a report on the electrical equipment of Minneapolis, being supplementary to a report made some time ago. It is declared that the persistent efforts of the mayor of that city are having a salutary effect, his appeal to the City Council to provide for a more efficient control of outside wiring resulting in the appointment of a committee to investigate the matter. One meeting has been held at which all interested were permitted to present their views, and a motion was carried to order the city attorney to draft an ordinance providing for the appointment of an inspector of outside wiring, and defining his duties.

Compliance with the following requirements should be insisted upon, according to the underwriters' committee:

1. Removal of overhead wires from congested business district, including warehouse section.
2. Effectual grounding of transformer secondaries.
3. Removal of all wires and transformers from roofs of buildings.
4. Reduction in the number of service wires attached to the front of any building, and the placing of attachments so that the work of the Fire Department will not be hindered.
5. Segregation of light and power wires as far as possible.
6. Removal of service entrances from skylight and replacement of flexible tubing, where used as entrance tubes, with porcelain.
7. "Wonderland Park" feeders to be provided with heavy guard equipment immediately under it, throughout the length of aerial section. Guard screen to be wide enough to prevent wires from dropping outside of it, and heavy enough to resist serious damage from arcing.
8. An emergency switch to be placed on this line, just outside of park, and wires to be carried into transformer house in underground conduit.
9. Insulated guard wires to be installed on pole line where line changes direction, so that the breaking of insulator, pin or tie wire will not permit wire to fall.

The underwriters' inspection of inside wiring is being conducted at a disadvantage, owing to the tremendous amount of work going in and the small force available for inspection work. Additional help is needed properly to supervise the new work and secure the improvement of old equipment.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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DATES AHEAD.

Illinois State Electric Association (annual meeting), National Hotel, Peoria, Ill., October 5th and 6th.

Railway Signal Association (annual meeting), Niagara Falls, N. Y., October 10th.

Ohio Society of Mechanical, Electrical and Steam Engineers (annual meeting), Canton, Ohio, November 17th and 18th.

Automobile Club of America (annual exhibition), Sixty-ninth Regiment Armory, New York City, January 13th to 20th.

Chicago electrical exhibition (first annual exhibition of Electrical Trades Exposition Company), Coliseum, Chicago, January 15th to 27th.

IT IS AT SEA that space telegraphy finds its greatest usefulness. An example is furnished by the possibility of directing the movements of a warship in its search for a derelict. Thus the waterlogged schooner Edward L. Warren, abandoned last May, is reported as drifting about on this side of the Atlantic, a constant menace to navigation. The United States cruiser Columbia has been dispatched to find the vessel and sink it. By means of "wireless" the captain of the Columbia will be kept in communication with the Brooklyn navy yard and will direct the movements of his ship, in making the search, by reports received from incoming vessels and transmitted to him. Already a message has been sent to the cruiser at sea which has caused a change of direction in the hunt for the dangerous hulk. In this way a new possibility in the practical application of space telegraphy has been utilized.

WHILE it is to be regretted that the attendance at the convention of the American Electrochemical Society in Bethlehem, Pa., last week was not larger, that fact is not to be taken as indicating that the meeting was not a profitable one. Every one of the 40 members present was an enthusiast in his chosen line of work, and anyone who has followed the course of this comparatively young organization will appreciate the fact that this enthusiasm is not of a transitory nature, but is accomplishing marked results in the promotion of the electrochemical industry.

The matter of annual versus semi-annual meetings was brought up at this convention. The result of a canvass among the members showed that the prevailing opinion was in favor of annual meetings, and the board of directors, in consequence of this feeling, recommended that the matter be definitely decided at the next meeting, which is to be held in Ithaca, N. Y., the seat of Cornell University, next May. It seems more than likely, therefore, that hereafter the society will hold annual conventions, which is the custom of most of the larger organizations and which course has been previously pointed out in these columns as productive of the best results. The holding of semi-annual conventions is, in the long run, almost certain to result in flagging interest on the part of the members. Most of them are busy men, who often find that the opportunity does not present itself to attend two meetings in the same year. If one meeting is missed, it is easier to let the next slip by. Better have one meeting each year at which a majority of the members are present than two at which there are many vacant places.

RAILWAY education is announced as a new departure at the University of Chicago. Primarily designed for railroad employes, the lectures will be given in the evening downtown, and a four-year course is planned. Practical railroad men are said to be greatly interested in the departure, to which they are giving active assistance. It has been observed by the heads of all departments in the railroad offices that their men easily get into ruts and soon lose much of their potential capacity. Only those who fight against the monotony of the daily routine secure promotion to the positions where the responsibility often enhances the ability of the man. Many railroad companies feel that the time is approaching when great strictness will be exercised in the admission of young men to their employment, and that, except in the lowest grades of manual labor, some training in railway organization and working will be required for admission. Accordingly, they welcome the effort to supplement practical experience by scientific training.

An advisory board of railroad men has been formed to co-operate with the college authorities in the new undertaking, but we do not observe that any electric-railway engineer or manager is included in its membership. This is unwise, for nowadays every operating railroad man should be alive to the possibilities of electric power and fully informed as to the development of electric traction. Many of the most important railroads of the country make use of electricity to propel some of their trains. And steadily, too, the purely electrical interurban railways are developing into railroads in the steam-railroad man's use of the term, with problems of freight handling, interchangeable mileage tickets and the like, quite different from those with which the street-railway manager has to deal. Electricity is now considered as a possibility in almost every new proposition involving the movement of trains, and its economies, advantages and disadvantages are dispassionately studied. The time when the steam-railroad man smiled indulgently when electricity was mentioned, and said that it might do very well for street cars but hardly for a real railroad, has nearly passed; modern, progressive railroad men now consider the steam locomotive and the electric motor on their merits and use the one or the other as circumstances require.

In this situation a course in railway education without careful study of what is doing in electric railroading is woefully behind the times. We cannot believe that electricity is to be entirely neglected in the new series of lectures of the University of Chicago, but we are surprised that not one electric-railway man is named on the advisory board as the names are given in the newspapers. Chicago is nothing if not progressive, and its university, if it goes in for railroading at all, cannot afford to neglect the electric railway, with its tremendous achievement and wonderful possibilities.

FRANCHISE negotiations in the Chicago traction tangle during the last week or two have developed more in the nature of practical ideas from which to weave a satisfactory solution of the complicated problem than all of the indirect dealings which have characterized much of the negotiations during the last few years. It cannot be said, however, that the local transportation committee of the City Council did not do good work in preparing the "tentative ordinance" which it offered about a year ago and in which it embodied its best thought as to an equitable and feasible adjustment of the differences between the traction companies and the cities. But the ordinance, apparently, was never seriously considered by the companies, at least not in time to permit of the points of disagreement in the document being worked out before the "immediate" municipal ownership agitation took the center of the stage and put a stop to further negotiations. Since then Mayor Dunne's "contract plan" of building a competing municipal street-railway system for the city has been advanced, but, whatever else may be said of this plan, its adoption by the City Council seems doubtful. The mayor's plan has its supporters, but its opponents include the extreme municipal-ownership men as well as those who think that private operation is best. The only official recognition which has yet been taken of the "contract plan" was by the local transportation committee, which body stands 8 to 4 against it.

It is encouraging to observe that the traction companies have made a comprehensive statement to the local transportation committee outlining what they will be willing to do in return for a renewal of franchises. The offer makes some important concessions to the city and proposes the adoption of improvements to make the service first-class. In some respects it resembles the "tentative ordinance." In the first place, the companies want a 20-year franchise covering all the lines, but they are willing to sell to the city at any time in the 20-year period if the value of the unexpired term is added. They offer through routing of cars and universal transfers over both systems for a five-cent fare. The companies, while they do not approve of underground trolleys, agree to install such a line if the city requests, and if it proves practicable will use this system in the downtown district. Cables are to be abandoned for the overhead trolley, and many points which the companies, in the days of the tentative ordinance, would not agree to have been conceded. Compensation at three per cent. for each of the first three years, five per cent. for each of the next two, seven per cent. for the next 10, and 10 per cent. for each of the remaining years of the grant is offered. Mayor Dunne and the advocates of "immediate" municipal ownership say that the offer has come too late. Many of the aldermen, however, look with more favor upon the proposition, but say that if the companies had made so direct a proposition several years ago the traction question might have been settled long since.

AMERICAN ELECTROCHEMICAL SOCIETY.

The eighth semi-annual meeting of the American Electrochemical Society was held September 18th, 19th and 20th at Bethlehem, Pa. If any demonstration of the success of the experiment performed four years ago in organizing an electrochemical society was needed it was supplied by the recent meeting. The number and quality of papers and the enthusiastic interest of the members present contributed to making the meeting one of the most successful in the history of the society. Something over 40 people were in attendance, and they were representative of both the educational and technical electrochemical interests of the country.

Bethlehem as a place of historical interest and possessing large metallurgical and cement industries offered attractions as a place of meeting, and Prof. J. W. Richards and other members of the local committee co-operated with the faculty of Lehigh University in entertaining the society.

An excellent programme of papers was offered. Of the 21 papers one-third were of strictly scientific interest, while the others were of a more or less technical character. The deposition of metals received the most attention, and the electric furnace was also a favorite subject of discussion. One of the most interesting features of the meeting was the demonstration of the osmium and tantalum incandescent lamps.

The entertainment committee arranged for excursions to the zinc works and steel works of South Bethlehem and to the Dexter Cement Works at Nazareth. The social features consisted in a reception tendered on Monday evening, September 18th, by Professor and Mrs. Richards, followed by a smoker at the club house. Lehigh University tendered a luncheon on Tuesday and the banquet was held on Tuesday night at the Eagle Hotel.

The result of a canvass of the membership showed the prevailing opinion to be that the meetings should be held annually instead of semi-annually, and the board of directors therefore recommended that the matter be thus decided at the next meeting. Upon invitation from Cornell University the next meeting is to be held at Ithaca in May, 1906.

Before adjourning the society had the honor of being presented to Mr. John Fritz, the great pioneer in the steel industry of this country.

The proceedings of the convention were begun on Monday afternoon, the delegates being welcomed to Lehigh University by President Drinker. On this and the following days the many important papers on the programme were read and discussed. The following is a general running account of the proceedings; some of the more important papers will be given in full or in abstract in this or future issues of the Western Electrician.

Electrodeposition of Metals.

Mr. Anson G. Betts, well known through his success in overcoming the difficulties involved in the deposition of lead, antimony and various other metals, summarized the results of his observations in a paper entitled "The Phenomena of Metal Depositing." He claimed that the ease of deposition is governed largely by the hardness of the metal—the harder the metal the easier it is to obtain a good deposit. Thus, iron is an easier metal to deposit than is lead. He showed that the effect of the reducing agents is not that commonly supposed, that surface tension of both metal and electrolyte are controlling factors, and that crystallization of deposited metals is not of great importance in determining the quality of deposit.

Prof. C. F. Burgess took issue with the statement that good electrolytic deposits seldom assume the crystalline state, and illustrated by microphotographs prepared by Dr. O. P. Watts the fact that while a metal may appear to have an amorphous structure, high magnification will reveal crystallizations typical of the metal. Thus, electrolytic iron was shown to possess the well-known ferrite grains.

Dr. W. D. Bancroft objected to the author's interpretation of the term "surface tension," and Prof. J. W. Richards called attention to the fact that data assumed for the hardness of metals were so inaccurate as to invalidate the conclusions drawn therefrom.

Two other papers were prepared by Mr. Betts on this general subject, one entitled "Notes on the Electrometallurgy of Antimony," and the other "An Electrolytic Process of Refining Silver." In the first of these papers the author described a new method for depositing antimony from a fluoride solution. This is superior to other known solutions for extraction, refining and deposition of this metal. Beautiful deposits of antimony may be easily made, and since this metal does not tarnish in the least, even in a laboratory full of fumes where other metals tarnish badly, it has a promising future as an agent for the prevention of corrosion.

In the second of these two papers Mr. Betts showed that the present methods in use for electrolytic refining of silver involve difficulties in the construction of plant, in recovery of the metal of suitable physical quality, and in the completeness of the separation of impurities. In the new process proposed these difficulties are largely overcome by the use of dithionic acid solutions, made by the action of sulphuric acid on alcohol.

Having a bearing on the subject of electrodeposition was a paper by Prof. Burgess, entitled "Some Observations on the Influence of Arsenic in Pickling Solutions." The fact that a small percentage of arsenic in sulphuric acid exerts a marked effect on the rate at which the acid will attack iron was first pointed out over a half century ago. The reason, however, for a trace of arsenic almost completely preventing the corrosive action of the acid on iron does not seem to have received much attention.

Data of the results of a laboratory investigation of the author were given showing quantitatively the effect of this impurity. It was pointed out that the reason for it may be an electrochemical one.

The practical bearing of this phenomenon is evident to users of acid pickles, and it was suggested that inasmuch as arsenic as an impurity in the acid would retard corrosion, its presence in the metal might likewise be useful in rendering that metal more stable. To demonstrate this, however, requires further experiment.

Electric Furnace Working.

A paper which drew much attention dealing with that live subject, "The Electric Furnace," was contributed by Gustave Gin, entitled "New Gin Process for the Electrical Manufacture of Steel." In the absence of the author it was presented by Prof. Richards. The author is a recognized authority and pioneer in the field of the application of the electric furnace to the iron and steel industries. His methods have been extensively discussed in the technical press, and the report of the Canadian commission, published last year, describes his method as operated in France.

This paper describes a new modification of the Gin furnace, which has for its purpose the simultaneous and continuous realization of the following operations: Fusion of the metal, purification of the metal by oxidation of the impurities, reduction of the dissolved oxide, and the recarburization or introduction of various elements to produce the quality of steel desired. This is effected by an ingenious construction of furnace comprising a crucible for fusion, another compartment for reduction and recarburization, and a third for observation of quality. The heat is generated principally by the passage of current through a layer of molten slag, and channels serve for conducting the molten metal from one chamber to another.

A lively discussion followed which conveyed the belief that the proposed furnace was one which, while ingenious in design, would probably fail in practical working through complication and low efficiency.

William Smith of Philadelphia stated that he was interested in the manufacture of crucible steel and would welcome the opportunity of trying on a commerical scale any electrical furnace process which gives reasonable prospects of satisfactory results. He objected to the proposed method, principally on the ground that the different grades of iron in the various communicating compartments could not be maintained on account of the rapidity of diffusion of carbon.

In reply to a query as to whether electrical furnaces were practically employed in the steel industry in this country, Dr. E. F. Roeber stated that an 80-ton Heroult furnace is in operation at Syracuse and that small experimental plants are being tried elsewhere.

Dr. W. D. Bancroft pointed out the fact that the new Gin furnace departed very materially in its principles of operation from what is commonly known as the Gin process.

Dr. Leonard Waldo was called on for a discussion and he contributed many interesting facts brought out in the operation of electrical furnaces. His remarks were principally directed to the induction type of furnace, which he believes to be the one which holds most promise. Among the peculiarities of this furnace is the Thompson effect, which causes metal placed in the annular crucible to be forcibly ejected on turning on the current unless held in place. Another peculiarity is the almost instantaneous drop in temperature of the molten charge upon reducing the pressure on the primary of the transformer. Others who contributed to the discussion were Messrs. Sadtler, Betts, Russell and Hering.

Another paper by Mr. Gin upon electric-furnace working was entitled "Note on the Electrical Resistivity of Iron and Steel at High Temperatures." The specific resistances of iron and steel in a molten condition have not hitherto been determined. This has been a matter of theoretical rather than of practical interest until recently. The utilization of the molten metal, as the heat-generating medium in various types of electric furnaces, makes a knowledge of data on its resistance highly important, and Mr. Gin has made such determinations between the melting points and temperatures several hundred degrees above.

The measurements were made by use of an electric furnace having a long narrow channel of M-shape, of a refractory material, into which was poured the melted iron. Current was then passed through this molten iron in such quantity as to vary the temperature, and by means of current and pressure measurements the specific resistance was determined. The temperature readings were taken by means of an optical pyrometer.

The resistivity of iron of the following composition was found to be about 16×10^{-6} microhms-centimeters for temperatures between 1,280° C. and 1,340° C.:

Fe	93-032
Mn	2.752
C	3.337
Si	0.783
P	0.061
S	0.035

The author proposes to continue the study to determine the variations in resistance caused by temperature and the influence by various impurities.

Prof. Oliver W. Brown and William F. Oesterle prepared a paper on the "Electric Smelting of Zinc." Of all the possibilities of using the electric furnace in the metallurgy of ores the zinc industry seems to be the most promising. This is due to the fact that present methods are wasteful of fuel and labor, give but an incomplete recovery of the metal in the ore and involve large outlay for plant. These features were dealt with in detail by Prof. Brown and Mr. Oesterle, who further discussed various methods of reducing zinc sulphide.

The sulphide of zinc constitutes by far the most abundant source of this metal, and present methods of treatment necessitate a preliminary roasting to convert it into the oxide before it can be reduced by carbon in the retort furnaces. The author describes various methods whereby the sulphide can be reduced directly by mixing the ore with various proportions of lime and carbon and subjecting the mixture to suitable heat, preferably in the electric furnace.

Basing their conclusions upon experimental work done in the electric reduction of zinc ores the authors assert that the zinc can be almost completely distilled from the ore, while present methods afford an extraction of between 80 and 90 per cent.

It is predicted that it will be but a short time before a suitable commercial electric furnace will be working on zinc ores, the problem being chiefly one involving the design of an efficient, durable and continuous furnace.

Prof. J. W. Richards called attention to the added interest which would be afforded by a thermochemical calculation of the various proposed reactions, and offered to submit such calculations later.

"Notes on the Use of Aluminum as a Reducing Agent," by Dr. Oliver P. Watts, was a short paper pointing out a modification of the well-known Goldschmidt process, which he had found useful in using aluminum for the reduction of silicon and boron.

The Goldschmidt process employs finely divided aluminum mixed with the material to be reduced, the reaction being once started at the surface proceeds rapidly to completion by means of the heat liberated by the reaction. In order that sufficient heat be thus liberated it is essential that the material to be reduced shall not be an excessively stable compound, such as silica, or that if such material is used a certain quantity of iron oxide or other easily reducible compound must be mixed with the charge. This method would yield therefore an alloy of the metals existing in the easily reducible and refractory compounds.

A. J. Rossi has modified the above process by using a bath of molten aluminum as the reducing agent, producing thus ferro-titanium and ferro-tungsten in large quantities free from aluminum.

The method suggested by the author for producing the pure metals—titanium, tungsten, uranium and the like—consists in mixing the respective oxides with finely divided aluminum in a magnesia-lined graphite crucible and having a magnesia cover. The reaction is started and carried through to completion by the heat from an electric arc, and in experiments cited a current of from 300 to 600 amperes at a pressure of from 70 to 80 volts was used for about five minutes. In such cases where the reaction proceeds too rapidly a retarder of powdered fluor spar or cryolite mixed with the charge is used.

Prof. Richards explained the necessity of supplying heat from external sources when reducing certain oxides and commended the method described in the paper.

Utilization of Active Oxygen.

One of the most important papers dealing with the development of electrochemical industries was read by Dr. R. von Foregger of Niagara Falls upon the "Utilization of Active Oxygen." The numerous uses of oxygen and ozone were listed and described. These are sterilization and purification of water, preservation of food substances, purification of air, aging of alcoholic beverages, purifica-

dressing oils, bleaching of oils, sugar, fibers, molasses and corn and numerous uses in metallurgical operations and for medicinal purposes.

By means of a new electric furnace process, calcium peroxide has recently been placed on the market. This has the remarkable property of liberating oxygen with great rapidity when placed in water. The cost of this calcium peroxide, or "oxone," as it is called, is such that oxygen can be produced at such cost as to compete with other methods, but it's great value lies in the fact that it can be easily transported in the solid form just as calcium carbide is transported for the production of acetylene. To emphasize its convenience Dr. Foregger says that if one wishes to provide himself with a sterilizer he has but to carry tablets of magnesium peroxide in his pocket and drop one in a glass of drinking water the purity of which may be a matter of suspicion. The paper was accompanied by an interesting demonstration of the uses of the new products.

Mr. Toch called attention to the usefulness of this product in the oil industries. Dr. Doemus questioned the possibility of producing oxygen by the new method at such a price as to compete with calcium permanganate, saying that this substance had proved its efficiency in military campaigns and would probably continue to be the cheapest and most efficient source of oxygen.

Dr. Foregger, in reply, pointed out the relative advantages of the calcium peroxide, ascribing to it not so much cheapness as convenience. A quantity of the material exposed in a room will slowly give off oxygen and at the same time absorb carbonic acid, thus playing a dual roll. Its action continues for about three days.

Osmium, Tantalum and Metallized-carbon Lamps.

"Thermodynamics of the Electric Incandescent Lamp," a paper by Dr. E. F. Roeber, dealt with the subject of incandescent lighting from both the theoretical and practical standpoints. An interesting feature of the paper consisted in the exhibition of various forms of new lamps of the osmium, tantalum and metallized-carbon types.

The new osmium filament is made by mixing finely divided osmium with a binding material and subjecting it to a high temperature. It has an efficiency higher than that of the carbon filament and has the peculiar property of increasing in candlepower during the first 200 hours of operation, after which it slowly decreases. It burns out, however, before the efficiency drops off 10 per cent., and it is thus impossible for the lamps to deteriorate and run continuously at a low efficiency. The limitation in the lamp is that the filament cannot be made of great length; it is peculiarly subject to damage by vibration, and must be operated in a vertical position. Its life is guaranteed for 500 hours, but is capable of running several thousand hours.

Prof. Richards offered a suggestion that inasmuch as osmium when exposed to the atmosphere gives off a volatile oxide which is highly poisonous and has resulted in the loss of eyesight by those exposed to it, a cracked lamp might be a source of danger.

The tantalum lamp is free from the objections offered to the osmium lamp and it appears to constitute a marked step in the progress of electrical illumination. The filament consists of a long fine wire drawn from pure tantalum.

Samples showing the latest development of incandescent carbon lighting were contributed by the General Electric Company.

In the discussion which followed the presentation of this paper numerous interesting facts were presented bearing on high-temperature work. Dr. Bancroft announced that pure magnesia tubes and crucibles are about to be placed on the market, and since this is a most infusible and non-conductive material at high temperatures, it will greatly facilitate research work.

Dr. Roeber announced the recent advent of an optical pyrometer based upon the use of an osmium filament and capable of reading temperatures as low as 500°C.

Miscellaneous Papers.

Dr. W. D. Bancroft in a paper on "The Chemistry of Electrochemistry," urged the necessity of a more careful study of the electrolytic cell in the light of purely chemical phenomena. The various reactions which take place during electrolysis were demonstrated by a large number of experiments to be capable of reproduction in purely chemical ways.

C. J. Reed discussed the views of Dr. Bancroft, differing as to his interpretations of electrolysis and presenting the advisability of studying the phenomena from the energy rather than from the chemical standpoint. Messrs. Betts, Hering, Richards and Burgess also contributed to the discussion.

"Centrifugal Experiments with Colloidal Solution" was dealt with by Prof. W. S. Franklin and L. A. Freudenberger. They gave the results of experiments showing that by rapidly rotating a vessel containing a liquid holding colloidal platinum the colloidal substance could be precipitated. Prof. Richards concluded by saying that this experiment confirmed the view that colloidal matter consists simply of finely divided solid particles in physical suspension, while Prof. Franklin said that the effect was perhaps produced by supersaturation in one portion of the tube and that when coagulation was once set up there it extended rapidly to other parts of the liquid.

"Electrolytic versus Sulphuric Parting of Bullion" was the subject of a paper by F. D. Easterbrooks. The various electrolytic and chemical methods of parting gold, silver and platinum were discussed and their relative advantages pointed out. It was asserted that while either type of process may yield high purity, the electrical methods do not afford attractive commercial possibilities except where platinum is present. The principal objection to the electrolytic method is its slowness and the consequent necessity of tieing up a large investment for material under treatment.

A number of interesting samples were exhibited showing the effect of tellurium on the physical qualities of silver and a large sheet of snow-white silver which was deposited by the use of gelatine in the solution attracted much attention. The paper was discussed by Messrs. Betts, Sadtler and Richards.

Maximilian Toch, the well-known manufacturer of paints, of New York, told of the many interesting problems which are arising in the paint industry. In his paper on "Insulating Paints" it was shown that each new electrical industry brought new problems to the paint manufacturer, and the third rail has been occupying his attention of late. The insulating covering which may be suitable in a moist, dark place, such as the New York subway, is not suitable when exposed to light, and experiments were described showing that the actinic light rays are responsible for the failure of various organic paints.

He claims that the third rail, while acting as the cathode, is peculiarly susceptible to corrosion through some unexplained action of the current. The possibility of cathode corrosion was argued by Carl Hering, S. S. Sadtler and W. D. Bancroft, and C. F. Burgess cited laboratory experiments showing that under certain conditions cathodic corrosion of iron is very marked.

"A Standard Method of Determining the Specific Resistance of Electrolytes," by R. Threlfall, F. R. S., of England, discussed the determination of the specific resistance of a metallic conductor, which is a simple operation compared to similar measurements of electrolytic conductors, and it is perhaps impossible to attain the accuracy in the latter operation which is possible in the former. The factors which lead to errors, where electrolytic conductors are concerned, are electrode polarization and surface resistance, the comparatively large temperature coefficients which must be taken into account and the difficulty of accurately measuring the dimensions of the electrolyte column which must be retained in a suitable vessel.

Mr. Threlfall described a potentiometer method for making this measurement, saying that his experience with the use of the method demonstrates that no other method hitherto proposed affords so direct and accurate a means of comparing the specific resistance of an electrolyte with that of mercury as the method in question. The method which was devised in 1904 consists in the employment of a glass tube of small bore, about 90 centimeters long, in which the column of electrolyte to be measured is contained. Connected to each end of the tube is an inverted T tube, in the vertical branch of which is placed the metallic electrode to make connection to the external source of pressure—a 25-volt accumulator. In series with this is a standard resistance. In the horizontal branch of each of the end tubes is inserted the liquid terminal of a non-polarizable Ostwald electrode. The tube is immersed in a constant-temperature oil bath which is stirred, whose temperature is measured by means of an accurate thermometer, and this value is taken for the electrolyte within the tube.

The measurement is made by comparing the fall of potential in the column of electrolyte with that at the terminals of the standard resistance.

The author makes no statement as to the degree of accuracy which he has attained other than saying that his measurements agree with those of Kohlrausch within a limit of error which would be equivalent to the error introduced by an error of one-tenth of a degree in the temperature measurement.

The errors inherent in this proposed method are four in number, due to the disturbing effects of the potentiometer electrodes on the stream lines of current; the heating of the column of electrolyte, and the impossibility of accurately deriving the temperature by a thermometer placed outside the tube; changes of concentration produced by terminal electrodes and difficulties in accurately determining dimensions of conductor within the tube.

Prof. Burgess said that a method similar to that described has been used for several years in the applied electrochemistry laboratories of the University of Wisconsin, and Mr. Hering referred to his own pioneer use of the method and suggested various means for eliminating errors.

Lawrence Addicks read a paper upon "Ammeters for Electrolytic Work." Mr. Addicks gave the results of his experience in the use of ammeters for the measurement of large volumes of current, from 5,000 amperes and upward, such as are used in copper-refining plants. He stated that the limit of accuracy is 99 per cent., and that to attain this accuracy care must be exercised in mounting the shunt and in placing the indicating instrument a suitable distance away from it or other conductors carrying heavy currents which set up a strong magnetic field.

The principal source of error is that due to the heating of the shunt: with a current of 5,000 amperes the energy which the shunt must dissipate is given as 300 watts. The temperature thus produced should not be allowed to exceed 200° F. If faulty connection is made to the shunt, unequal heating of the two terminals will result, and this leads to thermoelectric effects, which may cause the instrument to read either high or low, depending upon which terminal is the hotter. The temperature coefficient of the shunt is generally so low that no correction need be made on account of its heating. The discussion emphasized the value of the paper in affording practical information to those having to measure large currents.

Professors W. S. Franklin and L. A. Freudenberger read a paper on "Reversible and Irreversible Electrolytic Polarization," which was a continuation of a paper presented at the last meeting.

Dr. H. Schlundt and R. B. Moore presented two papers—"The Chemical Separation of the Excited Activity of Thorium" and "Radio-activity of Some Natural Waters of Missouri."

G. A. Roush dealt with the manufacture of iodoform in a paper on "Electrolytic Preparation of Iodoform from Acetone."

"Report on the Electrochemical Exhibits at the Louisiana Purchase Exposition," by C. F. Burgess, consisted of a report prepared by the secretary of the group jury on electrochemistry at the Fair, which was intended for publication by the World's Fair Commission, but since the plan of issuing reports was abandoned, the report was presented to the society for publication in the Transactions.

Death of J. Frank Butterfield.

J. Frank Butterfield, a well-known electrical contractor of Chicago, and president of the Butterfield Construction Company, was accidentally killed in Cincinnati on September 19th while superintending some underground conduit construction. He was standing on the ground near the trench and at the base of a new building which was being erected. A heavy plank was being hoisted up the side of the building, and had been lifted several stories, when the noose slipped and the plank fell, striking the unfortunate gentleman on the head and causing his death within a few minutes; at no time was he conscious after the blow. The funeral took place in Chicago on September 22d.

J. FRANK BUTTERFIELD.

Mr. Butterfield was born in Lockport, N. Y. on August 8, 1861. At the age of 14 he began to learn the telegraph business, and eventually entered the employment of the Postal Telegraph-cable Company in Chicago, acting in various capacities, among which were those of wire chief on the Chicago-Buffalo division, and electrician of the company. He became well known among telegraph men. About 10 years ago, however, he went into business for himself in Chicago, under his own name, and later organized the Butterfield Construction Company, taking up the construction of underground conduits and telephone exchanges. Some of his most important works in the line of telephone underground conduits were at Logansport, South Bend and Marion, Ind., Champaign, Ill., and Duluth, Minn. The largest telephone exchanges that he constructed were in Holdrege, Oxford and Grand Island, Neb. He was a member of the Electrical Workers' Union, and belonged to the Odd Fellows, Knights of Pythias and Royal League. He is survived by a wife and five children, the oldest son being 21 years of age.

Work on the laying of the final section of the London and Glasgow underground telegraph cable—that between Beattock Summit and Glasgow—is to be commenced. The contract for the cable has been placed by the Post Office authorities with two London firms of contractors.

Standardization of Enclosed Fuses Discussed at Institute Meeting.

The meeting of the American Institute of Electrical Engineers held at the assembly room of the New York Edison Company at 44 West Twenty-seventh Street, New York city, on the evening of September 22d, was the first of the season and the first of the administration of President S. S. Wheeler, who was introduced by Mr. Lieb, the retiring president, and who presided. Mr. Lieb, on behalf of the New York Edison Company, said the meeting was a sort of dedicatory exercise of the new assembly room. The company tendered the room for the meetings of the Institute until the United Engineering Building is finished. President Wheeler, in response, said the Institute was very grateful for the courtesy.

Secretary Pope announced that at the meeting of the directors earlier in the day 32 associates were elected, and also reported that C. O. Mailloux had been elected a director to fill the vacancy caused by Dr. Wheeler's election as president.

The first paper of the evening was on "Air-gap Flux in Induction Motors," and was prepared by Prof. A. S. Langsdorf of Washington University, St. Louis. It was read by Dr. McAllister. This was a highly technical paper and was criticized by B. A. Behrend of Cincinnati as academic and impracticable. Fitzhugh Townsend of New York and A. H. Pikler of Ampere, N. J., also briefly discussed the paper.

H. O. Lacount of Boston read his paper on "Standardization of Enclosed Fuses." The author, who is inspector for a fire-insurance company, said that fuse standardization is necessary. "In practice the large number of non-interchangeable fuses became a real fire hazard, growing out of the difficulty found in procuring the right fuse for the cut-out that happened to be installed. The supply houses found it impracticable to keep a full line and frequently could not furnish the fuses desired, so that either the customer or supply house was obliged to send to the manufacturer for a supply of the particular fuses needed. In the meantime some dangerous substitute for the proper fuse had to be provided, in the form of copper wire, wire nails, fuse wire, etc., because it was out of the question to cut out circuits until such time as the desired fuses could be obtained. As it was considered permissible to use in most places the enclosed fuse without a cabinet, the hazard was at once apparent when any of the above substitutes were employed in place of the enclosed fuses, because the combustible surroundings were at once directly exposed to the flash and melted metal produced when such a substitute fuse melted. Moreover, the use of such substitutes as have been mentioned was objectionable, because of the liability to overfuse the circuits."

The work of standardization was taken up by a committee of the Underwriters' National Electric Association, consisting of James E. Cole of Boston, William H. Merrill, Jr., of Chicago, Ralph Sweetland, E. V. French and H. O. Lacount of Boston. This was in July, 1903. Manufacturers were invited to make suggestions, and in September, 1903, a conference was held in Boston. Further conferences were held; proposed standard fuses were tested, and a report, with complete results of tests, was made in July, 1904. Later tests with heavier currents were made on November 30, 1904. Mr. Lacount continued:

"The result of the work of standardizing and tests for approval of the enclosed fuse, which has been in progress for nearly two years, is given in the National Electrical Code of 1905, and in the List of Approved Fittings of April, 1905. The completed specifications are given in the code, and therefore are not repeated here in detail. It may be of interest, however, to note some of the main features of the standard fuse.

"*Terminals.*—The form of terminal to adopt was one of the most difficult problems to solve. Every one of the several terminals in use had advantages and disadvantages, and in the conferences there were strong advocates for the adoption of each. The screw-and-washer type, though probably the simplest and possibly the best electrically, offered also a ready means for wrong re-fusing with wires; in fact such use was of everyday occurrence. This form of terminal had been used for fuse connections from the beginning of electrical installations, and everybody was accustomed to clamp the fuse wire under the screws, so that such a terminal would at once suggest this method of fusing, which would manifestly be improper where the cut-outs had been installed for the use of enclosed fuses. The merits of this type, however, were discussed at considerable length.

"Several suggestions were made for an entirely new terminal, and two or three models were constructed. Of course none of them had had the test of practical use, and it was soon decided to recommend some one of the forms that had been found reasonably satisfactory in practice.

"The spring-clip and knife-blade terminals were finally chosen. Neither of these was especially new, as both had been in use for some time, particularly the spring-clip type. These forms of terminals seemed to remove the temptation to wrong re-fusing, as far as it was practicable to do so by mere form of contacts. Just how successful such terminals will be in this respect is yet to be determined as the standard fuses come more and more into general use.

"Probably no fuse better illustrates the points that it was desired to secure than the old Edison plug; nevertheless this plug can be sadly misused. Inspectors and others have undoubtedly seen Edison plug cut-outs from which the plugs have been removed and pieces of fuse wire run over the top or along the sides of the cut-out and connected under the screws at the wire terminals. Sometimes the plugs have even been filled with type metal, and afterward naturally 'gave no trouble from blowing out and interrupting the circuit.' In other instances where the attendant was somewhat less ignorant or more interested in the safety of the equipment, 'blown' plugs have been re-fused on the premises with much larger wire than the plug was designed for, 'in order to prevent it blowing again.' It has also been found that bent hairpins, wads of tin-foil, etc., can be crowded into the Edison plug cut-out in place of the proper fuse plugs and carry a current all right. All such expedients are, of course, most dangerous..

"While the Edison plug has been subjected to all these abuses the total number of such cases is believed to be insignificant compared with the millions of plugs that have been properly used. This, however, cannot be said of the screw-and-washer type of terminal. The right use of the plug is probably due to (1) the rules of the underwriters and their inspection bureaus; (2) the readiness with which they can be secured in almost any location; (3) the reasonably low price at which the plugs can be bought; (4) the convenience in replacing them in the cut-outs, and (5) the difficulty frequently found in re-fusing them. The wrong use of the screw-and-washer type of enclosed fuse cut-out can probably be charged to (1) the cheapness of fuse wire; (2) the adaptability of a single spool of wire to cut-outs of widely different capacities, and (3) the familiarity of wiremen with the use of link fuses and fuse wire in similar cut-out blocks.

"The spring-clip and knife-blade terminals were believed to have as many of the advantages of the Edison plug and as few of the disadvantages of the screw-and-washer terminals, with respect to wrong fusing, as could be obtained and still retain other desirable features.

"Another point in favor of the terminals that have been adopted is that the fuses may be inserted and removed without the aid of screwdrivers or wrenches, which many times have accidentally been the cause of serious short circuits when fuses were being replaced on live circuits.

"*Dimensions.*—The dimensions for the fuses finally chosen were not those of an entire line of any one of the several manufacturers. In fact, many, if not most of them, were somewhat different from the dimensions of fuses then in use. At the start it was pointed out, on the one hand, that the dimensions must not be so small that the standard fuse would thereby be limited to a certain particular construction in order to successfully meet the other requirements, such as test, rating, temperature rise, and thus become a serious handicap to other manufacturers, who might find it necessary or desirable to use some different form of construction; and, on the other hand, that the dimensions must not be so large as to make the fuses unnecessarily bulky, as this would require, among other things, larger cut-outs, larger switch and panel boards and more room in cabinets, all of which would tend to increased cost, not only in the installation of the devices but probably also in the manufacture and shipping of the fittings themselves. As it was considered that the manufacturers had to a great extent the data necessary to show the safe and reasonable limits for these dimensions, they were looked to for suggestions, with the caution that they keep in mind the points above mentioned.

"After definite conclusions had been reached it was of considerable interest to compare the results of the several conferences and the large amount of study that had been given the matter with a table that had been prepared at the beginning and before any of the problems had received much attention. The table was based on the dimensions of the fuses then on the market, and gave for each classification what seemed to be average dimensions without special reference to any type or make. In many cases the average dimensions in the table were exactly the same as finally recommended for the standard fuses, and in practically all of the classes the differences were only small fractions of an inch. The average variation between this table and the table of dimensions finally adopted was only 12 per cent. The new dimensions are, therefore, not radically different from those of fuses that have been in use for several years.

"*Rating.*—As already pointed out, the previous specifications of the underwriters required that the fuses be marked with 80 per cent. of the maximum current they could carry continuously. This was an arbitrary rating, since theoretically the rating would be 100 per cent., or, in other words, the maximum current the fuse could carry indefinitely. The reason for the above rating was to take care of irregularities of manufacture, and especially to guard against blowing of fuses exactly proportioned to the existing load when, for example, the voltage happened to be slightly increased or another lamp added; in other words, the rating was intended to provide a reasonable margin for irregularities in manufacture and ordinary fluctuations in service conditions, including changes in temperature of the surrounding air. In many cases it is believed that this precaution prevents interruption of service caused by unnecessary blowing of fuses, and thus appreciably lessens the temptation to put in larger fuses, which many times would be much heavier than required. On the whole, therefore, better protection is secured by this rating.

"While this rule was retained for link fuses, it was slightly modified in the specifications for the standard enclosed fuse, which require that the fuse must carry 10 per cent. more current than that for which it is rated, and must melt with 15 per cent. current above its rating. The melting point of the fuse is, therefore, between 10 and 15-per cent. overload. The 25-per cent. overload necessary to melt a link fuse is thus reduced to from 10 to 15 per cent. for the standard enclosed fuse. This smaller margin between the rating and the maximum carrying capacity was considered sufficient, as it was claimed by manufacturers that the enclosed fuse could be rated more accurately than the link fuse, and possibly would be less affected by surroundings. The latter point, however, is perhaps open to some question.

"In order to be sure that the fuses would melt in a reasonably short time with an appreciably greater overload, a third requirement was made that with 50-per cent. overload the fuses must open the circuit within a specified time, ranging from 30 seconds for the 30-ampere class to 10 minutes for the 600-ampere class, the test starting with the fuse cold, that is, 75° F.

"The above figures were almost entirely a suggestion of the manufacturers, who were sure that they could meet such a specification for rating. In tests of a large number of fuses made later it seemed to be evident that it was going to be difficult, if not impracticable, to manufacture commercially a fuse complying with the first two parts of the rule, and the 15-per cent. limit was increased to 25 per cent., which is now required in the completed specifications. As the minimum melting point and the maximum carrying capacity are practically the same thing, the ratings of link fuses and enclosed fuses may be nearly alike regarding their overload capacity. The actual performance of the enclosed fuse is, however, more definitely defined.

"The rule for rating also has an especially important requirement, viz., that with the 25-per cent. overload the temperature of the fuse must not be sufficient to injure the tube or the cut-out terminals. To keep the fuses reasonably cool is obviously an important matter, and therefore an additional requirement has been made regarding it.

"*Temperature Rise.*—Excessive overheating of the fuses may mean ignition of lint or other readily inflammable material on or near them and would be almost sure to char the fuse tube sufficiently to weaken it seriously, so that it might give way when the fuse is blown, especially if on a bad short circuit or under other severe conditions. Although accurate tests have not yet been made regarding this point, it would seem from what has already been done that the present approved fuses will meet this requirement satisfactorily.

"*Test.*—Regarding the operation of the enclosed fuse, it is evident that it should successfully open the circuit according to the requirements for rating under the most severe conditions liable to be met in actual practice, and this should be done without liability of igniting near-by combustible material, since the fuses are intended for use outside of cabinets in almost any convenient place. The specifications, therefore, require satisfactory operation in both respects when one fuse is blown on a short circuit on a system of large generating capacity. There may be a difference of opinion as to what this capacity should be, but in the specifications the minimum limit of 300 kilowatts was designated to guard against testing on a system of such small capacity that poor fuses could stand the test.

"The amount and kind of resistance in the testing circuit are undoubtedly of considerable importance in such tests, for it has been found by actual test that a fuse that will operate well on a circuit having what would ordinarily be considered a small resistance and connected to almost unlimited generating capacity, such as a large storage battery, may be blown to pieces on a 300-kilowatt generator, if connected to the machine by only a few feet of wire of liberal conductivity. The ideal specifications, therefore, should probably also call for a definite resistance in the fuse circuit, but just what resistance should be used has not yet been fully determined. It is believed, however, that it should not be so small that fuses suitable for use practically everywhere, except in the stations themselves, will be condemned.

"If the fuses are made to withstand station conditions the cost must necessarily be greater than

if a less severe test were required, and this increased cost would fall on the general public, whose equipments, except in rare cases, do not require such heavily constructed fuses either for safety or for successful operation. Undoubtedly the present users of enclosed fuses will agree that they already cost enough, and any additional rule beyond the requirements of safety that would increase this cost would probably result in greatly reducing the number that otherwise would be in service. Therefore, in laying out the tests for fuses submitted for approval such conditions were chosen as seemed best to represent the severer conditions of the average equipment, without expecting that the fuses submitted would be satisfactory for station use. For such service stronger fuses would undoubtedly be required."

The author concluded by reciting the tests of enclosed fuses made under the specifications. He exhibited a complete line of standard fuses as adopted by the committee.

L. W. Downes of Providence, R. I., opened the discussion. He said that fuse standardization was his pet hobby. In relation to the form of contact, he said he hoped the area of the fuse terminals would be made ample—large enough to allow for variations bound to occur. He described some practical work with heavy-current contact-shoe fuses on the elevated-railway and subway systems in New York.

Prof. W. L. Puffer of Boston said, among other things: "I have in mind some tests of 50-ampere fuses where, when the circuit was closed, the bus-bar voltage of a compound generator went down 75 per cent. at the time the fuse closed, and when the circuit opened the bus-bar voltage went up 100 per cent. The current which went through that 50-ampere fuse was somewhat between 5,000 and 10,000 amperes, and the thing was over so very quickly that had these lamps here in this hall been on the circuit you would never have known it. I think the enormous increase of voltage coming across that gap produced the effect which Mr. Downes spoke of as necessitating the use of a bigger fuse in railroad work. As far as the amount of current to be used on testing a fuse is concerned, a fuse is put in as a protection on a circuit, which circuit delivers a certain amount of current. The circuit is calling for about a certain per cent. of drop, and therefore the maximum current that you can get will be, roughly speaking, the increase that you can get when you close your circuit; in other words, if the average drop is five per cent., that gives you a circuit increase of 20 times. At the same time I think he ought to bear in mind the fact that it is hardly just to expect all small users to buy a fuse which is sufficiently good to be used on Interborough work, for example. I think in such places as that they should have a specially made apparatus. It does not seem to me that the insurance people and the engineering people are especially interested in that type of fuse for general distribution. As far as the heating of the knife-blade terminals is concerned, I have very little information, but what little information I have from the experiments that I have seen seems to suggest that the knife blade in itself is not a source of heat, but that the heat which comes there at times is a heat which comes from another place. That has been suggested to me from the fact that I have observed that when the fuse was removed and a dummy fuse put in its place there was no heat, which would seem to indicate that the blade had nothing to do with it. As far as alternating-current work is concerned, I would like to throw out this caution: That on one hand you are working, say 100 amperes on a direct-current instrument, and on the other hand you have 100 amperes alternating current. If there is any difference in those two instruments your alternating current may be totally different from your direct current, and we all know that the exact discrepancy between an alternating-current and a direct-current instrument is not always the easiest thing in the world to ascertain."

Others taking part in the discussion were President Wheeler, H. G. Stott of New York, Joseph Sachs of Hartford, Conn., and Mr. Pikler.

German Labor Troubles.

A dispatch, dated at Berlin, September 21st, says: "It is learned tonight that the Allgemeine and Siemens-Halske electrical companies have decided to lock out about 10,000 of their employes tomorrow. This lockout will affect the cable works of the Allgemeine Company on the Upper Spree and the dynamo works of the Siemens-Halske company at Charlottenburg."

Trouble between the electrical companies and their employes, says the report, has been brewing for some time, and the workmen in several departments of the two chief companies have already gone on strike. The men say that living has grown so expensive, owing to the high price of bread and meat, that their wages are insufficient. The electrical companies of Berlin employ perhaps 60,000 men.

American Electrotherapeutic Association.

The fifteenth annual meeting of the American Electrotherapeutic Association was held at the Academy of Medicine, New York city, September 19th to 21st, under the presidency of Dr. Emil Heuel. A large number of medical men from all parts of the United States attended, and the papers read were of a high order of merit. It was apparent that considerable advance had been made in the various applications of electricity for the prevention and cure of disease, and from the reports of the various committees of the association it is evident also that the association's work is now thoroughly well organized. The following are brief reports of some of the more important papers:

Abstracts of Papers.

Dr. William James Morton of New York read a paper on the preparation of radioactive water. In view of the amount of quackery that had been associated with this subject, he had taken the precaution of having the radioactive fluids tested at Columbia University, and he desired that those present would not take anything that he said on trust, but would manufacture the radioactive fluids for themselves. His method consisted merely in placing about 10 pounds of pitchblende in about two gallons of water. After two weeks the water was strongly radioactive, and in his experience had a therapeutic value. The water retained its property for from four to eight days. The dose of this water was a few spoonsful twice or thrice a day, and it had a strong tonic value.

Dr. George Betton Massey, Philadelphia, Pa., gave a paper on the choice of methods in the treatment of operable cases of cancer. He analyzed statistics relating to cancer, and found that a much larger proportion than is commonly supposed could be treated by some mode of electricity. For the early stages of cancer he recommended mercuric cataphoresis; for advanced stages the knife; and for cancers difficult of access the X-rays. There were cases where these methods could be combined. In his experience, since 1893, about 20 per cent. of cataphoretic operative cases had been improved by the treatment and were living today.

Dr. Amédée Granger of New Orleans, La., contributed a long paper on the "Clinical and Experimental Study of the Action of Mercuric Catephoresis in the Treatment of Cancer; with a Further Report of Cases." Dr. Granger, whose paper was read in his enforced absence on account of the fever conditions in New Orleans, related many cases in which he had applied the mode of treatment identified with Dr. Massey's name. In his experience for cataphoresis he used currents varying from 200 to 700 milliamperes, the treatment lasting in some cases for one hour and 40 minutes. It was found that sudden changes in the strength of the current had a stimulating effect in the cases of feeble patients; in fact, the current generally stimulated physiological activity.

Dr. Edward C. Titus of New York discussed "The Relative Action of the Roentgen Ray and Light Upon the Enzymes and Their Therapeutic Significance." He recited details showing that the X-ray had an inhibitory effect upon metabolism, as of vegetable seeds, hens' eggs, etc. Hens' eggs which had been exposed to the action of the X-rays did not hatch so readily as those which had not been exposed, while those which had been exposed to the X-rays and afterward placed under a searchlight showed some signs of development, though imperfect. Arguing from these and other data, he concluded that the X-rays have a similar effect upon the enzymes, and this, he thought, explained the therapeutic action of the rays in certain diseases, as well as the great value of sunlight.

Dr. Fred Harris Morse, Boston, Mass., considered "The Practical Uses of the Sinusoidal Current." He described an apparatus designed in 1893 by Dr. A. E. Kennelly, which generated a high-frequency, high-potential current. This apparatus had 12 primary and 12 secondary rotating coils and when driven at a speed of 4,800 revolutions a minute gave 1,900 alternations a second. The current was controllable both by regulating the speed of the motor and by putting resistances in the alternating circuit, and it gave much better results than other forms of electricity. Dr. William James Morton said that the initiation of sinusoidal currents should be properly attributed to Dr. J. H. Kellogg of Battle Creek, Mich. This current was agreeable to take, but otherwise he had been unable to discover that its effects were better. Dr. Massey said that he had given away his sinusoidal apparatus because he could not get any muscular contraction by its actions. Dr. Margaret A. Cleaves of New York said that with her apparatus she was able to overcome the difficulties Dr. Massey mentioned.

Dr. F. B. Bishop of Washington, D. C., in presenting a report of the committee on electrodes, described an apparatus in which the Cooper Hewitt mercury-vapor lamp was used to transform an alternating current into a unidirectional current.

Dr. George Coffin Johnston of Pittsburg, Pa., read a paper on "The Treatment of Tubercular Glands." He advocated mercuric cataphoresis in treating the tubercular glands, using amalgamated zinc needles and a current of from three to seven milliamperes. In this way he treated about 60 per cent. of his cases, but there was a tendency to a large percentage of recurrences. Dr. G. H. Stover of Denver, Colo., commenting on the report, said that he used fluorescence in addition to the X-rays in his work. His fluorescent substance was uraline in solution. Dr. Morton said that the knife was an absolute failure in the extirpation of tubercular glands. Dr. Herdman recommended for these primary pulmonary troubles high-tension high-frequency currents, which brought about the destruction of the diseased tissues. Electrotherapeutics was particularly rich in methods of treating this class of disease.

Dr. Sinclair Tousey presented a short paper in which he recommended a systematic scale of "doses" when X-rays were indicated. He gave a sample record showing the quality of the ray, its intensity, distance of the cathode from the body, spark gap, strength of current, number of treatments, etc. Members, commenting on this paper, were of the general opinion that it would be impossible to rely upon Dr. Tousey's suggested system, on account of the personal equation of the observer who used the fluoroscope to determine the intensity of the rays. They all thought, however, that it would be possible to devise some method of securing uniformity.

Dr. William James Herdman of Ann Arbor, Mich., read a paper on "Radiant Energy and Ionization: The Physical Basis of Vital Processes and Their Derangements." In this paper the author reviewed the latest advances in chemistry and physics, and gave a clear exposition of the electron theory, as applied to organic as well as inorganic matter, and said that when an electrotherapeutic treatment was given, the electricity was a vehicle of energy which caused ionization in the bodily tissues; in fact, radiant energy was at the bottom of all physiological processes. Direct electric currents broke down the pathological tissues; high-tension currents brought about ionization and a quickening and concentration of physiological activity or else changed the character of the pabulum which supported the pathogenic organisms. The cathode rays, as in radium, bring about a similar result.

Dr. Wolff Freudenthal gave "Experiences with Radium in Diseases of the Nose and Throat." Dr. Freudenthal related two positive cures in the case of diseases of the larynx by the application of 10 milligrammes of radium put up in an aluminum tube. His experience was that radium was more efficient than any other remedy for diseases of the nose and throat.

Dr. Robert Reyburn of Washington, D. C., read a paper on "Some of the Causes of Failures in Treating Malignant Growths by Electric Currents and X-rays." After describing the general conditions of cancerous growths, he said that when the knife was used there was always considerable danger of infection, so that he preferred to recommend the galvanic cautery. He also recommended the use of the continuous current, in order to invigorate the patient and to increase the vitality of healthy cells, and afterward the use of the X-rays to destroy the cancerous cells. The X-rays should be applied with proper judgment. One of the causes of failure in applying them was that they were not applied to a sufficient extent of surface. Speaking of his own experience, he said that he had treated cancerous patients with local applications of electricity two years ago, and that up to date they were still apparently free of the disease. Several speakers joined in the subsequent discussion, and there was an apparent consensus of opinion that the curative value of the X-rays had been very extensively demonstrated.

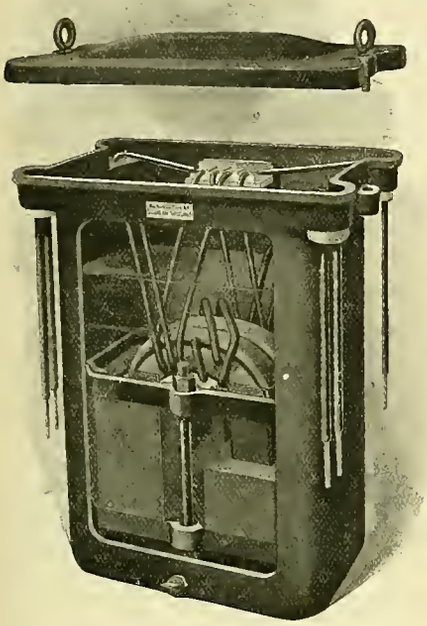
Exhibits.

In connection with the meeting was an interesting exhibition of all kinds of electrotherapeutic apparatus. The Victor Electric Company of Chicago had a large display of small-motor vibratory machines and a Finsen light apparatus. E. C. Regnier & Co. of Chicago, represented by I. B. Flint, showed the Regnier therapeutic lamp, constructed on scientific principles, it produces a powerful white ray, which is said to be pain-relieving and germicidal in action. W. Scheidel & Co. of Chicago, represented by Dr. F. G. Lewis and Alfred McArthur, exhibited their resonater, by which a high-frequency discharge can be applied by means of suitable vacuum tubes to any part of the body; they also showed a fine induction coil for X-ray work, fitted with a mercurial-turbine intercepter, giving an 18-inch spark. The Spear-Marshall Company of Chicago was represented by a lamp which it asserts gives out all the rays of the spectrum from the infra-red to the ultra-violet. Among other exhibitors were the Kny-Scheerer Company of New York, G. Wyatt-Hannath and the Wappler Electric Controller Company, also of New York, with the Rebman Company, and its new publications.

D. W. W.

Transformer for Light and Power Service.

Transformers for central stations are often used for both light and power work, and, therefore, a transformer so designed as to be adaptable to either or both of these classes of service will be found to possess the largest degree of usefulness from a central-station point of view. In recent years the Wagner Electric Manufacturing Company of St. Louis, as the manufacturer of a full line of alternating-current motors for central-station work, has been able to appreciate and respond to the requirements in the direction of an interchangeable transformer for lighting and motors. As a result of its experience in this line the company has developed the transformer which is shown herewith and which is virtually "two transformers in one." It is built in two types—the M and MH—and one of the characteristic features is that it is not essential to the satisfactory performance of the apparatus that taps be provided supplying 115 volts for motor service and 104 volts for lighting service. On the contrary, it is possible to supply, with a single ratio, a transformer which can be installed indiscriminately with regard to service, present or prospective.



TRANSFORMER FOR LIGHT AND POWER SERVICE.

As to the materials employed in the construction of these transformers, it may be said that the best only are used. Aging of the iron used in transformers, as is well known, is not so prevalent in high-grade iron as in the lower grades, but, nevertheless, the builder may greatly improve his raw sheet steel by proper furnace treatment, even when the quality is originally good. This the Wagner company does, and by an annealing process secures as far as is possible that molecular rearrangement which is generally thought to be essential in the production of a good iron for transformer cores.

The oil employed has a fire test of 425° F., and although the oil is not depended upon as an insulator, still it has been found by careful tests at the factory that the oil possesses in a marked degree the quality of an insulator. If acid is present in the oil it is rejected and if water is present it is dried out before shipment.

For standard motor and lighting transformers a primary winding has been adopted, interchangeable for either 1,100 or 2,200 volts, and a secondary winding interchangeable for either 110 or 220 volts or for three-wire service at either voltage. These voltages have been selected as nearest the line voltages in general use at the present time. All transformers of this ratio are capable of successful operation on voltages varying 10 per cent. from the standard, either up or down. The company is also prepared to supply other ratios if service absolutely requires it, and where, for special reasons, a number of ratios are desired in a single transformer, provision for interchangeable service connections supplying the various voltages desired will be made.

All sizes of standard transformers are built with four secondary leads, which can be interchangeably connected for either 110 or 220 volts or operated on three-wire service. The smaller sizes up to and including the four-kilowatt or 80-light size have four primary leads which may be interchangeably connected for 1,100 to 2,200 volts. The sizes between four and 20 kilowatts have two primary leads, an inside interchangeable block being provided by which connections can be made for either 1,100 or 2,200 volts. For 20 to 50 kilowatts inclusive, four primary leads are brought out.

Since there is considerable variation among manufacturers as to the permissible temperature rise, the company has deemed it advisable to adopt the standard of the American Institute of Electrical Engineers, which is, for continuous service, a rise in temperature of 50° C. under continuous full-load conditions. This standard has been adopted for the type M. The type MH, which is designed for intermittent service, has a temperature rise of 50° C. in five hours, or 60° C. under continuous full-load operating conditions. In the small sizes, where the radiating service is large relative to the capacity, the temperature rise is considerably less than here specified.

The type of hanger used has met with the endorsement of linemen. The wide-span feature in the small sizes allows the transformer to be placed on the cross-arm with one hanger on either side. In the larger sizes a straight hanger is employed. For standard 1,000 and 2,000-volt work an all-porcelain cut-out is supplied, though the company builds an iron-clad cut-out for these voltages.

The Electric Smelting of Zinc.[1]

By Oliver W. Brown and William F. Oesterle.

The enormous amount of heat wasted during the smelting of zinc ores, the loss of zinc and the cost of operating the process have caused the problem of the extraction of zinc from its ores to be a favorite field of research with many investigators. Electrochemists have attacked this problem along three different lines, namely, the conversion of the zinc in the ore into a salt soluble in water and the subsequent electrolytic precipitation of the metal from an aqueous solution; conversion of the zinc to chloride and the electrolytic separation of the metal from the anhydrous fused salt, and the electric smelting of zinc ores. A special endeavor has been made to develop electrical processes by which zinc can be economically extracted from complex and low-grade ores which cannot be smelted in the ordinary manner.

If a process were devised to electrically smelt unroasted zinc sulphide ore, the advantages of electrically heating the charge could be realized, while at the same time all the cost of roasting the ore could be saved. After experimenting for about two years on the extraction of zinc from its ores by electrolysis of fused salts and of aqueous solutions the writers attempted to find such a process. We have obtained interesting results from a process based on the electrical smelting of charges of unroasted zinc blende, lime and carbon, mixed in proportions corresponding to the following equations:

(a) $2ZnS + 2CaO + 7C = 2Zn + 2CaC_2 + CS_2 + 2CO$,

(b) $2ZnS + CaO + 4C = 2Zn + CaC_2 + CS_2 + CO$.

Before giving any of the results of our work we wish to refer to the process patented (United States Patent No. 746,798, December 15, 1903) by Paul Dankwart of Deadwood, S. D. The process described by Dankwart is similar in some respects to that employed by us. Dankwart smelts mixed sulphide ores containing zinc with lime, coke and sodium sulphate. He mixes the different materials in such proportions that sulphur of the ore is converted into alkaline and alkaline earth sulphides, while the zinc is liberated as vapor and is condensed in the usual manner. Dankwart's process is very similar to that of Kirkpatrick-Picard (United States patent No. 692,148, January 28, 1902) of London, except that Dankwart adds sodium sulphate to the charge of sulphide ore, lime and carbon used by Kirkpatrick-Picard, and also carries out his process in an electric furnace.

Kirkpatrick-Pickard's process is represented by the following reactions:

$ZnS + CaO + C = Zn + CaS + CO$
$PbS + CaO + C = Pb + CaS + CO$
$4ZnS + 2Fe_2O_3 + 6C = 4Zn + 4FeS + 6CO$
$4PbS + 2Fe_2O_3 + 6C = 4Pb + 4FeS + 6CO$.

He forms the mixture into briquets before the distillation.

The writers first tried the reduction of a charge containing equal molecular weights of zinc blende (59.6 per cent. zinc in ore), lime and carbon (coke) in an enclosed electric resistance furnace lined with firebrick. This is the same charge as that used by Kirkpatrick-Picard. When this charge was heated in the electric furnace the ore was readily reduced, the metallic zinc distilled out and a portion of it condensed in an iron tube which served as a condenser. The material remaining in the furnace after the distillation, consisting of impure fused calcium sulphide, contained only 0.13 per cent. of metallic zinc.

We next made a study of the electric reduction of charges of zinc blende, lime and carbon (coal or coke), mixed in proportions corresponding to the equations (a) and (b) given above.

1. Abstract of a paper read at the meeting of the American Electrochemical Society at Bethlehem, Pa., September 19, 1905.

When a charge containing 194 grams of zinc blende (59.6 per cent. zinc), 112 grams of lime and 84 grams of coke was heated in an enclosed firebrick-lined electric-resistance furnace, with a current of 50 amperes at 30 volts for two hours, zinc distilled and condensed, and the impure carbide remaining in the furnace contained only 0.036 per cent. of metallic zinc and 2.89 per cent. of sulphur. The other impurities in the carbide naturally depend on the purity of the ore treated.

When working with the very small furnace required to smelt charges containing only 194 grams of ore, it was not deemed desirable to endeavor to condense the largest possible proportion of the distilled zinc in a solid metallic form. As experience has shown, the difficulties in condensing the zinc as liquid metal, instead of zinc dust, disappear as the size of the furnace is increased.

The analyses of gases coming from the furnace during the operation, of the materials in the furnace after smelting, etc., show that the changes which take place in the smelting are probably best represented by equations (a) and (b).

Some additional experiments which were carried out during 1903 and 1904 by one of the writers on the reduction of zinc blende furnished the following results:

When a charge, consisting of 3.98 kilograms of zinc blende (containing 58 per cent. of zinc), 2.24 kilograms of lime (containing 38.2 per cent. of magnesia), and 0.84 kilogram of carbon (equal weights of coal and coke), was smelted in an enclosed electric-resistance furnace, the material remaining in the furnace after the distillation contained only 0.10 per cent. of metallic zinc. This experiment shows that even when a lime very high in magnesia is used, practically all of the zinc is reduced and distills out of the furnace. However, it is hardly necessary to remark that good calcium carbide cannot be made when a lime containing 98 per cent. of magnesia is used.

The internal dimensions of the furnace in this experiment were: Length, 12.5 inches; depth, 8.5 inches, and width, 4.5 inches. The inner walls and bottom of the furnace were of magnesia brick. A layer of dry lime was placed on the outside of the magnesia brick, then a layer of firebrick, followed by another layer of lime, and finally the whole was encased in a sheet-iron jacket. A round Acheson graphite electrode, two inches in diameter, entered the furnace at each end. These electrodes were fastened firmly into plates of Acheson graphite 0.5 inch thick, which were placed vertically at each end of the furnace, and reached from the bottom to within 1.5 inches of the top. In order that the furnace should be gas tight, the portions of the graphite electrodes which passed through the walls of the furnace were packed in powdered magnesia brick.

The materials comprising the charge were passed through a 20-mesh sieve and thoroughly mixed before placing in the furnace.

Connection between the two end electrodes was made by two cores of broken carbons (broken in pieces about 0.5 to 1 inch), which were imbedded in the charge. The lower core of granular carbon was placed two inches from the bottom of the furnace, while the second core was about four inches above the lower core.

The charge was filled into the furnace to within 1.5 inches of the roof and was covered with a layer of broken pieces of coke. A carbon tube, 0.5 inch internal diameter and 12 inches long, penetrated the side wall of the furnace, about two inches from one end and two inches from the top. The tube passed nearly horizontally through the walls of the furnace, the outer end being about 0.5 inch lower than the inner. On the outer end of this carbon tube was fastened a short piece of 1.5-inch iron pipe, which was surrounded with asbestos, and served as condenser for the zinc. The outer end of the pipe was nearly closed with fireclay. At intervals during the distillation of the zinc the fireclay plug was removed and the melted zinc, which had condensed, was allowed to flow out.

The furnace was closed at the top by an Acheson graphite plate 0.5 inch thick. A layer of lime was placed over the graphite plate, and on this were placed three layers of firebrick. When the furnace was sealed with dry powdered lime in this manner it was quite tight, and very little gas escaped except through the condenser.

A current of about 172 amperes and 68 volts was passed through the furnace for six hours and 40 minutes. Zinc vapors had stopped coming from the furnace when the current was broken.

After the furnace was allowed to cool and the cover removed it was found that the charge was a loose, porous mass, which could nearly all be removed with the hands. The temperature had not been sufficient to fuse the charge, although all but 0.1 per cent. of the zinc was expelled from the furnace.

In order to gain some idea of the temperature required to reduce and distill the zinc from various charges and also the relative value of various charges, four different mixtures were made up and heated in a hot coke fire in a wind furnace. The materials in each charge were pulverized to pass a 20-mesh sieve and well mixed. The blende used contained 58.6 per cent. of metallic zinc. The charges were as follows:

No. 1 contained zinc blende, 97; lime, 28, and coke, 24 grains, and corresponds to the equation,

$$2ZnS + CaO + 4C = 2Zn + CaC_2 + CS_2 + CO.$$

No 2 contained zinc blende, 97; lime 56, and coke, 42 grams, and corresponds to the equation,

$$2ZnS + CaO + 7c = 2Zn + 2CaC + CS_2 + 2CO.$$

No. 3 contains zinc blende, 97; lime, 56, and coke, 12 grams, and corresponds to the equation,

$$ZnS + CaO + C = Zn + CaS + CO.$$

No. 4 contained zinc blende, 97; silica, 120, and coke, 24 grams, and corresponds to the equation,

$$2ZnS + SiO_2 + 4C = 2Zn + SiC + 2CO + CS_2.$$

The four charges were placed in separate assay crucibles, loosely covered, and placed in a hot coke fire. Charges 1, 2 and 3 were heated 2¾ hours, while charge No. 4 was heated 2 1-16 hours. A zinc flame burned from the mouths of crucibles 1, 2 and 3 while they were being heated, but no zinc flame was given off from crucible containing charge No. 4, indicating that no reduction took place in No. 4.

An analysis of charges 1, 2 and 3, after heating, showed that about 55 per cent. of the zinc had been reduced and volatilzed in each case. A practically complete reduction and volatilization of the zinc takes place when either charge 1, 2 or 3 is heated in an enclosed electric furnace, with a current of 50 amperes and 30 volts for two hours or less.

Only five per cent. of the zinc in charge No. 4 was lost during the heating. This loss was probably due to mechanical loss in removing the ignited charge from the crucible after firing.

A charge made up in the same proportions as in No. 4, but containing zinc blende, 194; silica, 260, and coke, 48 grams, was heated in an enclosed electric-resistance furnace for one hour, with a current of 120 amperes and 50 volts. Only a very small amount of metallic zinc (about one gram) was found in the condenser, and an analysis of the powder which collected in the condenser showed that it contained only about four per cent. more metallic zinc than the charge which was placed in the furnace. The material remaining in the furnace after heating contained 3.98 per cent. of metallic zinc.

These data show that zinc sulphide is not reduced to metal when mixed with silica and carbon and heated to a very high temperature. The temperature attained in this experiment was high enough to volatilize most of the charge out of the furnace, yet the zinc ore was not reduced to metal.

Attention has often been called to the fact that processes requiring widely different conditions cannot be successfully carried on together. This is probably very true of the production of zinc and calcium carbide. The conditions required for the reduction of zinc and the production of calcium carbide are so different that there is little chance for their simultaneous economic production. Even if many of the drawbacks could be overcome, the production of a sulphur-free carbide from a charge of zinc sulphide, lime and coke, is most probably impossible. Also, if calcium carbide is to be made as a by-product, only the purest zinc sulphide could be smelted, as all of the impurities in the ore would contaminate the carbide. However, a method of smelting high-grade zinc ores is not needed so much as a process which will economically obtain the zinc from ores high in iron, etc.

Another disadvantage in the production of zinc and carbide in the same operation is that the sulphur cannot be recovered in a suitable condition, as the greater portion of any carbon disulphide which may be formed in the reduction is burned to sulphur dioxide, which escapes from the furnace in a highly diluted form.

Improved Carbon Brush.

What is known as the expansion-connection brush has a number of distinguishing features which render it worthy of consideration. It consists of a carbon brush, of any size, having a hole drilled into it, penetrating about one-half of the length of the brush. A piece of plaited flexible wire, terminating in a cable shoe, is raveled at the end opposite to the shoe, and this miniature wire net is formed cylindrically around a small brass sleeve. The sleeve is of the same length as the hole in the carbon brush, and is slotted over two-thirds of its length. The slot is made so that the closing screw fitting into the slot is forced into a tapering hole. The resistance with which the screw meets on account of this tapering is overcome by the sleeve expanding, so that the whole appliance acts as a wedge when the screw is inserted, making a close and rigid contact between the flexible wire and the interior of the brush. This is increased through expansion of the metallic parts, should the brush become slightly heated while in use. The flexible connection is easily detached, and can be connected to a new brush, simply by use of a screw-driver, obviating the necessity of attaching by means of the soldering process. The connection is so arranged that the distance between the commutator surface and the terminal connection is reduced to a minimum, thereby reducing the carbon resistance between these points, resulting in obtaining a higher efficiency and a lower loss between the commutator surface and the end of the connection. This brush is made by the National Carbon Company of Cleveland.

A Tale of Two Cities.

[From the Boston Transcript of September 20th.]

The Edison Electric Illuminating Company of Boston was incorporated in 1886. It is paying 10-per cent. dividends, having begun that rate in May, 1901. At current price, 250, it yields just four per cent. In February, 1903, it rose to 302, receding to 222⅞ in December of that year, selling ex-rights to new stock during the year; the 1902 range was 244 and 285; the 1901 range 217 and 270. The annual report for the year ended June 30, 1905, showed gross earnings well in excess of $3,000,000, net over $1,000,000 and dividends earned with $15,334 surplus. The company earned $226,298 more gross than in the preceding year and $104,080 more net, and while dividends were $97,365 larger, dividend balance was $107,156 greater and surplus increased $3,791.

The similar company operating in Chicago, the Chicago Edison Company, controls the Edison patents for electric lighting in Cook County, Illinois, under perpetual license from the Edison Electric Light Company of New York. This company showed in the fiscal year ended March 31, 1905, net earnings of $1,423,614. Since 1895 each year has shown an increase over the preceding, and over $1,000,000 was earned on the stock in the last fiscal year, nearly $300,000 more than the requirement at the eight per cent. rate paid continuously since 1889. Capital at beginning was $500,000, and it has been increased gradually to $9,863,880; the limit authorized is $15,000,000. The total authorized first mortgage bond issue is $6,000,000 in 5s. The company guarantees $226,000 Sectional Underground Company 4s and the interest on the same company's 5s. It may be interesting to compare the operating results of the Boston and the Chicago Edison companies. The Boston company figures are for the fiscal year ended June 30, the Chicago company for the year ended March 31, 1905:

Last fiscal year:	Edison Electric Illuminating Company of Boston.	Chicago Edison Company.
Gross earnings	$3,340,921	$4,051,082
Expenses	2,177,974	2,627,468
Net earnings	$1,162,947	$1,423,614
Other income	5,105	.....
Total net	$1,168,052	$1,423,614
Charges, interest	81,948	360,232
Balance	$1,086,104	$1,063,382
Dividends	*1,070,770	†789,262
Surplus	$ 15,334	$ 274,120

*Ten per cent. †Eight per cent.

The earnings run close in these two companies, the Chicago company exceeding the Boston, but the excess is not large in net, and in dividend balance the Boston company shows slightly better, while capital stock is about the same. The Boston company has no direct bonded debt, the Chicago company has $6,483,000 bonds. Chicago Edison stock is dealt in on the Chicago Stock Exchange and sells at 160, at which it nets five per cent. The Boston stock, paying 10 per cent. at 250, nets four per cent. The Chicago company earned 10¾ per cent. on stock last year with which to pay eight; the Boston company just earned its 10 per cent. paid.

Chicago Electrical Exhibition.

The Electrical Trades Exposition Company of Chicago is now fully organized, and includes among its stockholders many of the leading electrical men of Chicago. As previously stated, the purpose of the company is to hold in the Coliseum, Chicago, on January 15 to 27, 1906, an electrical exposition in which will be shown electrical machinery, appliances and apparatus in all branches of the industry. The show is not intended merely for the benefit of those directly connected with the electrical industry, but is also planned to interest and instruct the general public in the various uses to which electricity is applied.

The organization of the company indicates its strength. Following is a list of the names of the officers: President, Samuel Insull; vice-presidents, Edward B. Ellicott, Charles E. Gregory, E. B. Overshiner; treasurer, John J. Abbott; secretary, Stewart Spalding; general manager, Thomas R. Mercein.

The following-named gentlemen are the directors: Samuel Insull, Edward B. Ellicott, T. P. Gaylord, James Wolff, H. B. McMeal, C. E. Mitchell, Homer E. Niesz, E. B. Overshiner, G. H. Atkin, Stewart Spalding, Charles E. Gregory, G. Edward Kohler, George B. Foster.

Mr. Mercein, who has been chosen to have general management of the exhibition, is a man well qualified to fill the important position, having had much experience in the management of conventions and expositions, as, for instance, the Milwaukee Exposition. Mr. Mercein for a number of years has been secretary of the Northwestern Electrical Association. He has opened an office in Chicago at 464 Monadnock Building, where the business of the new enterprise will be conducted.

Electrical Equipment of New York, New Haven and Hartford Railroad.

During the last few weeks a body of able engineers, after investigation, has selected the alternating-current system for the New York, New Haven and Hartford railroad. Electric locomotives will be used, and the order has been placed with the Westinghouse Electric and Manufacturing Company. Westinghouse engineers think that it is now safe to assume that the alternating-current system will soon become as pre-eminent in the railway field as in that of power service. Its tremendous flexibility, the economy introduced in line construction, the large radius of action from a single station, the elimination of the rotary converter sub-station and of electrolytic troubles, and the economical and exact speed control are factors of far-reaching importance, the realization of which are due to the development of a thoroughly successful alternating-current motor suitable for railway work. Among the incidental advantages secured to the operating company by the adoption of the alternating-current system is the use of an overhead line in place of the inconvenient and expensive third rail, as the high-trolley voltage which can be used reduces the current to proportions easily handled by an overhead line and contacts. This feature is of great importance both at the terminals, where the complicated network of tracks and switches makes a third-rail installation doubly dangerous and troublesome, and on the main line, where the expense of the third rail is almost prohibitive and where difficulties of insulation are hard to overcome.

The contract taken by the Westinghouse Company comprises 25 locomotives for high-speed passenger service, each of which will weigh approximately 78 tons, and will be capable of maintaining a schedule speed of 26 miles an hour in local service with a 200-ton train, making stops every 2.2 miles, and reaching a maximum speed of about 45 miles an hour between stations. In express service a speed of from 60 to 70 miles an hour can be maintained with a train weighing 250 tons. To handle heavier trains two or more locomotives will be coupled together and controlled from the forward cab. The multiple-control system which forms part of the equipment makes it possible for a single engineer or driver to operate several locomotives coupled together just as easily and as accurately as he can handle one, in a similar manner to that used on electrically operated elevated roads where trains made up of many motor-driven cars are controlled entirely from the forward car.

One of the important characteristics of the Westinghouse single-phase alternating-current series motor is that it will operate with success when supplied with direct current and may therefore be employed on either the alternating or the direct-current system. It has, accordingly, been possible for the officials of the railroad company to select the most economical system for the operation of their lines and at the same time accommodate their equipment to the direct-current system now being installed by the New York Central Railroad Company, as the New York, New Haven and Hartford railroad utilizes the tracks of the latter company between Woodland and the Grand Central Depot in New York city. For a time the service will be confined to this section. It is therefore with an eye to future rather than to present requirements that the alternating-current system has been adopted. The decision indicates a firm belief on the part of the railroad engineers that this method offers the real solution of the problem of heavy transportation.

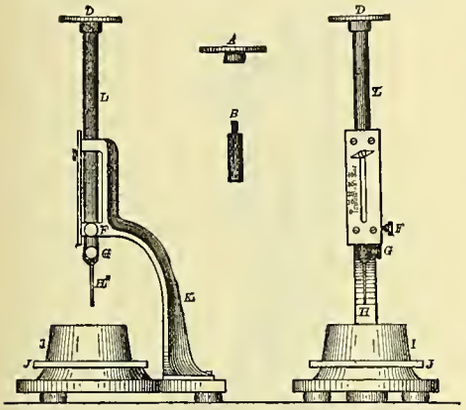
Each locomotive will be equipped with four Westinghouse single-phase railway motors of the straight series gearless type and with the unit switch system of multiple control. The motors will be permanently connected two in series. On direct current the pairs of motors will be operated in series parallel and on alternating current by voltage control. The motors will be spring-supported and connected by flexible drive in such a way that all dead weight will be taken off the axles. On direct current each motor will be capable of developing a rated output of 400 horsepower.

This installation is a very important one, and further information will be awaited with great interest. Both the railroad company and the electrical company are to be congratulated.

The August statement of the Elgin, Aurora and Southern Traction Company is the best shown in two years. Gross receipts increased from $41,893 in August, 1904, to $49,479 this year.

The Testing of Cement.

Much experimental work has been carried on to determine a satisfactory series of tests for Portland cement, and this work is one of great importance in view of the remarkable growth of the cement industry during the last few years. The electrical engineer is now confronted with cement possibilities in many forms—machine and stack foundations, foundations for poles, underground construction, building material for power houses, switchboard barriers and the like, to say nothing of the dams and similar structures used in hydro-electric plants. In many cases it is found the most desirable material to employ. In order to standardize as far as possible the methods of testing, the American Society of Civil Engineers has a committee on "Uniform Tests of Cement" which is doing good work; the New York section of the Society of Chemical Industry has a committee which is working toward the securing of uniform methods of analysis for limestones, raw materials and Portland cements, and the American Society for Testing Materials has a committee on "Standard Specifications for Cement." To assemble under one cover the recent reports of these three committees, Mr. Richard L. Humphrey of Philadelphia, who is secretary of two of them—those of the American Society of Civil Engineers and the American Society for Testing Materials—has prepared a small pamphlet which contains the authorized reprint of the findings of these committees. The progress report of the committee on "Unform Tests of Cement" (American Society of Civil Engineers) is the most elaborate of the three, and the following



VICAT APPARATUS FOR TESTING CONSISTENCY OF CEMENT.

condensation of the report will no doubt be found useful.

In testing cement the first thing is, of course, the selection of the sample, and this must be left to the discretion of the engineer. The sample should, however, be a fair average of the contents of the package; it is recommended that, where conditions permit, one barrel in every 10 be sampled. All samples should be passed through a sieve having 20 meshes per linear inch, in order to break up lumps and remove foreign material; this is also a very effective method for mixing them together in order to obtain an average. For determining the characteristics of a shipment of cement, the individual samples may be mixed and the average tested. Where time will permit, however, it is recommended that they be tested separately. Cement in barrels should be sampled through a hole made in the center of one of the staves, midway between the heads, or in the head, by means of an auger or a sampling iron similar to that used by sugar inspectors. If in bags, it should be taken from surface to center.

Chemical analysis may render valuable service in the detection of adulteration of cement with considerable amounts of inert material, such as slag or ground limestone. It is of use, also, in determining whether certain constituents, believed to be harmful when in excess of a certain percentage, as magnesia and sulphuric anhydride, are present in inadmissible proportions. While not recommending a definite limit for these impurities, the committee suggests that the most recent and reliable evidence appears to indicate that, for Portland cement, magnesia to the amount of five per cent., and sulphuric anhydride to the amount of 1.75 per cent., may safely be considered harmless.

In making tests for normal consistency, the use of a proper percentage of water in making the paste from which the pats are made is exceedingly important. The determination consists in measuring the amount of water required to reduce the cement to a given state of plasticity, or to what is usually designated the normal consistency. Although various methods have been proposed for making this test, none has been found entirely satisfactory. The committee recommends, however, the Vicat needle apparatus as the best to use.

The Vicat needle apparatus, which is shown in the accompanying illustration, consists of a frame (K) bearing a movable rod (L), with the cap (A) at one end, and at the other the cylinder (B), one centimeter in diameter, the cap, rod and cylinder weighing 300 grams. The rod, which can be held in any desired position by a screw (F), carries an indicator, which moves over a scale (graduated to centimeters) attached to the frame (K). The paste is held by a conical, hard-rubber ring (I), seven centimeters in diameter at the base, four centimeters high, resting on a glass plate (J) about 10 centimeters square.

In making the determination, the same quantity of cement as will be subsequently used for each batch in making the briquettes (but not less than 500 grams) is kneaded into a paste and quickly formed into a ball with the hands, completing the operation by tossing it six times from one hand to the other, maintained six inches apart; the ball is then pressed into the rubber ring, through the larger opening, smoothed off, and placed (on its large end) on a glass plate and the smaller end smoothed off with a trowel; the paste, confined in the ring, resting on the plate, is placed under the rod bearing the cylinder, which is brought in contact with the surface and quickly released.

The paste is of normal consistency when the cylinder penetrates to a point in the mass 10 millimeters below the top of the ring. The trial pastes are made with varying percentages of water until the correct consistency is obtained.

The time of setting is also important, and a test is recommended to determine the time which elapses from the moment when the water is added until the paste ceases to be fluid and plastic (called the "initial set"), and also the time required for it to acquire a certain degree of hardness (called the "final" or "hard set"). The former of these is the more important, since, with the commencement of setting, the process of crystallization or hardening is said to begin. As a disturbance of this process may produce a loss of strength it is desirable to complete the operation of mixing and molding or incorporating the mortar into the work before the cement begins to set.

It is usual to measure arbitrarily the beginning and end of the setting by the penetration of weighted wires of given diameters. For this purpose the Vicat needle should be used. In making the test, a paste of normal consistency is molded and placed under the rod (L), this rod bearing the cap (D) at one end and the needle (H), one millimeter in diameter, at the other, weighing 300 grams. The needle is then carefully brought in contact with the surface of the paste and quickly released. The setting is said to have commenced when the needle ceases to pass a point five millimeters above the upper surface of the glass plate, and is said to have terminated the moment the needle does not sink visibly into the mass.

As a standard sand the committee recommends the natural sand from Ottawa, Ill., screened to pass a sieve having 20 meshes per linear inch and retained on a sieve having 30 meshes per linear inch; the wires to have diameters of 0.0165 and 0.0112 inch, respectively, i. e., half the width of the opening in each case. Sand having passed the No. 20 sieve shall be considered standard when not more than one per cent. passes a No. 30 sieve after one minute continuous sifting of a 500-gram sample.

The material is weighed and placed on the mixing table, and a crater formed in the center, into which the proper percentage of clean water is poured; the material on the outer edge is turned into the crater by the aid of a trowel. As soon as the water has been absorbed, which should not require more than one minute, the operation is completed by vigorously kneading with the hands for an additional 1½ minutes, the process being similar to that used in kneading dough. A sand-glass affords a convenient guide for the time of kneading. During the operation of mixing, the hands should be protected by gloves, preferably of rubber.

Having worked the paste or mortar to the proper consistency, it is at once placed in the molds by hand. The molds should be filled at once, the material pressed in firmly with the fingers and smoothed off with a trowel without ramming. The material should be heaped upon the upper surface of the mold, and, in smoothing off, the trowel should be drawn over the mold in such a manner as to exert a moderate pressure on the excess material. The mold should then be turned over and the operation repeated.

During the first 24 hours after molding, the test pieces should be kept in moist air to prevent them from drying out. After 24 hours in moist air the pieces, for longer periods of time, should be immersed in water as near 21° C. (70° F.) as practicable; they may be stored in tanks or pans, which should be of non-corrodible material.

The tests may be made on any standard machine. A solid metal clip is recommended. This clip is to be used without cushioning at the points of contact with the test specimen. The bearing at each point of contact should be one-fourth inch wide, and the distance between the center of contact on the same clip should be 1¼ inches.

Test pieces should be broken as soon as they are removed from the water. Care should be observed in centering the briquettes in the testing machine, as cross-strains, produced by improper centering, tend to lower the breaking strength. The load should not be applied too suddenly, as it may produce vibration, the shock from which often breaks the briquette before the ultimate strength is reached. Care must be taken that the clips and the sides of the briquette be clean and free from grains of sand or dirt, which would prevent a good bearing. The load should be applied at the rate of 600 pounds per minute. The average of the briquettes of each sample tested should be taken as the test, excluding any results which are manifestly faulty.

Newfoundland's Telegraphic Extensions.

A submarine cable connecting Port au Basque—Newfoundland, and Canso, N. S., has just been completed, as previously stated. It is 200 miles long. The colony of Newfoundland is also about to secure control of its internal telegraph lines by paying to R. G. Reid $1,300,000. These lines are to be extended. Sir Robert Bond, the premier of Newfoundland, visited London a few weeks ago to raise a loan of £400,000 to pay for the new cable and proposed land-line extensions and also to square accounts with Mr. Reid. In an interview on September 5th the premier said: "All the telegraphs of the colony are now under the direction of the Postoffice Department. There are 2,178 miles already erected, and further extension is taking place to meet business requirements in the interior. We have also established wireless telegraphy all along the Labrador coast and connecting that coast with the north of Canada. The cable to Canso was completed last week, thus offering independent connection with all parts of the world. The government now has its own system of telegraphs and cables, which are not only of great benefit to the colony but are an important link in the empire chain of cables."

Central-station Advertising.

President Blood of the National Electric Light Association has appointed Paul Spencer of Philadelphia, John F. Gilchrist of Chicago and Joseph E. Montague of Niagara Falls as a committee to co-operate with the advertising committee of the American Association of Incandescent Lamp Manufacturers in the matter of assisting central stations in the adoption of advertising methods that will result in increased business.

The Lamp Manufacturers' Association made an offer to the National association at the latter's Denver meeting of $10,000, to be expended for the purpose named above, and, the offer being accepted, this committee has been appointed to complete plans for the work. One of the most important discussions at the Denver meeting was that upon advertising and general methods of getting new business. The papers and discussions on the subject created great interest and enthusiasm among the representatives of the smaller stations, and many of the suggestions made were of much value.

Landing a Submarine Cable.

The method employed in landing heavy submarine telegraph cables is unfamiliar to most people, and is an interesting process. Two light ropes are first brought ashore by boat from the cable-laying ship. One is passed round a pulley firmly secured in the ground and spliced to the second. On an agreed signal being given the ship, which is, of course, anchored, hauls on one end of the rope, and a heavier rope attached to the other end is drawn in to the shore. This also passes round the pulley and is taken back to the ship, but previous to its second end leaving the vessel the cable itself is attached to it. A number of barrels are then fixed at regular intervals between the vessel and the shore, and over these the cable passes, thus facilitating the hauling of the cable.

When the shore end of the cable has been made fast the barrels are released and the cable drops to the bottom. The cable steamer then heads seaward, paying out the cable as it proceeds.

Northwestern Elevated.

At the annual meeting of the voting trustees of the Northwestern Elevated Railway Company of Chicago the financial statement for the fiscal year ended June 30th was presented. The figures show a surplus of $217,159, after the payment of all bond charges, being equivalent to 4.3 per cent. on the $5,000,000 of preferred stock. This figure compares with a surplus of $203,254 in the preceding fiscal year. The earnings from passengers was $1,340,446 and the operating expenses were $616,628. The road carried an average of 73,460 passengers a day during the year, an increase of 3,796, or 5.45 per cent. The ratio of operating expenses, including maintenance reserve, to gross earnings, was 44.55 per cent. and the ratio of operating expenses, maintenance reserve, loop rent, and taxes to earnings, was 62.04 per cent. Clarence Buckingham, C. Ledyard Blair and Chauncey Keep, whose terms as directors expired, were re-elected to the board.

Rural-exchange and Line Construction.

At the convention of the Central Illinois Telephone Association in Peoria on August 7th and 8th, E. S. Sterrett of Henry, Ill., read a paper on the subject of rural-exchange and line construction, from which the following is taken:

The rural switchboard and party lines are a hard proposition to handle, and nothing but a bridging system should be recognized in this work. The average country line has from 10 to 12 telephones, and in a great many cases from 18 to 20, which we are all ready to admit are too many. This alone makes the line very susceptible to trouble, especially during the storm period, and care should be taken in the installation of this work. Your leading-in wire should be a good grade of No. 18 copper and thoroughly soldered to the line and ground connection. Much poor work is done along this line, from which much trouble arises, which is hard to locate, especially if the ground wire connection has been banked over with earth, as is often the case. Of course, this refers to the ground system, which is still quite generally used in our part of the country, and, with the exception of cross-talk, is giving very satisfactory service. We have all our telephones protected with a good carbon or plate arrester, and a baby knife switch in series with the line, between the arrester and telephone, and during a storm this makes your telephone absolutely safe from lightning. This also applies to metallic lines. The only trouble with this protection is that once in a while a subscriber will forget to throw the switch and, of course, cannot be called. But they soon become educated, and little trouble arises from this. Nothing but the best grade of telephone should be used for this work, and I believe one of 1,600 ohms is preferable, and country telephones should be standardized as much as possible, for many reasons, the cost of maintenance in particular.

Where you have so many makes of telephones in use, it necessitates a larger outlay in repair supplies, and the continual inconvenience of carrying so many different kinds of repair material, while driving over the country inspecting telephones. The inspecting tour is another feature which is sadly neglected by the average exchange, but when this idea is carried out, it saves many a dollar in the "maintenance account." We adopted this system three years ago, and find results very gratifying. We aim to go to every telephone on our lines early in the spring and late in the fall, give them a general trimming up, and put in new batteries when needed. This idea may look extravagant to some, but you will find that it will save many a long ride to fix some individual telephone, when this same expense would have fixed every telephone on the line, and probably saved the trouble in this one, had it been inspected. And not only this, but how much better your subscriber feels, when he knows you are looking after his interests and trying to give him good service, instead of him sending in for you, and being without service for a day or so.

The selection of a switchboard for a rural exchange is a difficult matter, and as far as I have been able to learn, there is no manufacturer who puts out a standard board for this class of work. There are several types of boards intended for this, but they fall short of the requirements for good service. A great many use an express drop, but this is not reliable when central's call must be distinguished from many others on the same line. There are also a good many boards with bells and ringers in use, but when there are a large number of party lines coming into your exchange, they are very confusing and the noise is distracting. After trying nearly all styles of boards and not meeting with success, we had a board made to our own liking and which is giving us good satisfaction. It is arranged with 1,600 ohm ringers, used in the form of buzzers, and rings loud enough to be heard in any part of the operating room, giving a good clear signal. The board is also arranged with low-wound clearing-out drops, which will make a louder noise than the average drop, and is adjusted to make a sound different from that of the buzzers, so the operators cannot mistake a ring-off signal.

In rural-line construction, the same as in any other class of telephone work, it pays to use the best class of building material that it is possible to get. We are rebuilding our system this year and putting in a good grade of white cedar poles, 20 and 25 feet, six-inch top, Washington fir cross-arms, locust pins and galvanized bolts and braces, which will make a line that will stand for a good many years, with little outlay for maintenance. We use No. 12 B. B. wire, and think that it should be used at all times in preference to a smaller size, as its breaking strain is more and it makes less trouble. Our light leads run 30 poles to the mile, and the toll lines 36.

I have always been a strong advocate of heavy guying, for it saves much trouble and expense, especially in sleet storms, and where leads are very heavy. Let a corner pole get loose, and try as you may, you can never get your lines back in shape until you cut loose and re-pull them.

In summing up the whole situation you will find that the rural telephone system is a branch of the telephone business distinctly by itself, for many reasons, and one might go on indefinitely in figuring out needed reforms and the effect of the lock-out system, if present prices would justify exclusive metallic circuits, etc. And in conclusion I will say, the rural field is not receiving the attention it deserves, for it is really the cornerstone on which you have built your success.

Indiana Telephone Items.

The Co-operative Telephone Company of Montgomery County has consolidated with the Home Telephone Company of Darlington. The latter is said to be owned by the Bell interests.

Two hundred and forty-seven telephone companies made returns to the Indiana Tax Board for 1905.

The Indiana Independent Telephone Association has just issued a pamphlet describing the plan of organization, giving the operating rules adopted and facts and figures on the Independent telephone companies of Indiana. C. S. Norton, secretary, says there are 368 Independent telephone companies in the state, 15,000 stockholders, 175,000 subscribers, 30,000 miles of toll line, 1,560 toll offices, $15,000,000 of capital invested and that the gross earnings of last year were $3,500,000. The uniform system of accounting is also described.

Four strong Independent telephone companies of Northern Indiana formed a working combine at Marion on September 22d. The recent purchase by the Central Union Telephone Company of a controlling interest in the United Telephone Company, which has exchanges in Marion and surrounding cities, has aroused the other Independent companies to organize to fight for their interests. The companies concerned in the combine are the Converse Telephone Company of Converse, the Wingate Telephone Company, the Delaware and Madison Telephone Company of Muncie and the Home Telephone Company of Fort Wayne. It is believed that it is the purpose of the new organization to ask a franchise in Marion and establish a plant there.

Pursuing the plan of organization adopted by the Indiana Independent Telephone Association, several districts held meetings this month. The second district held a meeting at Fort Wayne on the 12th, the tenth at New Albany on the 18th, and the ninth at Princeton on the 20th inst. According to reports, the meetings were well attended and much interest was manifested in the plan of organization. The meeting of the seventh district is scheduled at Indianapolis for this week, and that of the eighth district at Cambridge City on October 12th. The state association has 11 vice-presidents, each of whom is president of his district association. It is stated that there are but few Independent telephone companies in the state that have not joined. George W. Beers of Fort Wayne and C. S. Norton of Indianapolis, president and secretary, respectively, are active in their efforts for the good of the organization. S.

The Telephone on the Pacific Coast.

Materials for construction have been purchased by the Fowler Independent Telephone Company, recently incorporated at Fowler, Cal. R. E. Reid is superintendent of construction.

P. K. Higgins, who, on behalf of the Home Telephone Company, recently petitioned the City Council for a franchise at Stockton, Cal., has now applied to the supervisors for a franchise to build a long-distance line throughout San Joaquin. It is estimated that the system would cost from $300,000 to $400,000.

The Pacific States Telephone and Telegraph Company will soon commence the construction of a $100,000 central-office building in Berkeley, Cal. The switching will be done on the second and top floors, and the latest type of switchboards and instruments will be used. The company will also immediately erect two buildings in Seattle, Wash., to cost between $12,500 and $15,000, one on Fourth Avenue, between Garfield and Baline Streets, and the other on Seventeenth Avenue, between Pike and Pine. The construction of these buildings will mean a practical revolution of the telephone service in that city. The laying of underground conduits and other work will represent an investment of at least $25,000. The switchboards of the Seventeenth Avenue station will ultimately have a capacity of 11,000 subscribers, and the other station will have an ultimate capacity of 4,800. According to the statement of City Manager Reynolds, there will be gas engines for use in emergencies that will render the new system safe from interruptions. Jules Kuester is the local manager at Berkeley. A.

Telephone News from the Northwest.

The Maple Leaf Telephone Company at Foley, Minn., has been sold to the Twin City Telephone Company interests of Minneapolis.

The Tri-state Telephone Company has bought the system of the Minnesota Mutual Telephone Company, operating through the smaller towns north of the Twin Cities.

A. D. La Due has sold his interests in the local telephone exchange at Luverne, Minn., to other members of the company.

Negotiations are pending at Mazeppa, Minn., for the transfer of the local telephone system to a company to be formed of local persons there.

Induction from a 2,300-volt light current at Crookston, Minn., has considerably damaged a number of telephone lines in the vicinity of the light station.

The Northwestern Telephone Exchange Company has begun action in the Federal Court against the city of St. Charles, Minn., to have the city show cause why it should not grant the company a charter under which to work in that city. There is already an exchange in St. Charles and the council does not wish to grant a franchise for a second.

O. Shefferd has succeeded L. Middledorf as manager of the Carroll County Telephone Company of Carroll, Ia.

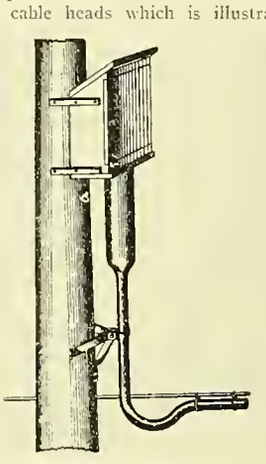
The Independent Telephone Clearing House has been organized, with headquarters at Des Moines, Iowa. Articles of incorporation have been filed with C. C. Deering of Boone as president and M. M. Plaister of Fort Dodge, secretary. The company has a capital stock of $10,000.

The Western Electric Telephone Company contemplates the expenditure of $50,000 in the vicinity of Spencer and Estherville, Iowa, before January 1st.

The Northeastern Iowa Independent Telephone Association held its annual convention at Waterloo, Iowa, on September 15th. R.

Hanger for Cable Heads.

Cable heads, where they enter the distributing box, present considerable dead weight which is sometimes embarrassing to support with sufficient solidity to prevent the cable from settling. The support for cable heads which is illustrated here-



HANGER FOR CABLE HEADS.

with was recently patented by Frank M. Winn of Des Moines, Iowa. The hanger, as shown in the picture, consists of parallel side bars diverging from each other and adapted to grasp the pole on opposite sides. The opposite ends of the bars are bent to form semi-circles, thus providing a clamp to grasp the cable. The middle parts of the two bars are held together by a bolt which also passes through one end of a stay or brace which projects downward at an angle, and is set against the pole to make the support solid. The diverging ends of the bars may be secured to the pole by lag screws.

Bell Output for August.

The American Telephone and Telegraph Company's comparative instrument-output statement for August, and eight months, just issued, is as follows:

August:	1905.	1904.	1903.	1902.
Gross output	127,928	98,272	63,565	84,279
Returned	58,390	46,540	46,136	43,034
Net output	69,538	51,732	17,429	41,245
January 1 to August 31:				
Gross output	1,140,445	770,304	732,823	733,323
Returned	405,911	336,572	325,393	303,355
Net output	734,534	433,732	407,430	429,968
Outstanding August 31	5,215,098	4,213,249	3,557,750	2,955,574

NEW COMPANIES.

A new telephone company has been chartered at Lexington, N. C.

Among recently incorporated telephone companies are the Delaware Telephone Company of Nowata, I. T., the Home Telephone Company of Colorado Springs, Colo., and the Willow Telephone Company of Willow, Okla.

The Eastern Utah Telephone Company, organized at Price, Utah, has filed articles of incorporation with a capitalization of $50,000. The company is prepared to commence work immediately on its prospective system.

Right-of-way is being secured for the Kansas City, Stranger Valley and Topeka electric railway. J. K. Manning is the president. The power house will be built at Bonner Springs.

State Telephone Maps in Preparation.

The National-Interstate Telephone Association has begun the preparation of maps showing the Independent telephone development throughout the country. These maps are being made up by states, and only data which is absolutely reliable is being used in their preparation. When completed they will be an accurate record of the existing Independent lines throughout the country, and will be constantly kept up to date. It is therefore requested that every Independent telephone company in the country send to the headquarters of the association, 708 Electric Building, Cleveland, Ohio, a map of all toll lines which it operates, designating copper lines of No. 10 gauge or over by very heavy lines and all iron lines and copper lines of No. 12 or No. 14 gauge by light lines. Where lines of both classes are on the same lead, the heavy line is to be used on the map.

A catalogue of the various supplies which the association is handling has been printed and a copy is being sent to each Independent company on the mailing list. All Independent companies who have not received the catalogue can get one by writing to headquarters.

GENERAL TELEPHONE NEWS

The Yelville Telephone Company of Cotter, Ark., has sustained a considerable fire loss.

The Atchison (Kan.) Telephone Company has increased its capital stock to $150,000.

It is reported that the number of Bell telephones in use in Ohio on August 1st was 149,079, showing a gain of 19,068 since the first of the year.

The Rocky Mountain Bell Telephone Company is negotiating for the purchase of the system of the Montana-Wyoming company at Red Lodge, Mont., and vicinity.

The Independent Telephone Company of Seattle, Wash., has been floating a large issue of bonds in the East and is getting franchises in cities as far north as Vancouver, B. C.

The New England Telephone and Telegraph Company is to construct a new telephone exchange in the city of Springfield, Mass. The company will expend about $200,000 for land, building and a new switchboard, erecting a fine fireproof structure.

The Michigan State Telephone Company has just completed a job of restoring to a working basis about 1,000 telephones in Detroit which were put out of commission in a recent storm. In the Majestic Building there were 175 telephones put out and the company has expended $1,000 for a new system of cable tubes for this building.

Ray W. Crawford, formerly manager of the Owosso (Mich.) Telephone Company, has resigned his position as secretary and manager of the Rhinelander (Wis.) Mutual Telephone Company to accept the position of district manager of the Wisconsin Central Telephone Company, with headquarters at Steven's Point. He will take charge on October 1st.

At the coming session of the South Carolina Legislature there will be a lively discussion, in all probability, of a bill to require the Southern Bell Telephone Company to connect with all the small Independent lines in the state. The Railroad Commission is now investigating the telephone situation to find the cost of connecting lines and the rates that would be equitable for long-distance connections.

Magnetic Survey in South Africa.

Professors Beattie and Morrison, reporting to the Mathematics and Physics section of the British Association in South Africa, on August 17th, upon the magnetic survey of South Africa, were able to place before the meeting the first maps of the magnetic elements in that country. The survey had been carried out along the lines adopted by Professor Rücker in the magnetic survey of Great Britain as suggested by the association in 1836. Professor Beattie said he was not troubled as to whether this survey had any economic value, but that many magnetic theories, such as that of Gauss, will remain unverified until more is known of the magnetic conditions south of the equator.

The first map shown gave the various stations, 400 in number, at which observations had been made, 20 of these being "repeat" stations for checking the secular and daily variations. The latitude and longitude was determined by theodolite in the usual way at each of the 400 stations, which are all on the railway lines. The annual and daily observations were derived from Sabine's work in South Africa; and also the government astronomer in Natal had carried on a series of observations in declination which had been invaluable for reduction purposes. A map of isoclinics (true), uncorrected for daily variation and for magnetic disturbances was shown. East of the Transvaal seemed to be one mass of magnetic iron ore.

Another map showed the terrestrial isoclinics without local disturbing effects.

CORRESPONDENCE.

Great Britain.

London, September 14.—The enormous increase in the London rates during the last five years has been the subject of much severe criticism, as it naturally would under any circumstances. This increase, however, has been coincident with a large expansion of municipal trading, i. e., in many directions which years ago would have been considered outside the functions of a municipality. Unfortunately it must be recorded that electricity supply in London, speaking generally, has been a contributory cause of the increased rates referred to above, and it is to be feared that the only justification to be urged in its favor on the part of some local authorities—judging on results—is that it is legal. Whether from want of "push"—the term brought into prominence by Mr. Merz—or bad management, or the unfortunate circumstances of the district from an electric-supply point of view, need not be entered into, but the one hard fact of non-success stares us in the face, as regards a number of London borough councils owning electricity works. In the south of London the lot of the municipal electricity works has not been a happy one, with gas down at the low figure of less than 48 cents per thousand, very little higher than in many colliery districts, and a crisis has seemed inevitable for many months. Strong action is now being taken in Bermondsey, a South London district, and a non-political ratepayers' association has been formed—the first of its kind—for keeping a check upon municipal expenditure. Such associations are being suggested for all districts, and the spread of the movement will be watched with exceeding interest.

In Bermondsey, where there is a refuse destructor in conjunction with the electricity works, the association is attacking the electricity department with all its force, and a method of procedure, quite novel, is being adopted, viz., nothing less than an appeal to the Board of Trade in the interests of the local manufacturers, etc. At the moment it is difficult to discover what any government department can do to restrict municipal expenditures, for their main function is to administer the law, and, as before mentioned, municipalities are legally entitled to carry on the business of electric supply. The one authority which might exercise some authority is the Local Government Board, in the matter of loans, but here again it hardly seems policy to refuse loans for extending works for meeting a possibly increasing business.

Fortunately, the Local Government Board is fulfilling a beneficial function with regard to new schemes, and it is a matter for regret that its vigilance was not aroused in the early days. Again, within the last few weeks a loan has been sanctioned to a small local authority on the ground of insufficient prospects of success being shown. On the general question it is a cause for wonder that whereas there are a large number of small local electric-supply companies paying dividends, in a considerable number of cases municipalities with far greater areas and possibilities are quite unable to show substantial profits, after paying all capital charges.

The annual meeting of the Association of British Chambers of Commerce was held this year in Liège, and, as usual, there was a large crop of resolutions passed. The members of the association, however, are influential business men and their opinions must carry considerable weight. The unanimous opinion was expressed that the adoption of the complete decimal system of weights and measures would be beneficial to this country. Another resolution asked for direct and more efficient telephonic communication between the large mercantile cities of the United Kingdom and the principal cities of Europe, while a continuous service of telegraphic communication, both day and night, was also asked for.

The Westinghouse company has just issued a pamphlet extolling the virtues of the Cooper Hewitt mercury-vapor lamp, which is highly thought of in some quarters here. The British House of Commons has been experimenting with the use of these lamps for lighting the parliamentary clock tower, "Big Ben," and the greenish appearance of one face of the four-sided clock excited so much comment and speculation that a few questions were put to the government concerning it.

As a consequence of the accident upon the Ramsgate tramways a short time ago—the second within a few months—in which a number of passengers were injured, the tramway company has deferred making the usual half-year dividend due on September 1st.

Reference was made in a recent letter to the opening of the Yorkshire and Fife electric power schemes. A further addition to this class of supply will shortly be made by the opening of the first power house erected by the Lancashire Electric Power Company, which has laid a considerable mileage of mains and has entered into several contracts for the supply of large quantities of power. None of the stations are driven by waterpower, but one such is now in course of erection in the north of Wales, where parliamentary sanction has been obtained to the considerable use of overhead mains.

The Torquay corporation, whose difficulties were recounted in my last week's letter, has now definitely decided to seek a loan for about $50,000 for extensions of the existing plant, in order to give a supply to the tramways. Fortunately, the tramway company was not ready to take a supply as early as was expected, and some possible complications were therefore avoided. G.

Dominion of Canada.

Winnipeg, Man., September 23.—The Jones & Moore Electric Company is about to establish a branch at Winnipeg in connection with its Toronto factory for the sale of electrical supplies.

The Canadian Pacific railway will install an additional 500-kilowatt Westinghouse generator in its power house at Fort William, Ont. For this purpose a Parsons steam turbine will be put in.

New plans and specifications have been prepared for the proposed dam and lock at St. Andrews Rapids on the Red River, and new tenders will be called for the construction of the work. It is proposed to generate power at the rapids and transmit it by cable to be used for Winnipeg industries.

The company which is to undertake the development of the Kaministiquia Falls near Port Arthur has let contracts to the Canadian General Electric Company for the generators, exciters and switchboards, the total cost of the plant being in the neighborhood of $200,000.

The British Columbia Electric Company has offered to light the city of Vancouver for $40 per lamp a year, with an enclosed series alternating system, on a 10-year contract for 500 lamps. It has been proposed to install a municipal plant, but this does not seem to meet with much favor.

Woodstock ratepayers have passed a by-law to spend $50,000 on improvements to the electric-light system and to extend the same.

Mayor Osborne of Fort Francis states that the work on the big dam is progressing rapidly and 750 horsepower will be ready for delivery by August 1, 1906. When the work is completed at the end of next year the city will be able to furnish power at $10 per horsepower and will have 40,000 horsepower to dispose of.

Owing to the extension of its lines in the last few months the British Columbia Electric Railway Company has found it necessary to add to its motive power, and now announces that it will increase the capacity of its plant at Lake Beautiful by the addition of another unit, involving an expense of $100,000. Another pipe will be run from the dam to the power house and a generator and three transformers installed there. At the Vancouver power house a converter and two transformers will be put in. At present the power generated at Lake Beautiful is equivalent to 9,000 horsepower, and these improvements will raise the supply to 12,000 horsepower, which, it is thought, will be enough for the next two years. Mr. F. Hoffmeister, who was chosen as the successor to Mr. R. H. Sperling when the latter was elected as general manager in place of Mr. Buntzen, who was called to the board of directors in London, England, has presented his resignation as general superintendent of the company. Shortly after his appointment his wife died and when he came to Vancouver from the East it was only to present his resignation.

The Toronto and Hamilton Electric Railway Company has applied to the Electrical Development Company for a lease of a portion of the right-of-way of the Toronto and Niagara Power Company. The right-of-way of the company is 80 feet wide; this is said to be necessary for safety, so that after the erection of transmission towers there is left space sufficient to accommodate a double-track railroad. The proposed agreement is for a 99-year lease, or contract, and the price to be paid by the railway is five per cent. upon one-half of the total cost of the right-of-way to the power company. The power company is to have the right to patrol the lines with cars and its officials are to have free transportation over the lines. H.

New York.

New York city, September 23.—Charles F. Murphy, the leader of Tammany Hall, now declares that the Fusionists are stealing his thunder and that Tammany Hall has always had a municipal-ownership plank in its platform. "Tammany," he says, "favors the municipal ownership of public utilities."

A large but nebulous scheme for still another tunnel to connect New York and New Jersey was announced Wednesday when the Inter-state Tunnel Railway Company was incorporated both at Albany, N. Y., and at Trenton, N. J. This scheme is being promoted by the Metropolitan Street Railway Company and by the Public Service Corporation, and the presidents of both these concerns have issued a joint note setting forth their intentions. In New York city they propose to have a terminal at Chambers Street and to connect this point with Newark, N. J., by means of a 15-minute express service. The scheme has evoked great interest, and if it is possible to carry it through and obtain the necessary franchises on both sides of the river

it will undoubtedly aid the Metropolitan company in its competition with the Interborough.

Mayor McClellan has interfered on receipt of representations from the City Club in the work of constructing the so-called "Steinway" tunnel between Manhattan and Long Island City. Last year the state Legislature held that the original franchise had lapsed, and there is no doubt about the need of a reapplication.

A suggestion has been made, or rather renewed, that tickets available on the surface cars should be issued with a view to facilitate the collection of fares on the crowded cars.

Consequent upon the approaching completion of the lower Broadway portion of the subway the city is advertising for tenders for the repaving of the roadway with wood blocks. Various attempts in the past have been made to use wood blocks in New York, but mostly without success, mainly, in the opinion of the writer, owing to the fact that the blocks have never been laid upon a satisfactory concrete foundation.

The Consolidated Telephone and Electric Subway Company and the Empire City Subway Company are putting down a long stretch of new conduit along Fifth Avenue. The work has been unduly prolonged and merchants on the avenue are complaining of diminished business.

A man named David Chatterton is under arrest in this city on a charge of swindling the New York Edison Company. The allegations are that Chatterton was one of a gang of men who called upon users of electric current and offered to put in a device which would reduce their bills 50 per cent. on the condition that the consumers paid over one-half of the money saved. Their method was to shunt part of the current around the meter. The New York Edison Company says that it has lost more than $50,000 a year on account of these tricksters.

The Rooney Electric Lamp Company of New York city has been incorporated at Albany with a capital of $50,000. The incorporators are J. J., F. J. and John Rooney.

The d'Olier Engineering Company of 74 Cortlandt Street has received the contract as lowest bidder for eight electrically driven pumps for the high-pressure fire service in Brooklyn.

The Scott Arc Lamp Company of Jersey City, N. J., has been incorporated by Louis B. Dailey, Thomas F. Barrett and L. H. Gunther, with a capital of $1,000,000.

The New York Telephone Company announces reduced rates for the Bronx Borough, to take effect October 1st. A business service of 600 messages a year will be reduced from $54 to $48, and a residence service of 500 calls from $48 to $39. Excess local messages will be reduced from seven to five cents. A reduction is also made in the charge for a private exchange. In the future the company will furnish a switchboard, two wires and 2,400 messages a year for $150.

The Hudson and Middlesex Telephone Company, which recently obtained a 21-year franchise from the local authorities at Perth Amboy, N. J., on an agreement to pay the city a percentage on its gross receipts, has made an additional agreement to construct and maintain a line for the use of the city water board for $200 a year. This private municipal line will be eight miles long, extending from the City Hall to the Runyon water station, and a portion of it is under-water cable. The New York and New Jersey Telephone Company's tender for the same line was $275 a year, on the condition that the city build a part of the line. D. W. W.

Indiana.

Indianpaolis, September 23.—The work of building a large dam in the Tippecanoe River, near Monticello, by the Tippecanoe Hydraulic Company, which was to have been finished October 1st, will not be completed until next year. The work has been suspended and nothing more will be done this year. The plant is to cost $1,000,000 when completed. It is understood that the work was suspended in order to secure title to the land likely to be flooded by back water. It is the purpose of the company to furnish electric light and power to Monticello, Logansport, Delphi, Brookston, Lafayette and other cities.

The contract for repairing the municipal electric-light plant of Crawfordsville has been awarded to J. F. Davies of Toledo, Ohio, for $7,433.

The Consolidated Traction Company, organized several years ago to build an electric railway from Indianapolis to Crawfordsville, paralleling the Peoria division of the Big Four, has been absorbed by the Indianapolis, Crawfordsville and Western Traction Company, a new company, which filed articles of incorporation with the secretary of state during the last week, the capital stock being placed at $2,000,000. The incorporators include A. F. Ramsey of Crawfordsville, George P. Heywood of Lafayette and Edward Hawkins of Indianapolis. It is the purpose of the new company to complete the road at once between Indianapolis and Crawfordsville, and then build to Covington and Danville, Ill.

The City Council of Columbus has granted a 50-year franchise to the Wabash and Southeastern Traction Company. The company asked for a perpetual franchise, but the council refused to grant it.

The Board of Public Works of Richmond has awarded a contract to the Fostoria Glass Specialty Company of Fostoria, Ohio, for the furnishing of 1,000 globes for the municipal lighting plant, and has authorized the superintendent to purchase other needed supplies for the plant.

The Shelbyville water and light plant is now owned by C. F. Street of New York city, who purchased it under a receiver's sale. Mr. Street paid $36,000 for the plant, and will at once improve it. Superintendent F. M. Nichols will continue in control of the plant.

The board of commissioners of Madison County has granted a franchise to the Celina, Hartford City and Indianapolis Traction Company. The road is an old project to build from Celina, Ohio, to Indianapolis, through Anderson, Alexandria, Frankton, Perkinsville and Noblesville.

The commissioners of Vigo County have granted a franchise to the Terre Haute Traction Company to cross the new Wabash River bridge at Terre Haute. This concession will bring about the immediate completion of the Terre Haute-Paris interurban line, the greater part of the work having already been done.

The contract for the construction of the Vincennes, West Baden, and Louisville Traction Company's interurban line has been awarded to Lewis Metesser of New Orleans, who represents eastern construction and financial firms. The consideration is $3,000,000. The officials of the company assure the people that the line will be constructed at once.

Word comes from Philadelphia that papers have been signed transferring four important western traction companies to the Philadelphia syndicate headed by Randall Morgan of the United Gas Improvement Company. The Indiana properties included are the Indianapolis and Northwestern Traction Company, operating a line between Indianapolis and Lafayette and the Indianapolis and Western Traction Company, operating a line between Indianapolis and Danville. These roads were built, financed and managed by Tucker, Anthony & Co. of Boston. Negotiations have been pending for two months or more.

The interchangeable coupon books of interurban electric railways which were announced some time ago as nearly ready for sale on 20 Ohio lines, 11 Indiana and two Michigan road, are now on sale in this city. They are good for transportation on all electric lines out of Indianapolis, with the exception of the Indianapolis and Northwestern. These books are sold for $10, or at a reduction of 16⅔ per cent. They can be presented only for rides requiring two coupons or more, and are not good on Indianapolis city lines.

The Indianapolis and Northwestern Traction Company and the Indianapolis and Northern Traction Company are engaging in a spirited excursion-rate war to Chicago. The former transports its passengers to Lafayette and over the Monon steam road to Chicago, and the latter to various points on the Pennsylvania line and thence to Chicago. Both roads are making a strong fight for the Chicago excursion buisness.

The Indianapolis and Ohio Valley Traction Company, which proposes to build from Indianapolis to Rockport, with a branch from Bloomington to Brazil, has been granted a franchise by the Brazil City Council.

The Hancock County commissioners have granted a franchise to the Indianapolis, Newcastle and Toledo Electric Railway Company for a branch line from Greenfield to Maxwell.

Sange Johnston, a well-known electrical engineer who planned and developed many traction lines in Texas and the Southwest, was a visitor at Purdue University, Lafayette, during the last week, and made a careful inspection of the institution. He was pleased with the evidences of thorough work at Purdue and the excellent facilities for the study of electrical engineering.

W. Wyssling and Charles Wirth, mentioned recently in the Western Electrician as having been sent to this country by the Swiss government to study electric-railway methods, inspected the lines of the Indiana Union Traction Company and then visited the central power house at Anderson during the last week. They expressed themselves as being highly pleased with the electrical development of Indiana.

The subsidy election for the Evansville and Eastern electric road resulted favorably at the election held on the 21st instant in Ohio and Luce townships, Spencer County. The subsidies will amount to $68,000. The officials of the company announce that the contract for the construction of the line will now be let.

The City Council of South Bend has granted a 50-year franchise to the Indianapolis, Logansport and South Bend Traction Company to use certain streets for the operation of trolley cars. The promoters announce that the right-of-way for this line between Logansport and South Bend is nearly all procured and the work of construction is to begin soon. S. S.

Ohio.

Cleveland, September 23.—From Newark it is reported that official announcement has been made of the acquisition of the Columbus, Buckeye Lake and Newark and the Columbus, Newark and Zanesville lines by Randall Morgan of the United Gas Improvement Company of Philadelphia. These roads were built and controlled by the Tucker-Anthony syndicate of Boston, with J. R. Harrigan as general manager. They have proved profitable investments. The Columbus, Buckeye Lake and Newark has 39 miles of track. Of the capital stock, $1,000,000 is common and $500,000 preferred. Bonds issued aggregate $1,250,000. The Columbus, Newark and Zanesville is 42 miles long. Its stock issue consists of $850,000 common and $400,000 preferred, with a bond issue of $1,250,000. Holders of common stock will receive $35 per share. It is said that the ownership of the road will not be in the United Gas Improvement at the present time, but ultimately it is expected it will go to the company.

In connection with the above, it is said that the Elkins-Widener syndicate is working to secure the Appleyard properties and that the bonds of the Central Market street railway of Columbus are now largely under its control. W. Kelsey Schoepf of the Cincinnati Traction Company has been in the East for some time in connection with this deal, it is said. The results obtained by these lines under the management of the receivers shows that they may be operated with profit. However, it is reasonable that they have so far spent no more money on improvements than actually necessary, so that the showing is better than it might be where a company was putting a portion of the returns into maintenance.

Directors of the Cincinnati Gas and Electric Company have approved contracts for additions and improvements amounting to about $300,000. A dividend of 1⅛ per cent. for the quarter was declared.

Owners of preferred stock of the Cleveland and Southwestern have formed a pool and agreed not to sell at less than 70. The directors have concluded not to pay dividends on the preferred stock for a time, and the pool became necessary to protect the stock, it is said.

The Plymouth and Shelby Traction Company was incorporated a few days ago to build an extension of the line now operating between Norwalk and Plymouth, to Shelby. Benjamin B. Avery, Sherman Culp and others are interested in the venture.

The Scioto Valley Traction Company is reported to have completed arrangements for a branch line from Carroll to Millersport, a distance of 9¼ miles. This will make a second road from Columbus to Buckeye Lake, and it may be that the company will also build a park at the lake.

In vetoing the ordinance giving the Toledo Railways and Light Company a franchise on Bancroft Street, Toledo, the mayor said he thought it was a bad policy to grant franchises for extension that will expire after the expiration of the original grants. The decision of Judge Taylor of Cleveland regarding the point as to whether the granting of a franchise for an extension would renew the original franchise will be investigated.

Although rights-of-way have been secured for an electric railway over 14 of the 22 miles between Fostoria and Fremont, farmers have offered the promoters free right-of-way for the entire line if they will go through Bettsville. This route is 2¼ miles longer, but the farmers say this will more than be made up by the additional business. The original route parallels the Lake Erie and Western.

The Miller Anchor Company of Norwalk has been incorporated with a capital stock of $25,000 by G. H. Miller, J. H. Beattie, C. F. Jackson, J. R. Wetmore and A. V. Andrews.

The Electric Magnetic Pumping and Power Company of Spencerville has been incorporated with a capital stock of $100,000 by E. H. Stoever, H. T. Miller, J. H. Lay and others.

A committee of the Chamber of Commerce at Cleveland has made a report in which the surface plan of handling cars in the center of the city is recommended for some years to come, at least. The committee recognized the fact that a great congestion results in the morning and evening, and that much time is lost, but at the same time says that the city is hardly ready for an extensive system of subways. O. M. C.

Michigan.

Detroit, September 23.—The Kalamazoo council committee on railroads will recommend that the Lake Shore and Chicago Traction Company be compelled to pay to the city $1,000 annually for each mile of track in the city. This feature will be embodied in the franchise. This company recently purchased 16 miles of Michigan Central tracks and will build an electric railway between South Haven and Kalamazoo. The abandoned roadbed purchased is the one from Mattewan to Kalamazoo.

The Kalamazoo and Battle Creek Interurban electric railway, since the inauguration of freight traffic, has been delivering goods direct to the merchants or leaving them on the curb in front of the postoffice for the shippers at Galesburg, owing to the lack of a warehouse. The president of the

village has forbidden the use of the streets for freight storage and the company now refuses to handle freight until warehouse facilities are secured. This works great hardship on the shippers of milk and cream.

Detroit men have recently organized the Windsor, Essex and Lake Shore Rapid Railway Company. Dr. Philip Heseltine of this city is general manager. The road is capitalized at $1,000,000, with the privilege of adding another half million if needed. It will run from Windsor to Chatham and with its switches will have a trackage of 120 miles. William L. Wilson of Port Huron is president and John W. Goodson of Detroit is secretary.

The subaqueous cable recently laid by the government between Charlevoix and Beaver Island in Lake Michigan is now in operation. It will be of much benefit to vessel-owners whose boats seek shelter at the island.

The Detroit, Monroe and Toledo electric railway's business this summer has exceeded the estimated earnings fixed by the engineers before the road was constructed. The board of directors at a recent meeting authorized the purchase of another unit of not less than 1,200 kilowatts capacity. It was feared that the present power would not be sufficient to handle the rapidly increasing business of the road. The present power house was built sufficiently large to accommodate the extra unit. Double-tracking will be continued until the entire line is finished.

The National Gas, Electric Light and Power Company of Detroit is negotiating for the purchase of the Niles gas plant and also for the one at Warsaw, Ind. Bascom Parker of Niles is a half owner and manager of both plants.

Mayor Codd of Detroit is now working on a plan to give the Detroit United railway a 20-year blanket franchise for all lines, in return for which the company will be asked to give a three-cent fare and universal transfers. The new plan does not contemplate putting municipal ownership into practice for several years. It provides for a commission to determine the value of the property and to settle the question of taxation, and finally to perfect a system whereby the street-car company may retain a fair proportion of the earnings—say four or five per cent. It is also proposed to have incorporated in the new franchise a provision giving the city the right to purchase the street railway at a fair and reasonable valuation, to be determined by a commission to be named by the city. Alderman Jeffries, on the other hand, proposes a plan for an entire new system of car lines to be built at the city's expense and to be leased to a private concern to run on a basis of three-cent fares. C. G. W.

Northwestern States.

Minneapolis, September 23.—Steam and electric-railway men are greatly interested in the proposition to build an electric railway from Duluth and Superior to the Twin Cities. It is known that the Great Northern Power Company is considering the feasibility of such a line, and it is thought that the road will be built within the next two years. Estimates are being prepared by two large electric manufacturing companies, on the supposition that power will be utilized for the purpose named from the new St. Louis River dam. The plan is believed to be entirely practicable.

The contract for a new dynamo for the electric-light plant at Marshalltown, Iowa, has been let to the General Electric Company.

An election is to be held at LeGrand, Iowa, on October 7th to vote on the proposition to install an electric-light plant.

Steps are being taken at Wheaton, Minn., looking to the establishment of a new electric-light system by a local company.

The capacity of the electric-light plant at Staples, Minn., is to be doubled at once.

The Hawkeye Electric Company of Manning, Iowa, is talking of moving its factory for the manufacture of electrical appliances to Davenport.

The contract for a 200-horsepower engine and a Warren alternator for the municipal lighting plant at Willmar, Minn., has been let to W. I. Gray & Co. of Minneapolis at $5,300.

A municipal electric-light plant is proposed at Afton, Iowa.

An election will be held shortly at Aberdeen, S. D., to vote on a proposition to issue bonds for $35,000 to establish a municipal electric-light plant. The opponents of the plan propose to grant a franchise to the private company making the most favorable terms. R.

PERSONAL.

J. B. Cowen, for a long time prominently connected with the General Incandescent Arc Light Company, has been secured by the General Storage Battery Company, New York city, as manager of its sales department.

J. F. Witmer, B. A., C. E., will assume charge of special work for J. G. White & Co. of New York in matters bearing on hydraulic work in foreign fields. Mr. Witmer is a specialist of many years' standing, with offices at Buffalo, N. Y., and during the last 10 years has designed and superintended the construction of waterworks systems in about 30 different towns and cities in the United States.

News comes from Cape Town, South Africa, of the death at that place of Col. Francis William Rhodes, retired, brother of the late Cecil Rhodes, and managing director of the African Transcontinental Telegraph Company.

George E. Bender, for some time assistant secretary of the Cleveland, Painesville and Eastern Railway Company, has been appointed superintendent of the London Street Railway Company, London, Canada. This system is owned by the Everett-Moore syndicate.

The members of the International Association of Municipal Electricians have presented to William Crane, city electrician of Erie, Pa., a handsome cut-glass punch bowl in token of their appreciation of courtesies extended to them when in attendance at the annual convention, in that city, last month.

H. M. Smith, who has advanced in a few years from a conductor on the Lake Shore electric railway at Cleveland, Ohio, to the position of superintendent of the Rockford and Interurban Electric Railway Company, has been chosen as superintendent of the Philadelphia and Western, a new double-track third-rail system that is just being completed.

The force of the United States Weather Bureau has been increased by the appointment, among others, of Prof. William J. Humphreys of the University of Virginia as professor of meteorological physics in charge at Mount Weather Observatory, and Louis G. Schultz of the Magnetic Survey of the Argentine Republic as research director assigned in charge of the magnetic work at Mount Weather.

Luther Allen, president of the Toledo and Western Railway Company, died at Lakeside Hospital in Cleveland, Ohio, on September 23d, as the result of an operation for appendicitis. Mr. Allen was 59 years of age and was prominent among the business men and financiers of Cleveland. It is said that he knew the railroad business as well as any other man in the country, as he had served in all capacities. Besides giving particular attention to the Toledo and Western road, he was president of the Adams Bag Company and the Reserve Trust Company and a member of the executive committee of the American Shipbuilding Company. He is survived by his wife and three children. The funeral services were held at the family residence, 1695 Euclid Avenue, Cleveland, on Monday last.

Professor R. W. Hargrave of the University of Michigan has been elected to the chair of electrical engineering in the Georgia School of Technology to succeed Professor A. H. Ford, who has left the technological school to fill the chair of electrical engineering in the University of Iowa. Professor Hargrave is a graduate of Rollins College, Florida, and of the University of Wisconsin, where he graduated in the mechanical and electrical engineering departments. He was appointed instructor in the University of Wisconsin and remained three years, at the same time taking post-graduate course in the electrical engineering. Resigning as instructor Professor Hargrave went to the General Electric Company as a consulting engineer, and after three years with this company he was appointed assistant professor in the University of Michigan, where he remained until he was elected to the Georgia School of Technology.

ELECTRIC LIGHTING.

H. W. Turner has been appointed receiver for the Dillon (Mont.) Electric Light and Power Company.

The Muskogee Light and Power Company's plant at Muskogee, I. T., is reported to have been destroyed by fire.

The Altus (Ark.) Gin, Manufacturing and Improvement Company is installing an electric-light plant in Altus.

The Kaukauna (Wis.) Electric Light Company has been granted a 10-year franchise to furnish commercial lights in the village of Little Chute, Wis.

The Wooley Electric Company of St. Louis, Mo., has been incorporated with a capital stock of $25,000 by W. D. Wooley, E. C. Hencken and Frederick Essen.

The Pawhuska (Okla.) Electric Light, Ice and Water Company has been incorporated with a capital of $25,000. J. W. McLoud of Little Rock, Ark., is interested.

Bids will be received by the village of Freeburg, Ill., until October 11th, for furnishing and constructing for the village an electric light and power plant. Bids must be sealed and have endorsed on face "Proposal for Electric Light Plant" and addressed to Charles Kessler, clerk, Freeburg, Ill. Plans and specifications are on file and may be seen at the office of Owen Ford, consulting and supervising engineer, 710 Security Building, St. Louis, Mo., and at the office of the village clerk in Freeburg.

The Mena (Ark.) Light, Heat and Power Company has been incorporated with a capital stock of $250,000 by Frank R. Hoyt, Francis M. Reeves and Wilson Hoyt.

It turns out that the talked-of searchlight on Pike's Peak is a small one with which some experimenting has been done. Next year it is hoped to arrange more ambitious effects.

J. W. Chapman, of Lawrenceville, Ga., has secured an option on a waterpower near Brevard, N. C., which he proposes to develop, and build an electric-light plant to supply the town of Brevard. The town has agreed to use a specified number of lights.

Business men of Mass City, Mich., have made arrangements with the Mass Consolidated Mining Company for supplying the village with lights. The company operates for its own use a dyamo with a capacity for 2,000 lights, but is using only 500. A new Corliss engine will be installed.

The Breese Water and Light Company of Breese, Ill., is preparing to install a central lighting plant in that city, and will receive bids on the entire equipment until 10 a. m. on Monday, October 9th. William H. Bryan, Lincoln Trust Building, St. Louis, Mo., is the consulting engineer in charge of the work.

The Superior Water and Light Company of Superior, Wis., will install two General Electric motor-generator sets, each consisting of a three-phase revolving field, 500-kilowatt, 2,300-volt, 60-cycle generator, driven by a 25-cycle, 6,600-volt, 500-kilowatt synchronous motor, together with exciters, switchboard, arc lamps, transformers, meters, etc.

The Cleveland Electric Illuminating Company has ordered from the General Electric Company nine oil-cooled and nine water-cooled, 250-kilowatt, 6,600:13,200-volt, and four 100-kilowatt, 4,160:460-volt, three-wire transformers, 24 motor-operated induction potential regulators, switchboard material, instruments, etc., and in addition a large number of watt-meters, oil switches, ammeters, voltmeters, etc.

ELECTRIC RAILWAYS

The Fort Wayne, Bluffton and Marion Traction Company of Fort Wayne, Ind., has ordered two three-phase, 300-kilowatt, 25-cycle General Electric rotary converters, with transformers, switchboards and accessories.

Horace C. Stilwell of Anderson, Ind., and George F. McCulloch of Muncie, are promoting the building of an interurban railway from Kansas City, Mo., to Topeka, Kan. There would be about 60 miles of main line.

The Washita Valley Interurban Electric Company has been incorporated, with headquarters at Tishomingo, I. T., and a capital of $12,000,000. An electric railway is to be run from Shreveport, La., to Anadarko, Okla., with branches.

Plans that are under way for the new fast trolley line between Boston and Lowell, under the direction of Charles F. Remington, the promoter of the enterprise, contemplate the construction of a line mainly over private land. The distance is about 25 miles, and high speed is to be attained.

The Twin City Rapid Transit Company of Minneapolis, Minn., is making additions to its present equipment, and has ordered from the General Electric Company four six-phase, 600-kilowatt, and two six-phase, 1,500-kilowatt, 25-cycle, rotary converters, complete, with transformers, reactive coils and switchboard apparatus.

The Aurora, Elgin and Chicago Railway Company reports gross receipts for the month of August of $71,373, and operating expenses amounting to $33,117. The figures for August, 1904, were, respectively, $53,553 and $26,129. Net earnings for the two months ended August 31st were $80,158 this year and $58,810 last year.

A 20-year franchise for building and operating an electric street-railway system and lighting plant in Hopkinsville, Ky., was sold to John H. Bell, Jr., of Hopkinsville for $26. The only other bidder was Samuel Crawford of Memphis, Tenn., at whose request the franchise was ordered sold. The cost of constructing the plant is estimated at $300,000.

A new company, it is stated, will construct and operate a second electric railway from Jackson to Detroit, Mich. The company is to be known as the Jackson, Ann Arbor and Detroit Electric Railroad Company. The officers are: President, W. A. Boland; vice-president, Charles W. Osborn, and secretary and treasurer, N. S. Potter.

The Chicago City Railway Company will equip two substations to be located at Fifty-first and State streets and Twenty-first and State streets. Each substation will contain three six-phase, 1,000-kilowatt,

25-cycle, rotary converters, three 150-kilowatt, air-blast, reactive coils, 10 375-kilowatt, 13,200:430-volt, single-phase, air-blast transformers, and the necessary switchboard for this equipment. The General Electric Company will furnish the machinery.

The Lexington (Ky.) street-railway, electric-lighting, gas and ice plants, the Paris and Georgetown interurban lines and the franchises of the proposed interurban lines radiating from Lexington have been sold to Philadelphia capitalists. Over $1,000,000 in cash was handed over to the former owners. The Frankfort street-railway property was purchased in the same deal, having been transferred several days ago. There will for the present be no change of management.

The Village Council of Watervliet, Mich., has granted two street-railway franchises. One, to Dr. W. A. Baker of Coloma, who will build a road from Forest Beach Hotel, Paw Paw Lake, to Watervliet. This line will be ready for the summer business next year. The line will finally be extended to Benton Harbor, and the cars will be operated with gasoline motors. A franchise was also granted to William E. Dodson for an electric railway in the village.

Farson, Leach & Co. have purchased from Hayden, Miller & Co. of Cleveland the Rockford, Beloit and Janesville electric railway, running from the center of Rockford, Ill., north through Beloit to Janesville, Wis. This company has a paid-up capital of $1,000,000 and has $650,000 bonds outstanding. The road for the last few years has earned more than double its interest charges. It is the intention to extend it north to Madison, Wis., and northeast to Milwaukee, it is said.

Some interesting figures concerning the operation of the Valtellina three-phase line in Italy have been made public. During the last financial year 500,000 train-miles were run, a train usually consisting of one 54-ton motor car and four or five trailers weighing from 60 to 70 tons. Including all capital charges (interest, depreciation and sinking fund), the total cost per train-mile came to 38.75 cents, of which sum 2.03 cents relates to power-station charges, 2.43 cents to drivers' wages, 3.45 cents to the maintenance of the locomotives and trailers, and 2.64 cents to the maintenance of the overhead equipment.

Articles of incorporation have been filed by the Peoria, Pekin and Bloomington Interurban railway of Illinois. The road is to extend from Peoria through Tazewell and McLean counties to Bloomington, the principal business to be established and maintained at Pekin, Ill. The first board of directors that will take active charge of the construction and management of the enterprise are Levi Johnson of Danvers, Ill., F. E. Seagrave of Toledo, Ohio, D. S. Brown of Peoria, Jesse Black and W. E. Lants of Pekin. The capital stock is divided into 1,000 shares of $100 each. The project for the construction of this road has long been before the people.

It is reported from Vincennes, Ind., that the directors and stockholders of the Vincennes, West Baden and Louisville Traction Company have signed a contract with a Philadelphia concern for the construction of the line for $2,000,000 and the building of a $300,000 power house either at Olwell or Petersburg. The road will be double-track, rock ballasted, and will run for 66 miles from Vincennes via Jasper to French Lick Springs. Passenger traffic in the daytime will be superseded by freight traffic at night. Thomas H. Adams of Vincennes is president of the company, and Smiley N. Chambers of Indianapolis and John L. Griffith, consul at Liverpool, are two of the most prominent directors and stockholders.

PUBLICATIONS.

The De Laval Steam Turbine Company of Trenton, N. J., has issued a small pamphlet descriptive of its steam-turbine machinery. The cover of the pamphlet bears a small picture, from which a clear idea may be obtained of the fundamental principles and the operation of the De Laval turbine.

The Fletcher Manufacturing Company of Dayton, Ohio, manufacturer of sleet-proof pulleys, windlasses, mast arms, incandescent brackets, Gem wire holders, etc., has issued a new price list of its various products. The price-list is No. 531, and is designed especially for the use of salesmen and purchasing agents.

Wooden and iron panel boxes, panel cut-outs, cartridge cut-outs and entrance switches are the subjects treated in Bulletin No. 26, issued by the H. T. Paiste Company of Philadelphia. Various types of these devices are illustrated and described briefly. A few words from "Aleck" concerning his trip to the contractors' convention in Boston are also a feature of the bulletin.

An interesting pamphlet from the Gould Storage Battery Company describes the use of a regulating battery in connection with a combined railway and lighting plant, the specific example given being the installation of the Edison Electric Illuminating Company of Topeka, Kan., which installation consists of 280 elements. That part of the plant of the company having to do with the storage batteries is illustrated in attractive style in the pamphlet.

An elaborate catalogue upon the subject of milling machines has been issued by the Cincinnati Milling Machine Company of Cincinnati, Ohio. The catalogue is worthy of praise for its typographical excellence and the arrangement of the descriptive matter which it contains. The line of machines described in the catalogue is intended for that class of manufacturers who are seeking to equip their works with only the best tools, and to whom first cost is a secondary consideration.

The Nernst Lamp Company of Pittsburg is distributing a circular describing the Nernst 220-440-volt, three-wire, alternating-current system for small cities. The directions for running the circuits, the placing of distribution centers, location of power house and transformers, etc., are very clear and are helped out by a number of diagrams. To those who contemplate making an installation of Nernst lamps in a small city, the circular is directed, and it will be found to contain many hints of a practical nature.

Bulletin No. 51 of the Northern Electrical Manufacturing Company of Madison, Wis., contains much helpful information regarding the ratings and dimensions of Northern machines, and illustrates some recent applications of heavy motor drives. Another publication of the company is leaflet No. 145, devoted to electric forge-blower equipments. There are five sizes of these equipments, Nos. 0000, 0, 1, 2 and 3, delivering, respectively, 75, 150, 225, 325 and 425 cubic feet of air a minute. The pressure in ounces in each case is 1½.

Belt-driven generators and Christensen air-brake equipments are taken up in two new bulletins which are distributed by the National Electric Company of Milwaukee, Wis. The generators are direct-current, type MB. They are built in capacities ranging from 50 to 500 kilowatts, with speeds and voltages to suit requirements. The Christensen air-brake system for use on electric cars is fully described in the bulletin devoted to that subject, and instructions for the operation of the straight air-brake apparatus are also given.

The De La Vergne Machine Company of New York is sending out a catalogue which, in appearance and general arrangement, is hard to beat. The product described is the Hornsby-Akroyd oil engine, of which it is said that over 10,000 are now in operation. Besides containing a description of the engine itself, the catalogue shows the engine's adaptability to various classes of work, such as refrigerating plants, pumping stations, space-telegraph stations, lighthouses, etc. Some standard tables are also a part of the reading matter, giving the book additional value.

For distribution at the Street Railway Association at Philadelphia the Westinghouse Companies' Publishing Department prepared an artistic special publication illustrating and describing in a general way the lines of alternating-current and direct-current railway motors manufactured by the Westinghouse Electric and Manufacturing Company. The pamphlet also contained descriptions of generators and systems of control for electric railways, as well as the system of catenary line construction. Two new Westinghouse bulletins have also been issued describing the No. 113 railway motor and Westinghouse prepayment wattmeters.

The Wellman-Seaver-Morgan Company of Cleveland, Ohio, usually "sets a fast pace" when it comes to the publication of advertising literature. The company's new publication concerning iron and steel works equipment, which is devoted especially to furnace-charging and manipulating apparatus, is not a bit behind its predecessors, and even those who are not directly interested in this particular class of apparatus will be constrained to give more than passing attention to the catalogue, so interesting are the large cuts and the general description of the machinery. This company is the sole manufacturer of the celebrated Wellman patented open-hearth furnace-charging machines and charging boxes, and has supplied them not only to the leading steel works in America, but to a large number of plants abroad.

A number of new pieces of advertising literature have just been issued by the General Electric Company. One of them is a pamphlet containing a reprint of a paper read by W. B. Potter before the New York Railroad Club upon the subject of "Developments in Electric Traction." Another reprint is an article by L. R. Pomeroy upon "The Electrification of Trunk Lines." There are also four new bulletins, Nos. 4417, 4418, 4419 and 4420, describing, respectively, "Generating-station and Sub-station Switchboards for Continuous-current Railway Systems Operated from Three-phase Generators," "The Synchronism Indicator," "New High-efficiency High-candlepower Incandescent Units" and "Thomson High-torque Induction Test Meter, Type B." Of these bulletins No. 4417 is the most complete and contains a great deal of valuable information and several useful diagrams relating to General Electric switchboard apparatus. Supply catalogue No. 7590 lists the General Electric line of enclosed-fuse cut-outs and fuses. Price list No. 5140 covers braided and lead-covered varnished cambric insulated cables for 125 to 15,000 volts. A little device indicative of modern-life luxury is described in a small folder; it is the "matchless light," and smokers are asked no longer to inhale the fumes of burning matches. The remaining sheets in the budget are a folder setting forth the merits of Edison lamps and three circulars devoted to the concentric diffuser for incandescent lamps, standard key and keyless sockets and electrolier key and keyless sockets.

SOCIETIES AND SCHOOLS.

The Polytechnic Institute of Brooklyn announces a series of evening courses in physics and mechanical and electrical engineering.

The Ohio Society of Mechanical, Electrical and Steam Engineers will hold its annual meeting in Canton, Ohio, on November 17th and 18th.

The Automobile Club of America will hold its sixth annual automobile exhibition in the armory of the Sixty-ninth Regiment in New York city on January 13th to 20th. The exhibition committee, which has charge of the show, has headquarters at 753 Fifth Avenue, New York.

Armour Institute of Technology of Chicago announces evening classes in mechanical, electrical, telephone, civil, chemical and fire-protection engineering; also drawing, shop work and mathematics. The courses are selected with special reference to those who are engaged in technical pursuits during the day.

MISCELLANEOUS.

The Underwriters' Laboratories of Chicago have been removed from 67 East Twenty-first Street to their new building at 382 Ohio Street.

The Central Heat and Power Company of Rockford, Ill., will extend a number of heating mains. It will also add a 500-horsepower engine and generator better to care for its increasing business.

The output of quicksilver in the United States during 1904, as reported to the United States Geological Survey, was 34,570 flasks, valued at $1,503,795. Up to June 1, 1904, these flasks held 76½ pounds each; since they they have contained 75 pounds each. The production of 1904 was a decrease from that of 1903, which amounted to 35,620 flasks, valued at $1,544,934.

The Supreme Court of Minnesota has given a decision in the long-contested case of the Western Union Telegraph Company, upholding the action of the state board of equalization in 1899, when it raised the valuation of the Western Union Telegraph Company from $865,500 to $1,000,000. The decision determines the right of the state to assess the franchise of telegraph companies and similar corporations on the basis of their earning power and not on the basis of their tangible property alone.

F. I. Allen, commissioner of patents, has issued the report of his department for the fiscal year ended June 30, 1905. The total receipts for the year were $1,737,344 and the expenditures $1,472,467. The number of applications for mechanical patents for the fiscal year was 52,323. The number of patents granted in 1905, including reissues and designs, was 30,266. There were also 1,028 applications for labels, 1,426 trademarks and 345 prints registered. There were 19,567 patents that expired during the year, and 5,154 allowed applications that were forfeited for non-payment of final fees.

TRADE NEWS

Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until October 19th for the installation of an electric passenger elevator and hydraulic lifts in the United States court house and postoffice building at Lincoln, Neb., in accordance with the drawings and specifications, copies of which may be obtained at the above address.

Another Richmond has appeared in the field among the storage-battery manufacturers. It is the Columbia Battery Company of Milwaukee, Wis. This institution, it is said, has been organized with a substantial capital, and numbers among its directors some of the leading business men of Milwaukee. It will manufacture storage batteries for electric vehicles and electric launches. It will also equip stationary electric-lighting plants and produce also batteries especially adapted for spark coils, electric bells, portable sets, etc. The company has temporary offices in Milwaukee on the northeast corner of State and Third streets.

The Bureau of Supplies and Accounts of the Navy Department is inviting sealed proposals until October 31st for furnishing western navy yards with the following: Schedule 159, wattmeters, electric traveling crane; schedule 160, motors and electric

traveling hoists. On October 17th the bureau will open bids for furnishing western navy yards with the following: Schedule 141, conduit, cable, electric wire and fittings, globes and shades; schedule 142, motors, motor-drive outfit, electric traveling hoist. Proposal blanks and specifications can be obtained on application to the bureau or to the Navy Pay Office in San Francisco. The Bureau of Supplies and Accounts also invites sealed proposals until October 10th for furnishing eastern navy yards with the following supplies: Schedule 147, dynamotors, insulators, testing sets, lighting wire, rheostats and miscellaneous electrical supplies; schedule 148, armored cable; schedule 149, motors, conduit. Blank proposals and further information can be obtained of the bureau or at the Navy Pay Office in New York.

BUSINESS.

The J. B. Galloway Company, Clarendon, Ark., manufactures standard oak pins and brackets for telephone and telegraph companies. The company gives special attention to accuracy in the manufacture of its products.

The Reeves Engine Company of New York, through its Chicago manager, Joseph B. Hall, has arranged with the Dwyer Plumbing and Heating Company of St. Paul, Minn., to handle the territory tributary to St. Paul. F. J. Spriggs, M. E., will be in charge of engineering matters for the Dwyer company.

"Quality is the cornerstone in the building of Success," say Pass & Seymour of Solvay, N. Y.; "mere cheapness never established a lasting reputation for a product." In the making of P & S sockets highest quality has always been aimed at. The best materials are used in their manufacture, and copper is used instead of brass or copper-plated metal for the contact shells.

Francis B. Badt, R. E., E. E., and George M. Willis, M. E., E. E., expert electrical and mechanical engineers of Chicago, are justly proud of the prominence and recognized standing of their clientele. They have issued a list of some of those for whom they are acting or have acted as experts, and it contains many prominent names. They have also obtained by special permission a list of references containing the names of some of the most influential business men in Chicago and elsewhere.

The Treasury Department has made a ruling to the effect that on the exportation of cables sheathed with lead manufactured wholly from imported pig lead, or from such lead and a small percentage of tin, a drawback will be allowed equal in amount to the duty paid on the imported lead so used, less the legal deduction of one per cent. The regulations requiring the submission of sworn samples of exported cables for analysis to determine the percentages of lead and tin therein contained have been revoked.

The directors of Dick, Kerr & Co. of London report profits during the year ended June 30th amounting to $420,875. During the year, the directors state, the company completed, among other important contracts, the electrification of the Lancashire and Yorkshire railway between Liverpool and Southport and the Hongkong and Mandalay electric-tramway systems and are at preset busily engaged in Tokio, Singapore, Bangkok and other places at home and abroad. Mr. Claud T. Cayley having retired from the chairmanship, Mr. John Kerr has been elected in his place.

Shown herewith is the trademark of the F. Bissell Company of Toledo, Ohio, in a modified form from that which has been already illustrated in the Western Electrician. The trademark is considered to be of great advertising value, and will, in this new combination, be used in all the advertising of the company and on all its manufactured product. As will be noted, the distinctive frog emblem is retained, but it is now enclosed in an oval band giving the name and address of the Bissell company.

Among the recent orders taken by the General Electric Company are the following: North Shore Electric Company of Chicago; one 500-kilowatt turbo-generator; Edison Illuminating Company of Detroit, one 3,000-kilowatt and two 500-kilowatt turbo-generators; Harriman Extract Works of Harriman, Tenn., one 100-kilowatt generator; Solvay Process Company of Detroit, Mich., 26 induction motors, aggregating 385 horsepower; Semet Solvay Company of South Chicago, a 75-kilowatt generator, two motor-generator sets and 19 induction motors, aggregating 550 horsepower; Chicago Union Traction Company, five four-motor equipments with controllers; Terre Haute Traction and Light Company of Terre Haute, Ind., three four-motor equipments with Sprague-General Electric control.

A party of German railroad engineers, it is announced, will shortly leave for the United States, to study American lines. The London Chronicle says that the visitors could not do better than make a study of some of the officials of the New York Central Railroad, "beginning with its most genial and capable manager, Mr. Daniels, a man of great qualities, guiding with sure hand the passenger traffic of one of the most complicated, and at the same time one of the best managed, railway systems in the world. The Daniels type does not exist in Germany. When in New York also they could not do better than study the Grand Central Station. Germany has much to learn in the way of equipping her railway stations." It may be added that the New York Central is making greatly reduced rates to the Adirondack Mountains during October. The Adirondacks are annually visited by many westerners, who will be interested, among others, by this announcement.

From all accounts, the Universal Electric Storage Battery Company of Chicago has made most rapid progress in the storage-battery market. The factory at 36 and 38 Union Park Place, under the management of William Morrison, the inventor of the battery, has been for some time thoroughly organized and is producing an output of which the company is proud. Already the new Morrison battery has met with marked appreciation in train-lighting service, for the Universal company states that a number of trains throughout the United States have been equipped and are now running with this battery exclusively. In the majority of instances the battery is the sole source of electric light on the entire train. For this durable lead battery a claim of superior weight efficiency is made. The explanation of this lies largely in the fact of the advantageous distribution of the active material in the positive plate and the large surface of metal for the conduction of current.

The mechanical stoker has reached such a state of perfection as to be considered indispensable in the equipment of modern boiler plants, says the Westinghouse Machine Company, this fact being indicated by the large number of orders booked for the Roney stoker, a type of its exclusive manufacture. During the last month orders have been received for no less than 51 Roney mechanical stokers, ranging in size from 54-inch by 20-grate to 132-inch by 26-grate, the largest of the orders being that of the Pennsylvania railroad for six 132-inch by 26-grate stokers and five 100-inch by 20-grate stokers. A large order from the Ohio Hospital for Epileptics at Gallipolis, Ohio, has also been received, and others from the American Bridge Company of Ambridge, Pa.; National Tube Company of Pittsburg, Pa.; Detroit United Railway Company of Detroit, Mich.; York Engineering Company of York, Pa.; Proctor & Gamble Company of Cincinnati, Ohio; the Union Rolling Company of Cleveland, Ohio; Gulfport and Mississippi Coast Traction Company of Gulfport, Miss.; United Presbyterian Board of Publication of Pittsburg, Pa.; Indiana Boys' School of Plainfield, Ind.; Baltimore and Ohio Office Building in New York city, and the Railway Exchange Building in Chicago.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) September 19, 1905.

799,655. Dash Electric Headlight. John Kirby, Jr., Dayton, Ohio, assignor to the United States Headlight Company, Buffalo, N. Y. Application filed December 10, 1904.

An incandescent electric lamp mounted in front of a suitable reflector comprises the light for the dashboard.

799,658. Telephone Signal Apparatus. David F. Laughlin, Clyde, Kan., assignor of one-half to Franklin H. Butler, Clyde, Kan. Application filed June 13, 1905.

A pair of superposed contact members are associated with a receiver hook having its inner end arranged to form a support for the upper member, the removal of the receiver from the hook permitting the upper member to descend into engagement with the lower member. The replacing of the receiver serves to separate the members, and an electromagnetically controlled pendulum moves the upper member from the support.

799,678. Insulating Material. Dominick W. Sharkey, New York, N. Y. Application filed November 28, 1904.

An insulating material is composed of a mixture of fibrous material and the deposited waste product of the Solvay soda-ash process.

799,684. Electric Fuse. Henry N. Snyder and Lewis A. Hardison, Santa Paula, Cal. Application filed August 8, 1904.

An electric fuse comprises a tubular body having screw-threaded ends, screw caps for closing the ends, a zigzag fuse support of non-conducting material within the body, the support having a longitudinal bore therethrough and electrical conductor terminals secured upon the ends of the support.

799,704. Electric-railway Signal. Joseph Bartl, Chicago, Ill. Application filed February 26, 1904.

A continuous electric conductor and a number of discontinuous electric conductors, all disconnected and insulated from each other, extend longitudinally along railway track all independent of and separate from the track rails. A source of electric current is located upon the railway vehicle and has one pole connected with the continuous conductor only and the other pole connected with both discontinuous conductors only.

799,717. Variable-speed Driving Mechanism. Howard A. Coombs, Washington, D. C. Application filed January 30, 1905.

Combined with a driven shaft is a variable-speed electric motor. Connections from the motor to the shaft include a transmission member constructed to yield under load. A controller for the motor has connections from the member to the controller, whereby the speed of the motor is automatically governed by the load on the shaft. (See cut on next page.)

799,720. Electromagnetic Clutch. Henry H. Cutler, Milwaukee, Wis., assignor to the Arnold Magnetic Clutch Company, Milwaukee, Wis. Application filed September 22, 1902.

A clutch has a magnet member and an armature member with means for reversing the current through the coil or coils of the magnet member when it is desired to de-energize it. Means resiliently press the armature member away from the magnet member, whereby the armature is freed from the magnet when the latter is deenergized.

799,721. Multiple Switch. Henry H. Cutler, Milwaukee, Wis., assignor to the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. Application filed March 24, 1905.

Associated with a number of switches arranged in a mechanical series are a retaining mechanism for holding the switches in a closed position, and means whereby the retaining mechanism will be operative only when the last switch of the series is closed.

799,722. Portable Support for Telephone. Augustine G. Davis, Baltimore, Md. Application filed January 5, 1905.

A portable testing telephone mounted in a case is described.

799,726. Insulator. Ernest J. Foreman. Trinidad, Colo. Application filed March 16, 1905.

An insulator comprises a body portion externally threaded and having a longitudinal recess provided with a wire-receiving channel. A member engages the recess and is provided with a wire-receiving channel registering with the channel in the body portion.

799,748. Connecting Wire to Binding Posts. William Mills, Elizabeth, N. J. Application filed December 27, 1904.

A disk with a flange and a resilient washer with inwardly extending annular shoulders separated by a space are the essential parts, the washer being secured upon the flange which enters the space.

799,752. Signaling System for Railways and the Like. Claud D. McPhee, Arnprior, Canada. Application filed May 5, 1905.

Combined with a number of electrically insulated track sections are an open electric circuit in one section adapted to be closed by the wheels and axles of a train in that section and means whereby the train will be stopped if the circuit fails to be operated.

799,760. Service-meter Apparatus for Telephone Exchanges. Charles E. Scribner, Jericho, Vt., assignor to the Western Electric Company, Chicago, Ill. Application filed February 23, 1904.

A service meter comprises a registering train, an electromagnet and an armature provided with a pawl for advancing the registering train. Associated with these are a manual switch key and a detent controlled by the armature adapted to latch the switch in its actuated position, the detent being moved to release the switch in the movement of the armature.

799,780. Self-propelled Vehicle. Joseph Le Conte Davis. Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed April 9, 1904.

An electric automobile is described in which there is a differential gear, one member of which is connected to the prime mover. A driven member is connected to one outer member of the gear, and a dynamo-electric machine is connected to the other outer member. A second dynamo-electric machine is connected to and adapted to assist in driving the driven member, means being provided for connecting the machines in series and varying their relative field strengths, and means for reversing the relative connections of field and armature of the second machine.

799,790. Electromagnetic Lock for Automatic Circuit-breakers. John D. Hilliard, Jr., Glens Falls, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 17, 1902.

Combined with an automatic circuit breaker are a slow-acting coil for causing the tripping of the circuit breaker and a quick-acting coil in series with the slow-acting coil, the quick-acting coil being responsive to an excessive overload and preventing the circuit breaker from tripping.

799,805. Power-transmission Mechanism. Charles G. Simonds, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed April 8, 1904.

A series of electromagnetic clutches are adapted when selectively energized to hold any or all of the rotatable members of the transmission device stationary or to lock any or all of the members to a pinion.

799,807. Block-signal System. Henry N. Sporborg, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed April 24, 1902.

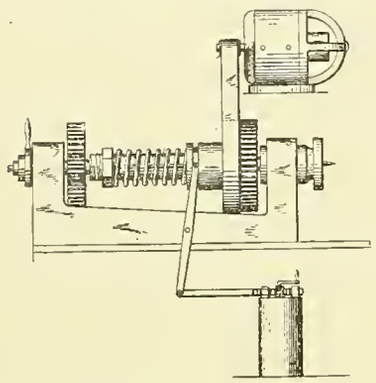
In a block-signal system are an electrically operated signal, a normally closed electrical circuit in which the signal is located, a switch in the circuit, a magnet controlling the switch, an independent normally closed electric circuit in which the actuating coil of the magnet is located and a switch in the magnet circuit adapted to be engaged and operated by a passing train to open the magnet circuit to cause the signal to move to danger position.

799,816. Block-signal System. Harold E. White, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 11, 1904.

In combination with two magnetic circuits are a movable armature adapted to be restrained when either magnetic circuit is energized and a coil mounted on one of the magnetic circuits and connected to a source of current. A second coil is arranged to be energized inductively upon a variation of current through the coil, and a third coil is mounted on the other magnetic circuit and connected in series with the second coil. (See cut.)

799,817. Telegraphic Transmitter. Richard Wolters, Düsseldorf, Germany. Application filed September 20, 1904.

In a telegraphic transmitter are combined a contact rail and a slide having a pair of oblique faces. A spring is



NO. 799,717.—VARIABLE-SPEED DRIVING MECHANISM

adapted to engage either of the faces. The slide is pivoted to a lever and a stop engages the slide, a key being pivoted to the lever.

799,851. Motor Vehicle. Ralph O. Hood, Danvers, Mass. Application filed November 11, 1904.

A combined engine and battery-driven automobile is described in the patent. An explosion engine is carried on the vehicle and has its crank shaft connected directly with the rear axle. A storage battery is also carried, and an electric motor is connected in circuit with the storage battery, gears connecting the armature of the motor with the crank shaft of the engine.

799,860. Process of Galvanizing Wire. Guy L. Meaker, Evanston, Ill., assignor to the American Steel and Wire Company of New Jersey. Application filed February 1, 1905.

The method of depositing zinc on a wire consists in continuously passing the wire as a cathode through a ferriferous zinc solution in the presence of a series of anode sections of insoluble material having a surface larger than the surface of the cathode, and conducting the current from the cathode wire at a series of distributed connection points so as to superpose upon the deposit formed at the connection points the deposit formed at points intermediate between the connection points.

799,861. Electrolytic Apparatus. Guy L. Meaker, Evanston, Ill., assignor to the American Steel and Wire Company of New Jersey. Application filed February 1, 1905.

Electrolytic apparatus comprises a series of anode sections of insoluble material and a series of interposed cathode contacts, both the anode sections and the contacts being open on their upper sides to receive a cathode wire dropped into them from above.

799,862. Process of Separating Ferriferous Zinc Compounds. Guy L. Meaker, Evanston, Ill., assignor to the American Steel and Wire Company of New Jersey. Application filed February 1, 1905.

In a process of separating ferriferous zinc compounds by rendering the iron component neutral to the electrolytic action, the method of oxidizing the electrolytic solution consists in giving the anode an active surface larger than that of the cathode.

799,887. Party-line Telephone System. Mary A. Breadheft, Indianapolis, Ind., executrix of Samuel Martin Gant, deceased, assignor to Sara O. Wilson. Application filed February 24, 1903. Renewed February 16, 1905.

In a party-line telephone system are a pair of main-line circuits and energizers and several telephones connected to both circuits. Cut-out means for each telephone, two sets of circuit changers, connections between the several circuit changers and between the circuit changers and the cut-outs of the telephones and means for energizing and deënergizing the several circuit changers are the other features.

799,896. Electric-contact Device. Robert W. Farrington, Buffalo, N. Y. Application filed September 23, 1904.

An electric contact device comprises a single rotary support, an annular series of contact shoes pivoted directly on the support and each having a tangential bearing face and a spring device operating to hold the shoes yieldingly in position on the support.

799,934. Process for Electrically Welding Rail-joints. Carl Pahde, Breslau, Germany. Application filed June 30, 1904.

The process of welding rail joints consists in securing the ends of the rails, placing about the ends iron molding forms having proper shape to fit the contour of the rails, melting parts of the rails and of the forms by means of an electric current and gradually adding metal, piece by piece, to the molten mass thus formed until the joint is completely filled.

799,957. Hanger for Cable Heads. Frank M. Winn, Des Moines, Iowa, assignor of one-half to Louis F. Doellinger, Des Moines, Iowa. Application filed November 2, 1904.

A hanger for cable heads comprises side bars having parallel portions, at one side of which the bars diverge and being at the opposite side bent to embrace the cable. A bolt engages the parallel portions and a stay is connected with the bolt.

799,973. Speed Control for Machine Tools. Nicholas D. Chard and William Lodge, Cincinnati, Ohio, assignors to the Lodge & Shipley Machine Tool Company, Cincinnati, Ohio. Application filed January 3, 1905.

A motor-driven lathe is described, the motor rheostat being actuated by a shaft parallel to the line of the carriage travel.

799,989. Outlet Box. Charles J. Klein, New York, N. Y., assignor to Ralph A. Schoenberg, New York, N. Y. Application filed September 23, 1904.

An outlet box is provided with means for holding armored conductors, a bushing device being applied to the conductors at the end of the armor of each, and means for securing the bushing device in positioo.

800,022. Train-operated Time-signal System for Railways. William B. Severance, Manchester, N. H. Application filed May 29, 1905.

An electrically-operated signaling device has normally open electric circuits, an electrically controlled time mechanism being included in certain of the circuits. Means are supplied whereby the circuits are successively closed through the wheels of a train passing across it.

800,049. Device for Coiling and Uncoiling Electrical Conductors. Henry C. Ayres, Greenville, Ohio, assignor to the Adjustable Fixture and Manufacturing Company, Greenville, Ohio. Application filed January 23, 1905.

A spring-actuated drum having a grooved circumference is adapted to take up the slack of a conductor wire.

800,050. Cord Adjuster for Holding Surplus Cord. Henry C. Ayres, Greenville, Ohio. assignor to the Adjustable Fixture and Manufacturing Company, Greenville, Ohio. Application filed January 23, 1905.

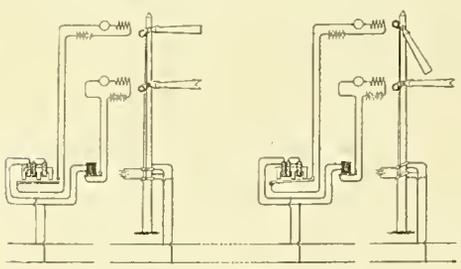
A cord adjuster for holding surplus cord comprises a strap having socket members at the ends and lugs projecting from the faces of the strap and adapted to engage the socket members, thus forming two loops for the reception of the cord.

800,051. Adjustable Electrolier. Henry C. Ayres, Greenville, Ohio, assignor to the Adjustable Fixture and Manufacturing Company, Greenville, Ohio. Application filed March 13, 1905.

A device is described in the patent by means of which an electrolier may be raised and lowered, the slack in the conductor being taken up by a spring-actuated drum.

800,052. Conduit for Electric Wiring. Henry C. Ayres, Greenville, Ohio, assignor to the Adjustable Fixture and Manufacturing Company of Greenville, Ohio. Application filed March 13, 1905.

A conduit for electric wiring comprises an angular metallic casing, with apertures, oppositely disposed, adjacent to the longitudinal edges in the sides of the casing. Rectangular-outlined cross pieces having contracted projecting portions forming angles with the ends of the cross pieces, the projecting portions being adapted to engage the apertures.



NO. 799,816.—BLOCK-SIGNAL SYSTEM.

800,053. Angular Conduit for Electrical Wiring. Henry C. Ayres, Greenville, Ohio, assignor to the Adjustable Fixture and Manufacturing Company, Greenville, Ohio. Application filed March 13, 1905.

An angular conduit for electric wiring having an opening in the inclined face is provided with marginal edges at opening into the conduit which are bent in opposite directions forming hook-shaped portions. A cover of resilient material substantially S-shaped in cross-section is adapted to engage the hook-shaped portions, and form a symmetrical closure for the conduit.

800,054. Conduit for Electrical Conductors. Henry C. Ayres, Greenville, Ohio, assignor to the Adjustable Fixture and Manufacturing Company, Greenville, Ohio. Application filed March 13, 1905.

A metallic conduit for electric wiring, comprises a casing open upon one side and having flanges spaced apart upon the outer faces of the side of the conduit. A cover, having its opposite longitudinal edges turned into rolls is adapted to engage the flanges, portions of one of the rolls being slitted and bent over the flanges upon one side of the conduit, and the space intermediate the opposite longitudinal curved edges of the cover being adapted to fit between the two walls of the conduit and form a support for conductor wires.

800,055. Cover for Electrical Conduits. Henry C. Ayres, Greenville, Ohio, assignor to the Adjustable Fixture and Manufacturing Company, Greenville, Ohio. Application filed March 13, 1905.

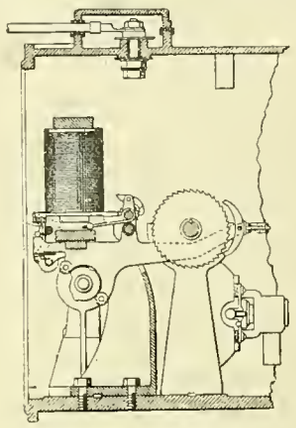
Details are described.

800,084. Electric Water Heater. William C. Dice, Seattle, Wash., assignor to the Climax Electric Heater and Manufacturing Company, Seattle, Wash. Application filed December 6, 1904.

A core formed with a longitudinal opening has a socket in one end. A coil is wound on the core, and connecting wires lead from the coil to the socket, one of the wires extending through the opening of the core.

800,114. Regulator for Electric Currents. Patrick Kennedy, New York, N. Y., assignor to the Consolidated Railway Electric Light and Equipment Company. Application filed November 12, 1904.

Combined with a dynamo are a circuit fed by the dynamo, and a rheostat in the circuit. Means regulate the current supplied to the circuit, the means comprising an electromagnet in the circuit. The magnet armature is carried by a lever, a spring antagonizing the pull of the magnet on its armature. Ratchet mechanism, controlled by the lever, actuates the arm of the rheostat, the direction of the movements of the rheostat arm being governed by the distance of the armature from the pole of the magnet. (See cut.)



NO. 800,114.—CURRENT REGULATOR.

800,117. Electrical Indicator. Hermann Lemp, Lynn, Mass., assignor to Elihu Thomson, Swampscott, Mass. Application filed May 5, 1903.

Associated with a steam-generating system for self-propelled vehicles is an electric indicating device which is sensitive to temperature variations of the steam delivered from the boiler. The device includes a switch controlled from the vehicle seat which in one position indicates high temperature of the steam and in the other position indicates low temperature.

800,118. Control of Automobiles. Hermann Lemp, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Original application filed January 14, 1904. Divided and this application filed January 13, 1905.

The method of stopping a self-propelled vehicle deriving its motive power from an electric generator driven by a prime mover consists in reducing the speed of the prime mover below the critical speed of the generator without stopping the prime mover.

800,119. Coherer. Walter W. Massie, Providence, R. I. Application filed March 27, 1905.

Combined with two supports are a bridge removably clamped to the supports and a coherer involving a filings-containing cup and a needle carrier. The filings-containing cup is connected with the bridge, a conducting strip having a notch to receive the needle carrier. A terminal to which the conducting strip is connected is also provided, one of the supports also constituting a terminal.

800,128. Grid or Element for Secondary Batteries. William Gardiner, Chicago, Ill., assignor to the Universal Electric Storage Battery Company. Application filed August 22, 1904.

An electrode for accumulators comprises a thin sheet of relatively pure lead provided with a number of closely arranged apertures extending therethrough, the sheet being folded transversely into a number of folds the walls of which are curved oppositely, forming single pockets. The adjacent edges are forced into close contact and integrally connected at a number of points intermediate the lateral edges of the sheet.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on September 25, 1905:

389,870. Registering Meter for Electric Currents. J. D. Bishop, San Francisco, Cal.
389,876. Electric Motor. P. Dichl, Elizabeth, N. J.
389,882. Secondary Battery. C. A. Faure, New York, N. Y.
389,883. Telegraphy. S. D. Field, Yonkers, N. Y.
389,888. Electric Incandescent Lamp and Attachments. I. W. Heysinger, Philadelphia, Pa.
389,894. Dynamo Armature. W. G. Meyers, Philadelphia, Pa.
389,928. Dynamometrical Governor. J. A. Hurdle and A. W. Steiger, New York, N. Y.
389,935. Electrical Storage System. W. H. McDonald, Albany, N. Y.
389,943. Electrical Conductor and Insulating Conduit. R. F. Silliman, Troy, N. Y.
389,974. System for the Distribution of Electric Energy. G. Pfannkuche, Exeter, N. H., and A. Pfannkuche, Cleveland, Ohio.
390,058. Telephonic, Telegraphic and Signaling Circuit. E. I. Bermheim, Paris, France.
390,067. Galvanometer. I. W. Crisholm, New Concord, Ohio.
390,101. Electric Testing Device for Card Flats. E. Tweedale, Accrington, County of Lancaster, England.
390,113. Electric Testing Device for Carding Machines. J. Bullough, Accrington, County of Lancaster, England.
390,115. Electric Current Indicator. P. B. Delany, New York, N. Y.
390,180. Dynamo-electric Machine. W. Mather and E. Hopkinson, Manchester, County of Lancaster, and J. Hopkinson, Westminster, England.

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The Practical Operation of a Modern Railway Sub-station.

By Sydney W. Ashe.

Part II.

Precautions to be Observed when Connecting a Rotary in Synchronism to the Direct-current Bus.

When a rotary has been synchronized and is about to receive its load, the following precautions should be taken: The polarity and voltage of the direct-current brushes should be tested with a voltmeter to see that the machine voltage corresponds to the direct-current voltage of the bus, and also to see that the polarity has not become reversed. The field rheostat should then be adjusted so that when the rotary is connected to the direct-current bus it will take a minimum load. This is readily accomplished by having most of the field resistance in the circuit. If the proper field resistance is not in the circuit, the voltage of the rotary will be slightly lower than the bus, and when the positive rotary switch is closed, connecting the machine to the bus, a sudden rush of current will enter the machine from the direct-current side, and the reverse-current relay will trip the direct-current circuit-breaker.

With a 1,500-kilowatt machine the proper time to throw the load upon the machine is when the individual load on the rotaries operating in the same station is about two-thirds full load. If the individual load is greater than this, the rotary being placed upon the circuit is liable to take such a heavy share of the load as to trip its oil switch, throwing the machine out of step. When a rotary has been stationary for some time its field resistance changes quite perceptibly. This is quite noticeable when the machine has been operating a few hours and has had time to warm up.

Load Adjustment.

Each rotary is usually provided with its individual set of instruments, consisting of a direct-current ammeter, a recording wattmeter, an indicating wattmeter, a power-factor meter and an alternating-current ammeter. The last-named instrument is seldom used by the station operator.

The power-factor meter is of primary importance to the operator. With this instrument in view, the individual load on the rotary may be adjusted by the field rheostat, so that the rotary may have a lagging or a leading current. The machine should have unity power factor at full load. If the rotary be not in proper condition, and it is desirable to shift some of the load to the other rotaries, the field of the rotary is weakened by cutting in more resistance. This is not considered good practice, as rotaries now built by the large companies are fully capable of standing temporary overloads, providing their maintenance is good. They should, therefore, always be in the best possible condition when operating.

When a rotary is to be disconnected from the direct-current bus it is good practice each time to try the reverse-current relay. The field rheostat of the rotary should be cut in entirely, the rotary dropping its load, and when there is sufficient difference in the machine and bus voltage the reverse-current relay should trip the direct-current circuit-breaker controlling the machine. The reverse-current relays are usually mounted on the rear of the circuit-breaker panel. They consist of a soft-iron shell almost surrounding the positive feeder. This shell terminates in two poles, between which moves an armature whose motion is limited. This armature is energized by the local storage-battery circuit previously mentioned. When the current in the feeder reverses, it magnetizes the iron core in the opposite direction, turning the armature, which, through a slender arm attached, closes the battery circuit through the tripping coil of the circuit-breaker, which opens instantly. It is a very easy matter to break the flexible connections of a reverse-current relay when the relay is exposed. Operators while dusting behind the operating board may strike the terminals with the duster, rupturing the contact wires. This has happened several times to the writer's knowledge.

It is desirable to use plenty of time when disconnecting a rotary from the bus. When the field rheostat has been cut in and the reverse-current relay has tripped the direct-current machine bus circuit-breaker, it is wise to allow the rotary to operate on the alternating-current side as a synchronous motor for about five minutes. Where railway circuits are operating heavy interurban trains the fluctuations of power consumption are sometimes quite heavy. If these fluctuations should occur while a machine is being "cut out," the load might be too heavy for the remaining machines, and, as a result, trip all the circuit-breakers, putting out the station.

When the rotary about to be disconnected from the alternating-current mains is operating as a synchronous motor it is an easy matter to close the direct-current circuit-breaker and switch, allowing it to carry the overload in the above-mentioned case, whereas if the machine were out of synchronism, resulting from tripping the oil switch, it would take at least a minute and one-half to get the machine on the bus again. As a result the time-limit overload relays set only for a few seconds would trip the other machines out, shutting down the station. Caution: Never close a circuit-breaker with its switch closed, and never open a switch without first tripping the breaker.

There is another possibility of trouble worth mentioning. Assume three rotaries feeding the direct-current bus, and also imagine the load has fallen to such a point that the operator feels confident that two machines will carry the load. He decides which machine to take off the bus, and cuts in all of its field resistance, expecting the reverse-current relay to trip the machine circuit-breaker. Suppose the conditions are such that the relay does not trip the breaker and in the excitement the operator trips out the circuit-breaker on one of the

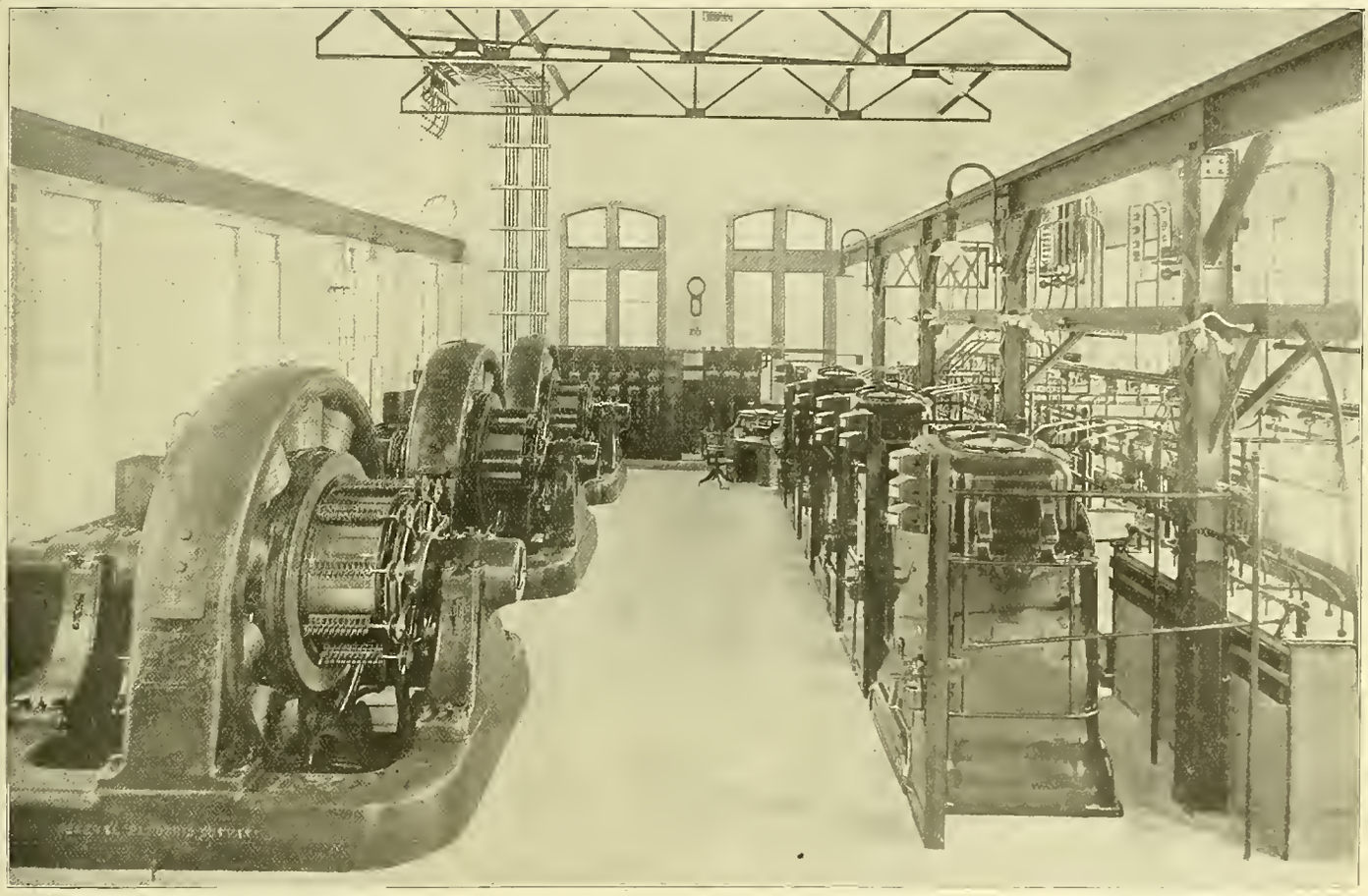


FIG. 8. BROCKTON (MASS.) SUB-STATION OF OLD COLONY STREET RAILWAY COMPANY.

remaining machines in preference to the machine whose field resistance is "cut in." This would throw the entire load on the remaining machine, which would be carrying anywhere from 100 to 125 per cent. overload, and probably with a small fluctuation happening at this time, putting the station out.

There are many such slight mistakes which will throw out a station, and it requires a cool head and quick action on the part of the operator to know what to do on such occasions. This only

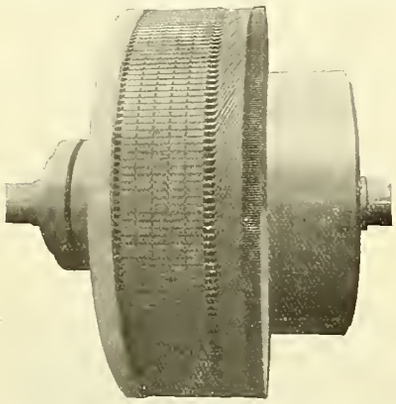


FIG. 9. ARMATURE OF 1,500-KILOWATT ROTARY.

comes after the operator has had considerable experience in watching other operator's troubles and making a careful study of what to do in case the inevitable happens.

A good method is to ask yourself questions. For example, "What will happen if I open this five-point switch when I have made the first contact and the rotary is just beginning to rotate?" Answer: "The current interrupted will be about from 400 to 500 amperes, and there would probably be little remaining of the operator's switch."

Similar questions with different answers would be: What would happen if the wrong oil switch was tripped? if the field circuit was opened when rotary was connected to the alternating-current mains? if the rotary was compounded feeding the direct-current bus, and the alternating-current oil switch was tripped? if the rotary was operating alone and the field switch was thrown over to the starting set operating in preference to the switch of a rotary just starting?

There are many such questions, each with its interesting answer. However, it is a bad policy in solving the question to try the experiment and see what will happen, for sometimes protective devices refuse to protect, in which case the experiment may prove dear to the operator.

Fig. 8 is a view of the Brockton sub-station in Massachusetts, in which both rotaries, transformers and operating board are on one floor. This view is interesting in that it shows how a station may be arranged so that one operator at a time could take care of the entire station, dispensing

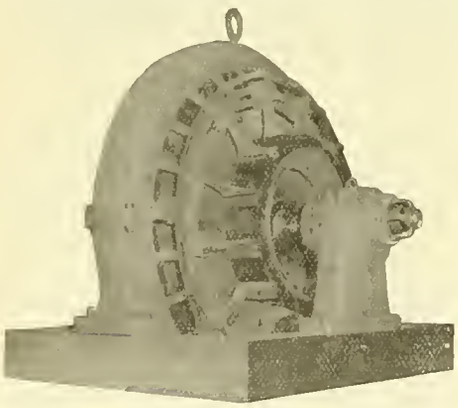


FIG. 10. COMMUTATOR END OF 1,500-KILOWATT ROTARY.

with the service of a rotary tender. This station is furnished largely with General Electric apparatus.

Maintenance of a Rotary Converter.

The successful performance of a rotary converter under various conditions of load depends almost entirely upon the amount of care bestowed upon the direct-current brushes. The writer has had occasion to study for several months the operation of 1,500-kilowatt rotaries built by the Westinghouse Electric and Manufacturing Company. The result of these observations has proved conclusively that these machines, where their maintenance is good, will readily stand overloads as high as 100 per cent. for a short interval without the slightest signs of distress. After carrying an overload of 25 per cent. for several hours (fluctuating load) the temperature was never higher than 40° C. If, however, the brushes are not maintained in good condition and likewise the commutator surface, the inability of the machines to carry severe overloads is quite marked. This, however, applies to all forms of commutating apparatus. To obtain efficient service from a rotary the following conditions should be observed:

Conditions for Efficient Operation.

1. At moderate intervals use a piece of sandstone on commutator so that it is bright, smooth and free from burnt commutator segments. Sandstoning a commutator requires from three to six hours' effort, depending upon its condition.

2. Every three days go over direct-current brushes, wiping off copper dust, sandpapering brushes that are burned in any way and which do not bear on the commutator over the whole brush surface. About one-third of the brushes will have to be sandpapered each time.

3. With the same frequency go over alternating-current brushes, drawing a rag under them several times, so that the brushes will snap back in place, shaking out the dust. About once a month it will be necessary to take off the alternating-current brushes, cleaning them thoroughly, clipping off bad ends and filing off any uneven wear. If alter-

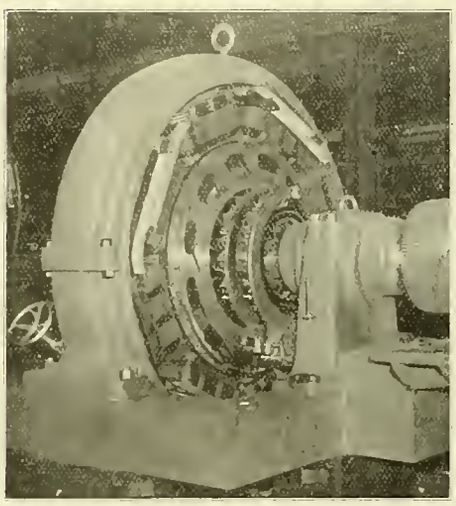


FIG. 11. SLIP-RING END OF 1,500-KILOWATT ROTARY.

nating-current rings need sandpapering, wait until the machine, if operating, is cut out and has slowed down to about half speed. Then apply sandpaper, pressing it against the slip ring with a flat piece of wood.

4. Never under any circumstances apply sandpaper to the slip rings of a rotary operating on the line. The sandpaper, covered with metallic dust, is liable to come into contact with two of the rings, forming a short circuit.

5. Keep machine clean and free from metallic dust by frequently applying compressed air and clean rags.

6. If machine sparks when commutator is in prime condition and likewise direct-current brushes are properly maintained, look to tension of brushes. This should be about 2.5 pounds. Under some conditions, such as when brushes chatter under load, it is necessary to apply a little more tension. If brushes do not all have the same tension, one or two brushes may carry the entire load of a rocker-arm, sparking quite viciously.

7. See that the rocker-arm is placed so that sparking will be a minimum at normal load. Also note that rocker-arms are placed equidistantly. These conditions are usually looked after by the manufacturing companies when machines are first installed.

8. When machine is operating, occasionally wipe off the commutator and slip rings with rags slightly moistened with oil. After which wipe off again with dry rags. Do not use any more oil than is absolutely necessary on the commutator. Slip rings should be oiled more frequently than the commutator. Under normal load about hourly intervals will be sufficient application.

9. When a machine has been operating and is being disconnected from the service, wipe off the

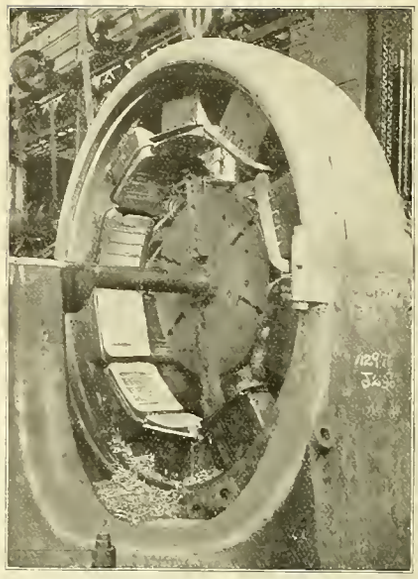


FIG. 12. METHOD OF FACING POLE GRIDS AS PROTECTION AGAINST HUNTING.

commutator and slip rings so that oil will not coagulate.

10. Keep bearings replenished with oil and see that they do not heat excessively.

Details of Rotary.

Fig. 9 is an illustration of the armature of a Westinghouse 1,500-kilowatt rotary converter. Fig. 10 shows the commutator end of this converter, and Fig. 11 is a view from the other side showing the slip rings. Fig. 12 is interesting as exhibiting the method of truing up the pole-faces of one of these rotaries when the grids, to protect from hunting, have been mounted on the pole-faces. Fig. 13 illustrates the method of overlapping the armature terminals. When cleaning a rotary care must be taken to blow out the copper dust which lodges in these windings. This can be readily done with compressed air.

How to Sandpaper the Direct-current Brushes.

Properly to sandpaper a brush so that it will accurately fit the commutator the following method may be adopted: Two sizes of sandpaper are necessary—a coarse and a fine quality. This paper should be cut in strips about two inches in width and applied to the brush, as in Fig. 14. Usually all the brushes are removed except the one being sandpapered. Pressing the brush against the paper and keeping the paper flush with the commutator surface, it should be drawn along the commutator surface. The brush should then be raised, the paper slid back and the operation repeated. This should be continued until the brush fits the commutator accurately. Then the surface of the brush should be finished in a similar manner with fine sandpaper.

If possible a large piece of sandpaper surround-

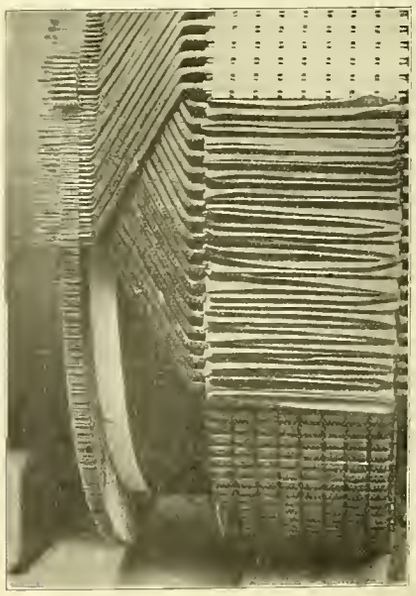


FIG. 13. OVERLAPPING ARMATURE COILS OF 1,500-KILOWATT ROTARY.

ing the commutator should be applied, all the brushes bearing on its surface. The rotary, if driven by an induction motor, could then be started in operation and the whole work done in a few minutes. This method is obviously not applicable in the case where a separate starting set is employed. The former operation may seem tedious, but it well repays itself in the increased efficiency of operation of the rotary.

CONCLUSION.

In closing the writer wishes to express his admiration for those engineers who have contributed

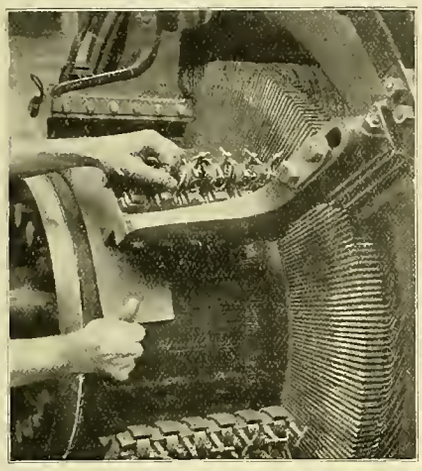


FIG. 14. METHOD OF SANDPAPERING BRUSHES.

so much to the rapid development and high efficiency of modern sub-station apparatus, and also to those engineers through whose organization the successful performance of such apparatus as a unit is made feasible.

Gas Engines for Power Stations.

The problem of the adoption of the gas engine as a prime mover is one of interest to power-station managers who are not satisfied with the low economy of the steam engine and boiler. It is true that many are skeptical of the ability of the gas engine to operate successfully in a power plant for either light or railway purposes; but the general tendency is to give serious attention to the problem as one which may be worked out in the future and which is worthy of careful study. At the meeting of the American Street and Interurban Railway Association just held in Philadelphia two papers bearing on this question, which point out clearly the present status of the gas engine, especially in relation to street-railway practice, were read. One of these papers was by J. R. Bibbins of Pittsburg upon "The Application of Gas Power to Elec-railway Work," and the other, "Notes on the Design of Large Gas Engines with Special Reference to Railway Work," was written by Arthur West of Pittsburg. Although space does not permit of giving these papers in full, extracts from them giving the latest aspects in gas-engine developments will be found interesting.

Mr. Bibbins said that he believed that he was conservative in making the statement that the future of the gas engine in its general application depends largely upon the development of a producer-gas system especially suited to the use of low-grade bituminous coal. Anthracite producers have already reached a high state of perfection, are reasonable in price, simple to operate and are usually unencumbered with much auxiliary apparatus. They do not deteriorate rapidly, and generally show an efficiency considerably higher than the best steam boiler and furnace, viz., 75 to 80 per cent.

The ideal bituminous producer is yet to come, viz., one in which the volatiles are completely converted into fixed gases without serious loss and without complication of the operating system. There are a number of makes now on the market intended to be used with bituminous coal, but when the gas is to be used in engines they are attended with special, and often complex, cleaning apparatus for the removal of suspended impurities. The efficiency of bituminous systems is also generally lower than anthracite, not only owing to the fact that some of the valuable distillates are lost but on account of the distillation of volatile matter requiring heat for its accomplishment. Present types, however, sometimes exceed 70 per cent. efficiency, which rivals that of the best boiler plant.

Passing to some of the practical points, a producer, if provided with an automatic blast control, may be made almost instantly responsive to variations in demand for gas. This is shown by the success which the suction producer has attained in small sizes; and in this respect the steam boiler is quite outclassed, owing to the more direct effect of the blast in transferring the heat content of the coal to the working medium—gas. In one type of producer possessed of this automatic feature the steam blast, and consequently the gas generated, is controlled entirely by the pressure in the delivery gas main and in inverse proportion. It combines this feature with the conservation of the sensible heat of gases leaving the producer. By this means steam is generated at a rate proportional to the demand for gas without requiring extra boiler equipment or fuel. This largely increases the producer efficiency. In some types of producer the fuel for steam amounts to as much as 15 to 20 per cent. of the total coal gasified.

The especially severe conditions of heavy railway work prescribes storage capacity at some part of the system. Owing to the limitations of gas-engine capacity, electric storage is most desirable, as it relieves the machinery of the wear and tear of it relieves the machinery of the wear and tear of fluctuating loads. There is ample precedent the world over for the use of a storage battery auxiliary in railway plants, and it should prove even more desirable in a gas-power than in a steam-power plant. In fact, gas storage is often to be desired in many plants where the gas demand varies greatly, simply as an insurance against poor gas, due to careless operation. This, however, simply relieves the gas-generating equipment, while electric storage relieves the entire station.

Maintenance expense is frequently thought to be excessive in a gas station. When this is so, faulty operation or design of the plant may be looked for. Recent data from the station at Bradford, Pa., shows what may be accomplished when the equipment is properly operated. The plant is in its seventh year of service; yet the average cost of repairs on the engines for the last two years was $92.70 per year, 11.6 cents per horsepower-year, or 0.0125 cent per kilowatt hour generated. As an example of the results secured may be mentioned the following: After six years service, averaging 18 hours per day, it is found necessary to inspect the engines only once in 12 months. This was formerly done in three months and later in six months. At each inspection a set of piston rings is replaced by new ones, whether worn out or not. Up to the present time no extensive repairs have been made on any of the engines, except a voluntary change on the builders' part, from dry to water-cooled exhaust valves. The present exhaust valves average one years working without regrinding, and even then are not in bad condition. Some valves have run 15 months. Admission valves require no attention. Igniters average about nine months without repointing. By reversing the current each day electrodeposition is entirely avoided, so that the points wear evenly.

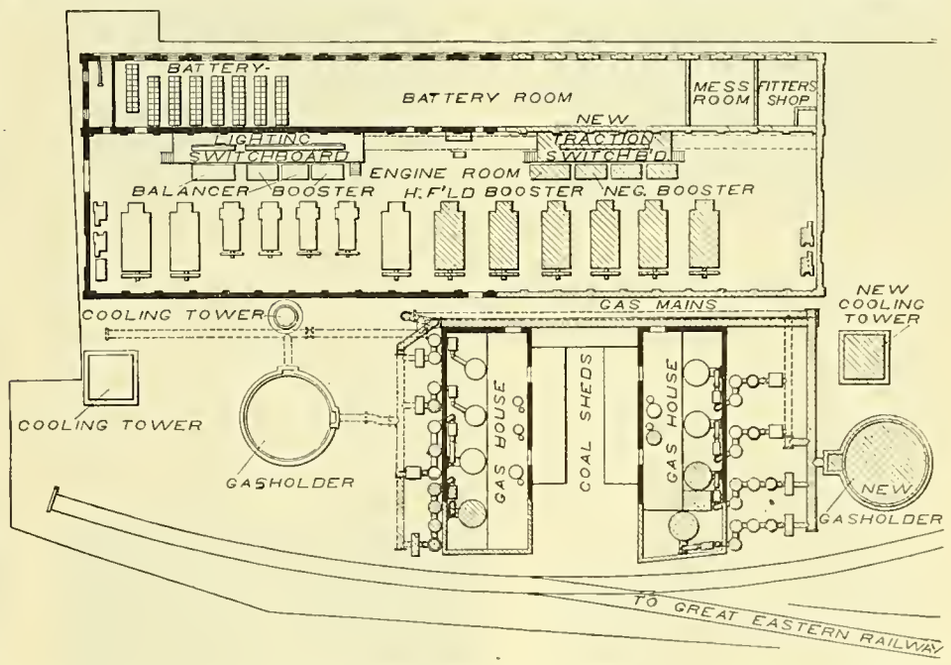
Comparative plant economy is best brought out in figures expressing the total operating cost of power. The complete returns from Walthamstow (London, England) show that with a load factor of only 15½ per cent and coal at $6.75 per ton, delivered, the total cost of generating current was 1.7 cents per kilowatt-hour; or, based upon current delivered to consumer, 2.13 cents per kilowatt-hour, the average price obtained being 7.14 cents. and the net profit nine per cent. [The accompanying illustration is a plan of this plant.] In the average borough steam plant of over three times the capacity and of higher load factor the generation cost is 2.2 cents. It is presumable that the steam plants used cheaper coal; yet with gas coal at $6.75 a ton the saving in cost of coal alone was over 38 per cent. in favor of the gas station. At this price the Walthamstow plant required throughout the year's run but slightly over two pounds of coal per kilowatt-hour generated. Of the total operating cost, fuel represented 43 per cent.; in the steam plant, 55 per cent.; repairs, five per cent. for gas and 20 per cent. for steam. The total operating cost at the Birmingham plant was 1¼ cents per kilowatt-hour, of which fuel represented 26½ per cent. and repairs 14 per cent.; this on a load factor of 43 per cent. average, and bituminous coal having 31 per cent. volatile.

At the Bradford (Pa.) station, although handicapped with old-type belted machinery, the average yearly gas consumption is less than 25 cubic feet of gas per kilowatt-hour on a 19½-per cent. load factor and a total operating cost of power of about 0.8 cent. per kilowatt-hour.

The application to railway service has in this country been limited, yet there are found abroad many evidences of successful working. A prominent European engineer reported in 1903: "Nineteen stations on tramway work, totaling 6,000 horsepower capacity. These include Barcelona, Tunis, Lausanne, St. Gallen, Poictiers, Orleans and Zurich, from 400 to 600 horsepower, each working on either producer or town gas." As a result of the excellent experience with the Walthamstow electricity station 650 horsepower has been added to the plant for operating the new tramway system recently constructed. At Buenos Ayres, South America, two plants, aggregating 2,240 horsepower, are at work for the Buenos Ayres, Great Western and Great Southern railways. Both use Mond gas.

But eclipsing in interest probably all former gas-power railway undertakings is that of the Warren and Jamestown railway system, now under construction. This plant will practically inaugurate the use of the heavy-duty-type engine, in connection with single-phase railway systems in America.

The new engine equipment, now nearing completion, consists of two 500-horsepower Westinghouse double-acting engines of the horizontal tandem type, each direct-connected to a 260-kilowatt alternating-current engine-type generator. These engines are both of the single-crank type, but with the tandem arrangement, a power stroke is developed at each half revolution, as in the double-acting steam engine. The gas units will operate in parallel on the electrical end, without the necessity of synchronizing the cranks. Owing to the absence of battery and the small number of cars, the plant will be subjected to the most severe tests possible. It is estimated that one generating unit will take care of the present maximum demand with two cars starting and two running.



PLAN OF WALTHAMSTOW GAS POWER STATION.

Natural-gas fuel is entirely used in this territory, and at the present price and heat value will correspond with producer gas delivered at a cost of two cents per thousand cubic feet. The economy in operating with natural gas is striking. In the old gas plant it is estimated that the cost of power average 0.75 cent per kilowatt-hour, including all items chargeable to operation, except repairs on building and battery, the corresponding gas consumption being 20 cubic feet per kilowatt-hour.

The Warren and Jamestown railway is a high-speed interurban road, approximately 21 miles in length, operating over a comparatively level and straight right-of-way between Warren, Pa., and Jamestown, N. Y., at the southern end of Lake Chautauqua. The population of the territory traversed is estimated at 50,000, with 11,000 tributary, not including a large summer population at the various lake resorts. Heavy high-speed cars will be used, approximately 52 feet over all, and with a

normal seating capacity of 54 persons, each car being equipped with four alternating-current 50-horsepower motors on 33-inch wheels. Four cars will be operated at present, with two additional cars later on.

Power will be generated at the power house now operated by the Warren street railway, at Stoneham, four miles south of the city. For some time gas engines of the vertical single-acting type have been used for operating the present city railway system, and it is due to the general successful experience from gas power that gas engines will be used for operating the interurban road.

A noteworthy feature of the new interurban system is that Westinghouse single-phase apparatus is used throughout, with 22,000-volt transmission and 3,300 volts on the trolley, which is of the Westinghouse catenary construction. A step-up transformer station is located at the power house and two step-down sub-stations about one mile distant from both Warren and Jamestown. These equipments contain transforming, switching and protective apparatus alone. As no direct current is used upon the system, it is impracticable to employ storage batteries, so that the generating equipment will thus be required to sustain at all times the entire demand. In the present city system a 150-ampere-hour (one-hour rating) storage battery is in use, which is kept floating on the line throughout the load fluctuations, to the relief of the gas-engine equipment. In the new plant the gas engines must sustain both load and fluctuations without assistance. Each unit complete of the new equipment occupies a floor space of 20 by 47½ feet, allowing four to five-foot passageways, which is equivalent to 3.65 square feet per kilowatt, or 1.9 square feet per horsepower capacity.

Practical features of the design and operation of gas engines were taken up in Mr. West's paper. It is his belief that one of the most important considerations in the design of large gas engines is the arrangement of the cylinders. In a single-cylinder single-acting four-cycle engine an explosion takes place once in every two revolutions. In order, therefore, to get the same rotative effect as with a double-acting steam cylinder, it is necessary to work four single-acting cylinders on the shaft or two double-acting gas cylinders tandem on one crank pin. With this arrangement four explosions are obtained in two revolutions, or an explosion every 180 degrees of crank angle. In case of a misfire or premature ignition due to bad gas, the crank can only move one-half turn before another explosion takes place. In a single-cylinder single-acting engine the crank must move two whole turns before the next explosion, while with two single-acting cylinders opposed to each other, or one double-acting cylinder, the crank may be required to move 1½ turns before the next explosion.

The European designer of gas engines has allowed himself an amount of complication in valve gear which would not be permissible under American operating conditions. The successful American machine must be as nearly "fool-proof" as the large Corliss engine. If it is not, it will fail to be a success from the purchaser's point of view—no matter what thermal efficiency may be claimed by the builders—as a consequence of such complication as the European engineers have been prone to adopt. In the designing of valve gear for large gas engines wide range of quality of gases must be considered. In this respect the design of the gas engine is very different from that of a steam engine, inasmuch as the steam used has practically constant characteristics, differing only in such minor points as pressure and superheat. With the different kinds of gas to be met with, however, the proportions of air and gas, and sometimes of compression, are radically different, and no gear can hope to be a universal success which does not provide for meeting the widely varying conditions to be encountered in the market.

There is an impression rather prevalent that a gas engine is uncertain and hard to start. A properly designed engine, supplied with fairly decent gas, can be started as easily as a steam engine. Large Westinghouse horizontal gas engines are started by means of compressed air, the only operations required being, (1) open the main gas valve; (2) close the igniter circuit; (3) open one compressed-air valve; similar in construction to an engine throttle. The compressed air puts the engine in motion, which draws the charge into the cylinders and compresses the same, after which the first explosion takes place. Air is shut off and the engine is in full operation. No more difficulty is experienced in starting gas engines than a steam engine.

With certain kinds of gas, inspection of the interior parts of the cylinders is often desirable at regular intervals of, say, a couple of months. This is especially the case with blast-furnace gas, and also with producer gas made from certain kinds of fuel. Particular pains has been taken to arrange the cylinders so that no parts of the valve gear or valves are below the floor. The inlet valves being located directly on the top of the cylinder, easy access can be had to either end of either cylinder by removing the inlet bonnets. The exhaust valves are also a part of the engine which need occasional attention for regrinding. Especial care has been taken to render these quite easily removable. The cylinders are, therefore, directly accessible from the top through the inlet openings and from the bottom through the exhaust openings. The fact that all the valve parts are entirely above the floor line renders these operations much easier than if a large part of the valve gear extended downward into foundation parts. It is not necessary to remove the cylinder heads, except to examine the piston rings themselves, which is not often required. Inasmuch as clean gas cannot always be secured, the importance of such easy entrance to the gas cylinders cannot be overestimated.

Effect on Atmospheric Electricity of Eruption of Mount Pelée.

At the Sloane Physical Laboratory at New Haven, Conn., observations of the phenomena of atmospheric electricity are among the daily exercises of the students attending the institution, the work being generally taken up during the months of April, May and June. Prof. Arthur W. Wright, in an article in the Monthly Weather Review, describes the results of the laboratory observations of several students on May 8 and 9, 1902, the day of and the day following the eruption of Mount Pelée in the West Indies. The students assigned to the work on those days preserved the records of their observations, which were plotted in the form of curves and show some remarkable results.

Fig. 1 represents the observations of May 8, 1902, as made by Frank J. Sladen and Norman C. Thorne of the class of 1902. The curve does not show very marked deviation from the normal or the average of those generally observed, except that the changes are somewhat more rapid and abrupt than usual.

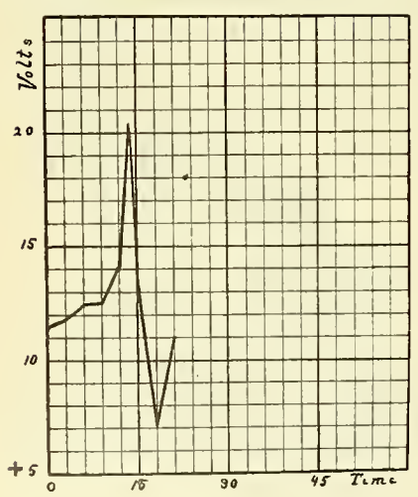


Fig. 1. Observation of Atmospheric Potential on May 8, 1902.

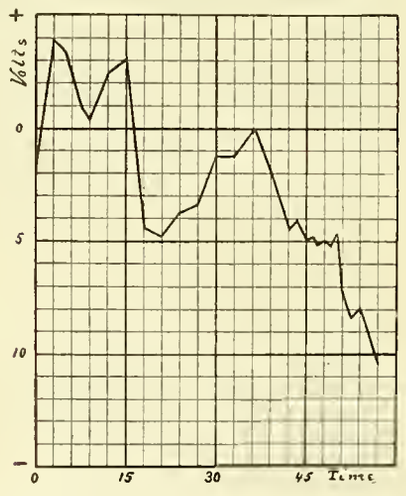


Fig. 2. Observation of Atmospheric Potential on May 9, 1902.

EFFECT ON ATMOSPHERIC ELECTRICITY OF ERUPTION OF MOUNT PELÉE.

The curve shown in Fig. 2 was drawn from observations made by W. W. Duncan of the same class on the morning of May 9, 1902, the day following the eruption. This curve is remarkable from the fact that it indicates a considerable negative potential for the greater part of the observation. This is more unusual for the reason that the atmosphere was perfectly clear and there were no signs whatever of thunderstorms. During the last 20 years that observations have been carried on the atmosphere has uniformly shown a positive charge in fair weather, except, perhaps, a mere momentary dipping below the zero line in a few instances. Strong and sustained negative potential had never before been observed except on occasions of heavy rain or snowfall. The result obtained on the morning of May 9th was so striking and unusual that several observations were made later in the day. The potential remained strongly negative during most of the afternoon, though apparently diminishing slowly. The next day it was found to be positive again and did not depart from the normal conditions. Another peculiarity of the record of May 9th is the vacillating character of the charge observed, the larger excursions of the curve having superposed upon them a number of small and rather rapid fluctuations, whereas, in general, the variation of potential occurs gradually and rather slowly.

These results appear to indicate an abnormal electrical condition of the atmosphere, and the influence of some energetic disturbing agency. It seems not at all improbable that the immense volumes of gas and other eruptive products ejected from the crater of the volcano, and which were manifestly the seat of intense electrical charges, may have made their influence felt, gradually and progressively, at great distances from their point of origin, and so have produced a widespread disturbance of the electrical condition of the atmosphere. This would naturally accord with the absence of any immediate and radical departure from the normal in the observation of May 8th, made within about two hours after the great eruption, the minor peculiarities observed being such as might be due simply to inductive effects at a distance.

Death of William B. Rankine.

William Birch Rankine of Niagara Falls, N. Y., second vice-president of the Niagara Falls Power Company, died in Franconia, N. H., at 1:30 o'clock on the morning of Saturday, September 30th, after an illness of a few days. Accompanied by Mrs. Rankine, Mr. Rankine went to the White Mountains on August 12th for a vacation and rest.

WILLIAM BIRCH RANKINE.

During the latter part of September he contracted a severe cold, which developed congestion of the lungs, which, with a weak heart, caused death.

Mr. Rankine was born in Owego, Tioga County, N. Y., January 4, 1858. He was educated at Hobart College, Geneva, N. Y., and Union College, Schenectady, N. Y., graduating from the latter in the class of '77 with the degree of A. B., and later receiving the degree of A. M. from both colleges. He was a son of the late Rev. James Rankine, D. D., LL. D., of Geneva, N. Y. He selected the law as his field of labor, and was admitted to the bar in 1880. He practiced for a short time in Niagara Falls, N. Y., going from there to New York, where he was most successful. When the ambition grew to develop the power of the Falls of Niagara, the men who became interested in the early plans sought out Mr. Rankine in New York city and asked his assistance in securing capital for the development. This was along in the '80's. Mr. Rankine became very much interested in the scheme, and with his assistance capital was secured and the work of the Niagara Falls Power Company begun. This great development, together with the allied industries, had, since 1890, commanded Mr. Rankine's full attention. In fact, it was the work of his most vigorous years, and it resulted in his making his home in Niagara Falls as second vice-president and treasurer of the Niag-

ara Falls Power Company. He held similar offices with the Niagara Junction Railway Company and the Niagara Development Company. He was vice-president of the Canadian Niagara Power Company and of the Francis Hook and Eye and Fastener Company; he was secretary and treasurer of the Cataract Power and Conduit Company, director and chairman of the executive committee of the Natural Food Company of Niagara Falls, director of the Tonawanda Power Company and of the Suburban Power Company, secretary of the Tesla Company, director of the Bell Telephone Company of Buffalo, of the Ramapo Iron Works, the Niagara Tachometer and Instrument Company and of the Niagara Research Laboratories, a trustee of the Equitable Trust Company of New York, a trustee of De Veaux College, Niagara Falls, a life trustee of Union College, a member of the Buffalo Club of Buffalo and of the University, Metropolitan, Lawyers' and Alpha Delta Phi clubs of New York city, a member of the New York State Bar Association and of the Bar Association of New York city.

On the 23d of last February he was married to Miss Annette Kittridge Norton, daughter of Mrs. E. K. Norton of Niagara Falls. Mrs. Rankine, his brother, deLancey Rankine, and other relatives were with him when the end came. His mother, Mrs. James Rankine, lives in Geneva, N. Y., and in addition he is survived by three brothers, Richard and Harold of Buffalo and deLancey, of Niagara Falls.

Ever since he became interested in the development of the power of the Falls of Niagara Mr. Rankine had been a material factor in the upbuilding of the industries of Western New York. He was a man of pleasing personality, beautiful character and fine integrity. At home and abroad he was highly esteemed by many prominent people. The death of no man could be felt to such an extent in the Niagara locality. It is recognized that Niagara owes a great deal to his efforts. He was a man of great executive ability, and Niagara bows in tribute to his memory, sorrowing deeply that a life of such value, such usefulness should have been closed so early.

Mr. Rankine informed himself to a remarkable extent in electrical engineering, and he was an authority on practical power-transmission work. Electrical engineers from all parts of the world had been received and entertained by him at Niagara, so that the sorrow of his death will be widespread. The lamented McKinley, President Roosevelt, as well as royal personages from England and other countries, had enjoyed his hospitality. He was a Christian gentleman, and prominent in the work of the Y. M. C. A. at Niagara.

At a special meeting of the Common Council of Niagara Falls, held last Saturday night, the flags on the city buildings were ordered at half mast for a period of 30 days; all city offices were directed to be closed on the day of the funeral and a committee was appointed to prepare suitable resolutions expressing the sorrow of the city of Niagara Falls over Mr. Rankine's death.

The funeral was held from St. Peter's Church, Niagara Falls, Tuesday morning, October 3d, at 11 o'clock.

Edward D. Adams, Victor Morawetz, Francis Lynde Stetson and Edward A. Wickes of New York attended the funeral, representing the boards of directors of the Niagara Falls Power Company and allied companies. Two special trolley cars brought friends from Buffalo, while many others were present from Toronto and other cities.

The honorary bearers were Philip P. Barton, Harold W. Buck, W. Paxton Little, F. L. Lovelace, A. H. Van Cleve and Edmund S. Wheeler, while the active bearers were Hjalmar Anderson, George M. Harrington, J. A. Johnson, A. W. Pierson, D. S. Porter, W. D. Robbins, F. U. Wilcox, R. V. Rose, H. A. Smith and F. S. Wheeler, all employes of the Niagara Falls Power Company.

Philadelphia Street Lighting.

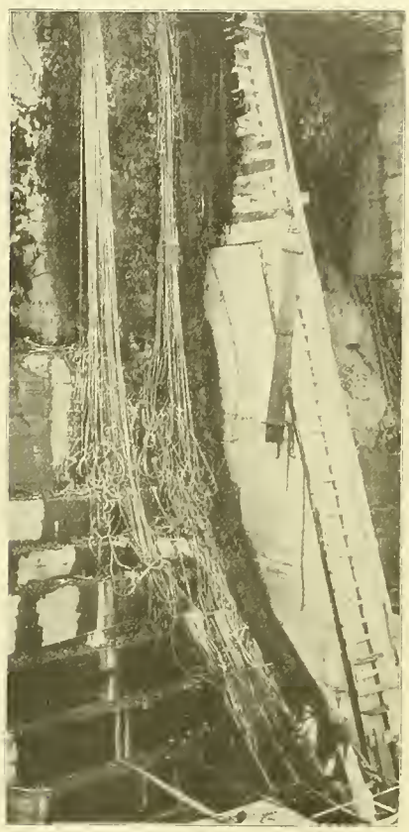
Following a careful review of the situation in conference with his advisory board Mayor Weaver of Philadelphia has decided to award to the Philadelphia Electric Company—the only bidder—the contract for city electric lighting next year at an average price of $99 a lamp. In deciding to make the award the mayor said that he was not satisfied with the bids, but recognized the impossibility of obtaining lower prices in the existing situation. Next year, he hopes, conditions will be different, and for 1907 prices to be paid by the city will probably be as low as can be obtained. According to estimates of the electric bureau the city's lighting at the rate in the bid will cost next year $1,073,271.55. This means a saving of $118,205.45 on the basis of prices for this year. The city's expenditure for electric lighting in 1905 will be $1,135,508. The estimate of the electric bureau made for 1906 was $1,191,477.

Cable Fire on High Bank at Niagara Falls.

By Orrin E. Dunlap.

About eight o'clock on the night of Saturday, September 9th, a short-circuit occurred on the insulated cables of the Pittsburg Reduction Company between the power station of the Niagara Falls (N. Y.) Hydraulic Power and Manufacturing Company and the aluminum plant on top of the bank. The cables were of 500,000 circular mils and carried about 16,000 horsepower at 300 volts. They ran from the plant of the Pittsburg Reduction Company through the gatehouse of the Niagara Falls Hydraulic Power and Manufacturing Company to the reduction company's bus bars at the base of the cliff and carried current from generators owned by the Pittsburg Reduction Company, which company buys mechanical horsepower from the Niagara Falls Hydraulic Power and Manufacturing Company. There were about 60 cables in each leg of the service. Twelve of the cables were aluminum, the others being copper.

The Cables as they Appeared Before the Fire.



The Cables After the Fire.

CABLE FIRE ON HIGH BANK AT NIAGARA FALLS.

CABLE FIRE AS SEEN FROM CANADIAN SIDE.

The fire was first discovered at the base of the cliff, but the exact cause of the short-circuit is not known. The insulation burned very rapidly, following the cables up the face of the cliff to the gatehouse in the rear of the aluminum works. Except for the roof boards and a little other wood this gatehouse was of corrugated iron, which the intense heat injured. The wire tower and the conduits of the Niagara Falls Hydraulic Power and Manufacturing Company were not injured. The insulated cables stopped under the gatehouse. There was another line parallel with the one destroyed, but this was uninjured, except some of the line connections at the top. Owing to the proximity of the high-tension cables to the fire, power was taken off temporarily in order to safeguard the firemen, who had been called by the ringing in of a general alarm in order that the factories of the district might have ample protection. A large part of the incandescent lighting of the city is supplied from this power station, and this service was temporarily cut off. All power delivered direct to customers by the Niagara Falls Hydraulic Power and Manufacturing Company was resumed after the firemen had left. It is seldom that electrical engineers have the pleasure of viewing reproductions of photographs showing not only the "before and after" period, but the scene of the actual fire on cables so notable as those on the cliff at Niagara.

Berlin Electrical Workers' Strike.

News comes from Berlin under date of October 2d that the negotiations between the electrical manufacturing companies of Berlin and their employes for higher wages have been broken off and that a general strike in the works has been ordered. There are many thousands of men employed in the industry in Berlin. Some of the employes of the electric power and lighting plants of the city are said to have gone on a sympathetic strike, tying up half the street cars and making it necessary for the municipal government to order 50 engineers from the fire companies to the various power houses. Applications are said to have been made by the companies affected to the minister of war for temporary details of engineers and stokers from among the trained workers in the army. The war ministry has declined to issue an order announcing to discharged soldiers, about 200,000 of whom have served out their term, that engineers and stokers can find employment with the electric companies. But the army administration will offer no objection to battalion commanders giving out such notices, it is said.

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DATES AHEAD.

Railway Signal Association (annual meeting), Niagara Falls, N. Y., October 10th.

Indiana Electric Railway Association (first fall meeting), Traction Terminal Building, Indianapolis, Ind., October 12th.

Kansas Gas, Water, Electric Light and Street Railway Association (annual meeting), Mercantile Club, Kansas City, October 14th and 15th.

Ohio Society of Mechanical, Electrical and Steam Engineers (annual meeting), Canton, Ohio, November 17th and 18th.

Automobile Club of America (annual exhibition), Sixty-ninth Regiment Armory, New York City, January 13th to 20th.

Chicago electrical exhibition (first annual exhibition of Electrical Trades Exposition Company), Coliseum, Chicago, January 15th to 27th.

SUB-STATION practice has reached the distinction of being a branch of electrical engineering in itself. With the great growth of plants and systems of transmission and distribution the sub-station has acquired a dignity and importance not foreseen a few years ago, when sub-stations were comparatively small in size and few in number. The illustrated article on "The Practical Operation of a Modern Railway Sub-station," by Sydney W. Ashe, B. S., E. E., concluded in this issue, is therefore of timely interest. The author, who is well fitted for his task, enumerates the apparatus necessary for a modern interurban sub-station and then considers the local storage battery, the circuits, the rotary and methods of starting it, precautions to be observed in connecting the rotary to the direct-current bus-bar, load adjustment, maintenance of the rotary, conditions of efficient operation, and other details of his interesting and important subject. Many practical hints as well as an accurate general description are given in Mr. Ashe's article, which we are sure our readers will find of value.

THE RESISTANCE which a conductor presents to electric currents of very high frequency is supposed to be that found by certain elaborate formulas that have been worked out on a mathematical basis. Whether these theoretical results will conform to results obtained by actual experiment may be open to question. Two French investigators, Broca and Turchini, undertook some experiments to ascertain how far the actual values of resistance to high-frequency currents correspond to values calculated from Kelvin's Law. The frequencies used in these experiments ranged from 142,000 to 3.8 times 10^6, and were obtained from condenser discharges. A high-frequency dynamometer was used to obtain the high-frequency current values, the heat developed being measured by a calorimeter. A continuous current producing the same heating was then passed through the wire. The ratio of the galvanometer deflections obtained was therefore that of the resistances offered by the wire in the two cases. It was found that for the non-magnetic metals (copper and platinum) the divergences from values calculated from the formula $x = \rho\sqrt{\pi C \omega \mu}$, where μ = permeability, C = conductivity in c.g.s. units, and $\omega = 2\pi/T$, are small; for values of $x\sqrt{8}$, the heating is greater, and for $x > 8$ less, than is given by the formula. In the case of iron there was no agreement with calculated results, the figures obtained depending on the current passing. The heating was also much less than that which would correspond to normal values of μ. If μ is taken as about 100, the results are comparable with the calculated values. German silver showed similar but less marked effects. The reason for the divergence in the case of the non-magnetic metals still requires explanation.

WITH new constitution and by-laws, wider aims, permanent headquarters and a more explicit if more awkward name, the successor of the American Street Railway Association is preparing to do more and better work for its member companies through the parent organization and its important subordinate associations. The headquarters might have been located in Chicago to greater advantage than in New York, we think, but the latter city was chosen for what evidently appealed to those in charge of the movement as good reasons. If found wise in the future this particular clause in the constitution may be amended. But as to the wisdom of the general plan of modernizing and systematizing the work of the association there can be no question.

The new secretary, Prof. B. V. Swenson, has technical training and will no doubt devote his entire time to the association. He is young, industrious and enterprising. With a permanent office he should be able to collect and disseminate information of much value to the members. A word of praise should be spoken for the retiring secretary, Mr. T. C. Penington, who faithfully performed the duties of the position, as then laid down, for a number of years. Mr. Penington cannot lay aside his private duties, however, to give all his time to the association, and moreover is a street-railway executive rather than a street-railway technician. The first president of the rejuvenated association is Mr. W. Caryl Ely of Buffalo, who has already served two terms as president of the American Street Railway Association. The compliment of re-election for a third term is unusual but well merited, for Mr. Ely has taken great interest in the reorganization and has given no little time and thought to it. He is entitled to remain at the helm during the first twelvemonth of a voyage toward greater usefulness.

Philadelphia, 1905, added another to the list of great street-railway conventions in the matter of interest, attendance and exhibits. It is further distinguished by the rehabilitation of the association, which, we trust and hope, will prove in every way worthy of the high hopes entertained for it.

TECHNICAL men are evidently needed in the navy. The boiler explosion on the United States gunboat Bennington while lying peacefully in San Diego harbor last July seems to teach the lesson clearly enough. More than 190 men were on board at the time, and Lieutenant Perry and 60 men were killed. Forty-three others were seriously injured. The disaster was one of the most serious in the history of the United States Navy and caused greater loss of life than the Spanish fleets. A commission was appointed to discover the cause of the explosion, and this commission made its report not long ago. It found that the trouble was due to excessive pressure in boiler "B." This, in turn, was caused by a mistake of a fireman, who closed a steam-gauge valve, so that the increasing pressure was not noticed. The safety valve failed to lift at the pressure for which it was set and the explosion resulted. A young ensign was in general charge of the boilers. The commission of inquiry found him guilty of neglecting to assure himself that the safety valves were kept in good working order. Further, the ensign failed to keep the sentinel valves in proper condition and failed to cause the safety and sentinel valves on all boilers to be tested in accordance with the navy regulations. The commission recommends that Ensign Wade be brought to trial before a court-martial.

The moral seems obvious; there should be more officers in the service competent to supervise the operation of boilers, engines, dynamos, pumps, motors, piping, wiring and the like. The graduates of Annapolis are good men and a credit to the service as a rule, but only a few have an aptitude for technical work. It is difficult to get most of them to take post-graduate work at technical colleges. But a remedy has been suggested for this state of affairs. Here it is, stated in the words of one who is able to speak with knowledge:

> The gate to a commission in the navy should be opened wider, and I know of no better way of bringing such action about than by permitting the graduates of technological schools who possess military aptitude and inclination to compete for commissions in the service. The curricula of at least a dozen scientific schools, from a scientific viewpoint, are equal, if not superior, to the curriculum of the Annapolis institution. The work of the modern naval officer is to a great extent technical, and surely such must be the case in the junior grades. The work of the ordnance and electrical expert in both army and navy is not widely separated from that of the mechanical. In fact, the measure of one's success in ordnance and electrical lines is simply proportional to his technical inclinations, study and training. * * * Instead of calling upon all young men of the country to perform military service, as in the case of some continental countries, it should be our aim to compel every technological institution receiving direct or indirect national aid to perform the service of training leaders for the military necessities of the future.

This advice is well worth considering, and it is emphasized by the Bennington disaster. It was given by Rear Admiral George W. Melville in a paper on "The Naval Strength of the United States," read before the Franklin Institute on June 15, 1904, and partly reprinted in the Western Electrician of September 17, 1904. It seems evident that the engineering department of the navy needs new blood, and Admiral Melville shows where it can be found. Congress would do well to investigate the subject, with the idea of utilizing the resources of the technical schools.

AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION.

What was the American Street Railway Association is now known as the American Street and Interurban Railway Association; so it was decided at the convention held in Philadelphia last week. The most important thing accomplished at the convention was the reorganization of the association and the adoption of a new constitution and by-laws by which the relationship of the main association and the affiliated bodies is placed on a more clearly defined basis, while permanent headquarters are established in New York. These improvements and more systematic work are expected to result in much more efficient work all around.

The character of the papers presented was good and they elicited valuable discussion, particularly in the subsidiary organizations. The exhibitition of railway appliances was one of the important features of the convention. It was one of the most complete collections of street-railway apparatus and appliances ever shown at a convention. Everything from the smallest details to the heavy trucks and frames that enter into the construction of a modern street or interurban car were shown.

A very large amount of capital was represented at the convention in Philadelphia, which not only marks the gathering as one of the most important in the history of the organization but also goes to show the remarkable development of the street-railway interests. The registered attendance, including delegates, visitors and ladies, was about 2,200, but the total attendance, exclusive of the general public, was considerably larger than that number.

American Railway Mechanical and Electrical Association.

The first session of the American Railway Mechanical and Electrical Association was called to order on Monday morning at 11 a. m. by President C. F. Baker, who immediately introduced the Hon. John Weaver, mayor of Philadelphia. Mayor Weaver greeted the delegates cordially and welcomed the convention to the city. He spoke of the increasing growth of street, suburban and interurban railways, especially in the Middle West, and of the proposed electrification of many steam roads, at least locally. He said that it is no longer certain what the word "local" means in connection with the electrification of steam railroads, as it seems that it will soon be extended to mean hundreds of miles.

Following Mayor Weaver President W. Caryl Ely of the American Street Railway Association made a few remarks, which were directed chiefly toward the proposed reorganization of the street-railway associations. He believed that the several organizations were not working as harmoniously as they might. He said in particular that there was not one in the parent organization who desired in any way to detract from the dignity of the Mechanical association. The work of the Mechanical association is of vast importance—the safety of the apparatus, its proper working, its adaptability for convenience are all dependent upon the department which the Mechanical association represents. The only thing, therefore, which the proposed reorganization contemplated was that the expenses attendant upon the running of the several organizations be paid at one time and to one end, and that the work might not fall into confusion. He said that a square deal and a fair show all the way around was desired—nobody to be subdued, nobody to be silenced or muffled.

Great praise was also due the Manufacturers' association, whose work was excellent, the exhibits which were there in response to its efforts reminding one of those at a great exposition.

Daniel M. Brady, chairman of the Manufacturers' association, then spoke of his early association with mechanics and mechanical men and of his warm feeling for them. He welcomed the visiting members and spoke of the efforts to run the Manufacturers' association on an equitable basis.

President Baker's Address.

Following the opening speeches, President C. F. Baker, superintendent of motive power and machinery of the Boston Elevated Railway Company, read his address. He said that the extension of the bonds of the association to admit of the inclusion of the members of the maintenance-of-way departments has greatly broadened the scope of the association and will be of benefit not only to the association, but also to the individual members, whether they be of the mechanical, electrical or maintenance-of-way department.

"One of the principal efforts," he said, "of an executive officer of our railways, and through him and his subordinates, is to increase the difference between the cost of operation and revenue received. In this effort the departments represented by this association can, above all others, materially assist. There are numerous channels through which this may be accomplished, one of the most important, to my mind, is system and organization properly laid out and applied. Often desired results may be obtained and success in small matters made possible without the necessity of inaugurating anything that might be dignified with the term 'system,' as in such matters an officer would be able to so divide his time as to come in personal contact with much of the detail, but this can only be done where the organization is small and where dependence must be placed on but few. In large companies covering considerable territory and employing many men an executive officer is unable to go into much of the detail or have frequent personal contact with his men. In this case success in the management of property is absolutely dependent upon good organization and system. The larger the company the greater is the necessity for a proper and adequate organization, since the executive officer must depend to a greater extent upon his subordinates. Any system to be successful must clearly define the duties and measure of responsibility of each individual so that if a failure occurs there will be no doubt as to who is to be looked to for an explanation, and no difficulty in placing the responsibility.

"An organization and system of this kind is not brought about at a single stroke, but can only be

W. CARYL ELY, PRESIDENT AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION.

the result of long and patient study of the conditions surrounding the department, the kind of men in the department, and the hearty co-operation of the subordinates upon whom the head of the department must depend for attention to the details. We have already taken a step in this direction in the report of the joint committee of the Accountants' and our own associations upon the standardizing of the blanks and forms used in these departments. That this can be continued to a good advantage there is no doubt, but as local conditions vary so much it is extremely difficult, if not impossible, for any general system to be devised which will be applicable to all. We can only strive, by earnest study and hard work, to improve our organization and system of records and accounts in every conceivable way in order that we may approach as closely as possible the ideal."

President Baker also referred with deep regret to the loss sustained by the association in the death of W. O. Mundy, who was one of the original members of the organization, and who, by his strenuous efforts, contributed largely to its success. In a similar strain E. W. Olds and Alfred Green deplored the loss to the association of such men as Mr. Mundy.

President Baker then appointed a committee to draft suitable resolutions on the subject of Mr. Mundy's decease, which committee was composed of Mr. Olds and Mr. Green.

Report of Secretary and Treasurer.

S. Walter Mower of the Detroit United Railway Company, secretary and treasurer of the association, read the report of the executive committee, containing details of the management of the association during the last year. He also presented the report of the secretary and treasurer, in which was set forth that during the last year there has been added to the membership of the association 10 company members, 59 active members and one junior member, making at present 38 company members, 134 active members and 31 junior members. The New Orleans railway on account of passing into the hands of a receiver, lost its membership.

The financial report showed cash on hand October 9, 1904, $403.55, dues received from company members $760, from active members $635, from junior members $18 and miscellaneous resources $30.98, making a total of $1,847.53. The expenditures were: For printing and stationary, $454; postage, $68; salaries, $500; annual convention, $109.25; expenses executive committee, $191; miscellaneous, $29.48; a total of $1,351.73, leaving a balance in the bank of $495.80.

Concluding Remarks on Monday Morning.

H. H. Adams, superintendent of shops of the United Railways and Electric Company of Baltimore, chairman of the committee on organization, said that Mr. Ely outlined the principal thought in connection with the subject of reorganization. In the plan submitted the points would affect the association in relation to financial assistance. The organization, he thought, was going to look to the parent association for support. This financial assistance in the opinion of Mr. Adams was one of the principal reasons for reorganizing. He also referred to the question of the printing and binding of the reports of proceedings which the parent association will take care of, and set forth the desirability of closer relations between the associations.

In answer to a question by Mr. Green as to whether the association will elect its members as usual, President Baker said that it was for the association to determine. It would make its own constitution and by-laws and would be left largely the same.

Mr. Green expressed the opinion that the constitution of the association as it now stands should not be changed, in reply to which Mr. Adams said he thought the constitution could be kept virtually on the same lines.

E. W. Olds, superintendent of rolling stock of the Milwaukee Electric Railway and Light Company, said that under the proposed plan the membership of the association would not be restricted to the companies belonging to the parent association but that the individuality of the association would be retained. He expressed the idea that the wish was to work absolutely in harmony with the parent association.

Mr. McCulloch of the United Railways of St. Louis said it was not the intention in the plans suggested to diminish the authority or standing or prestige of the subsidiary organization. In regard to the membership, he said that the members were to be the railway companies themselves and also such associate members as should be elected. There was no reason why anyone interested or who had formerly been interested in the street-railway business, should not become a member of the association and have all the privileges of membership except voting and holding office.

Fred G. Simmons, superintendent of construction and maintenance of way of the Milwaukee Electric Railway and Light Company, commented upon the remarks of Mr. Ely, expressing the thought that they should wipe out all feeling that there is any desire to curb these associations in its power to do good. Mr. Simmons also spoke of the amount to be subscribed for the partial support of the organization by the main association which can only be determined as events proceed. He said that the scheme of raising funds is to have each company pay in proportion to its gross receipts as the larger companies are going to derive far greater benefit than the smaller ones, the large companies having present a dozen different men representing different departments, while the small company will have but one man present.

H. E. Farrington, master mechanic of the Boston and Northern Street Railway Company of Chelsea, Mass., moved that the subject matter under discussion be placed in the hands of the executive committee, which was carried.

The meeting then adjourned until the afternoon.

Papers on Monday Afternoon.

The order of business for Monday afternoon was the reading and discussion of papers. Several of these papers have been given in the Western Electrician or will be given in full or in abstract at a future date. Before beginning on the papers, however, Mr. Charles Hewitt, engineer of the Philadelphia Rapid Transit Company, extended an invitation to the delegates to visit the power houses and stations of the company, and mentioned that perhaps the most interesting station, on account of the newness of the installation of turbines and high-tension alternating current, would be the Second and Wyoming streets station in the lower part of the city.

The first paper was by C. H. Hile, superintendent of wires of the Boston Elevated Railway Company, upon "Power Distribution." The author took as a specific example the power-distributing system of the Boston Elevated Railway Company. He showed that there are two tendencies at present among engineers in the construction of railway systems. One is to have large central power stations and an alternating-current transmission system with substation conversion. The other is to have a larger number of separate power plants with an interconnected power-distribution system. He then went on to consider in detail the Boston system, taking up in particular the feeder system and the underground conduits and cables.

Following Mr. Hile, L. P. Crecelius, chief electrician of the United Railways company of St. Louis, read a paper upon "The Power Station Load

Factor as a Factor in the Cost of Operation." This paper was given in abstract in the Western Electrician last week.

In discussing this paper, Mr. Hile suggested that it would be a good thing to hear from the local company. There was no question about maintaining a good load factor and its bearing on the economy in the production of power and the desirability of running a plant at its most economical point both for the engine and the dynamo, and probably from an ideal point of view it would seem that the storage battery is one of the strongest features in getting a good load factor on the station. He understood they had several storage batteries in use in the Philadelphia installation and he desired information about them.

Charles Hewitt, representing the local company, stated that in Philadelphia they had six storage

JOHN I. BEGGS, FIRST VICE-PRESIDENT AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION.

batteries, five of them being located in sub-stations and used for facilitating the distribution of the load and for steadying the load; for obtaining regulation. The sixth battery is connected directly with one of the stations. He could not give the load factor in percentage, but thought it was about 70 to 75 per cent., that is the average of the various stations. They had a practice in Philadelphia of maintaining a full load on every engine throughout the day by means of the tie lines, as referred to in Mr. Crecelius' paper, but they transpose the load from one station to another to accomplish such results. In that way, no matter what time of day or what the load may be, the engines are running at practically their most economical load, and the storage batteries no doubt assist very greatly in accomplishing that. They notice the effect of the batteries very strongly in the operation of the station. Mr. Hewitt said it was difficult to answer Mr. Hile's question as to just how important a feature they are. If Mr. Hile meant to get at any reduction in cost per kilowatt-hour from the use of them he would say that they had never been able to discover any. After nine years experience with the batteries they have not reduced the cost per kilowatt-hour, but they have materially assisted in maintaining a good load factor and in enabling the company to transpose the load from one station to another.

Mr. Crecelius, in answer to a question regarding the cost of coal, said it was a variable quantity; in some cases they burned pretty good lump coal—$1.25 to $1.30 per ton. It runs from 1,200 to 1,300 B. T. U. in calorific value. In their big stations they burn the coarsest grade of slack they can obtain. Its calorific value does not go much over 9,000 B. T. U. The ash is pretty high in fixed carbon but the coal is bought at about 78 cents a ton. Rather than endeavor to secure economical apparatus to get the maximum heat value, and thus tie up money, the company can afford to throw the refuse of the coal away.

Paul Winsor of Boston remarked that in Boston they tie the stations together by copper directly and feed certain sections from two stations; they can shift the load from one station to a section that may be equidistant from two stations, either to one station or the other, and in that way keep the machines at one station fully loaded and be able to shut down machines at the other station. If they tied from one bus-bar to the other they got the same result as far as loading the machines was concerned, but introduced heavy losses because they got losses from current jumping from one station to another station several miles away. He said that the load factors would be benefited by the use of storage batteries, but raised the point that a heavy loss in the storage batteries is introduced, which will frequently make a difference in power-house operation. His study of the question had never led him to believe that it was favorable to use storage batteries. He believed that in their case, at any rate, the batteries would introduce losses which would fully tend to offset the benefit derived in the power house.

G. S. Lawler, superintendent of the power distribution of the Boston Elevated Railway Company, in a written communication, said that the method of raising the load factor in the larger stations as used by Mr. Crecelius is the one used by him. He had not been fortunate enough to be able to obtain corresponding figures for his system which show results as clearly as do those given by Mr. Crecelius, although his figures tend the same way. This was due to the fact that the load factor varies with the time of the year and they make most of their repairs not when the wear and tear is the greatest, but when the load is light, that is, during the summer. Therefore their maintenance is light when the load is heavy and heavy when the loads are light. On this account their total expenses may not vary with the load factor and the results of the various methods of operation are somewhat concealed.

The last on the programme for Monday afternoon was the report of the committee on "Controlling Apparatus," which was read by J. S. Doyle, the chairman of the committee, who is superintendent of equipment of the Interborough Rapid Transit Company of New York. This report embodied two papers. One of these was by Hugh Hazelton, electrical engineer of New York city, and was entitled "Multiple-unit Systems of Control." The paper went quite thoroughly into the characteristic features of the Sprague-General Electric multiple-unit control and the Westinghouse system. W. A. Pearson, electrical engineer of the New York City Railway Company, prepared the other paper of the report—"The Series-parallel Railway Controller." He traced the development of controlling apparatus from the early days when shunt motors were used and the brush-holder designed to be moved around the commutator to reverse the direction of rotation.

Proceedings of Tuesday.

The convention was called to order on Tuesday morning at 10 o'clock by President Baker, and proceeded at once to the consideration of the report on "Way Matters," compiled and edited by Fred G. Simmons, superintendent of construction and maintenance of way for the Milwaukee Electric Railway and Light Company. This report was of considerable length and embodied a number of valuable papers as follows: "The Treatment of Rail Joints," by Fred E. Simmons; "Thermit Rail Welding," by G. E. Pellissier, civil engineer for the Holyoke Street Railway Company; "Joints and Track Construction in Philadelphia," by H. B. Nichols, engineer of maintenance of way, and C. B. Voynow, assistant engineer of the Philadelphia Rapid Transit Company; "Electrical Rail Welding," by T. W. Wilson of Buffalo; "Electric Welding of Rail Joints" (from the Iron Age), and "Cast Welding of Rail Joints," by Fred G. Simmons.

The treatment of rail joints is one of the most important matters concerning both the construction and maintenance of trackage, and the papers above enumerated took up almost every phase of the subject. Mr. Simmons in discussing the treatment of rail joints referred to what he considered to be the most satisfactory types of joints from a mechanical and electrical point of view. He contributed considerable information on the subject which he had received through correspondence, indicating in general, that the continuous joint is a very satisfactory one.

Mr. Pellissier described thoroughly the process of thermit welding of Dr. Hans Goldschmidt, and gave an account of some work done at Holyoke, where 170 joints were made in this way. Where these welds were made not a single break occurred last winter, showing that where the joint is properly made its strength is sufficient to stand the stresses due to changes of temperature.

The methods followed by the Philadelphia Rapid Transit Company in track construction were explained by Messrs. Nichols and Voynow. The joints there used consist of two Z or special bars riveted to the webs of the rails. These are made to fit the fishing section of the rail, spaces being left under the head, tram and around the foot of the rail. These spaces are then filled with molten zinc, which enters and fills all the irregularities of the rolled surfaces, giving an absolutely continuous bearing throughout the whole length and width of the flanges of the plates. The adhesion of the zinc, together with the body-bound rivets, hold the joint permanently tight.

The next number on the programme was a short committee report upon "Maintenance of Electrical Equipment," read by William Pestell (chairman), chief engineer of the San Juan Light and Traction Company of New York city. He said that in considering the subject the committee had tried to take into account all the factors that enter into the operation of equipment working under different conditions. It has therefore written to all of the railway companies in the United States, asking for information regarding details of their operating conditions and the methods pursued in caring for their equipment.

The committee had been fairly successful in obtaining this information, and when it is complete it will furnish a means of determining how the different conditions affect the maintenance account. The committee asked for further time to carry on this work, as it believes the information, when once obtained and properly tabulated, will enable not only the drawing of conclusions as to the best of the various systems now in use but the segregation of the best points of each of the systems. From this data it will be possible to devise a system complete and of economical value to all.

One point that shows up more clearly than any other in tabulating the answers to questions already submitted to the committee is the utter lack of standardization of materials. It seemed to the speaker that a permanent committee should be appointed by the association to consider and suggest ways and means of standardizing various parts of the equipment. This has been attempted before but results can only be obtained by working continuously at it, and he trusted that the convention would take some steps toward starting the work of standardizing equipment.

Some discussion then followed upon the subject of standardization. Mr. Sterns said, in regard to the suburban roads of Chicago, that one road has already entered the city over the elevated lines and the other lines reach the center of the city and are branching out now, and it is not any question but that in a short time there will be absolute necessity for an interchange, and those companies certainly feel that they ought to get the benefit of a consensus of the opinion of all the intelligent men who are interested in this subject in other parts of the country. If it does not come sooner or later in some substantial manner similar to the way the thing was brought around by the Master Car Builders, there will be a local standardization in Chicago similar to what is going on in New York. He was very much in favor of some more radical move in this direction.

Mr. Olds said that nine years ago they started with the journal box and brake-shoes in Milwaukee. Up to two years ago every new piece of apparatus that was bought, no matter whether it were a snow plow, a sweeper, a utility car or a passenger car, the same axle and journal box would fit it. There was no difference whatever in that respect. The brake-shoes were also made standard. There has been no change to this day. They have changed the journal box and brass for the same reason. The one that was put in nine years ago, which was thought to be large, was found too small. Two years ago they adopted two other standards, one for the city equipment and the other for the interurban. These are the present standards. The size of the axle nine years ago was four inches for the motor fit, and 4½

H. H. ADAMS, PRESIDENT AMERICAN RAILWAY MECHANICAL AND ELECTRICAL ASSOCIATION.

for the wheel fit, with a 3½ by six-inch M. C. B. journal brass and box. Two years ago they adopted a 3¾ by seven-inch journal box and brass with a five-inch axle, and 5½-inch wheel and gear fit for the city equipment. The interurban equipment has a 4¼ by eight-inch standard M. C. B. journal box and brass with 5½-inch motor fit, six-inch wheel and gear fit. These are the standards at the present time. The brake-shoe is of the regular M. C. B. standard. The different types of trucks have made it necessary in quite a number of cases to make a head that shall attach to the brake beam or hanger, but it takes the same shoe, so there is no trouble in sending out brake-shoes in having them fit.

Mr. Pestell then said that if Mr. Olds had started nine years ago to do this no doubt others are doing the same thing. If this matter had been taken up in the same comprehensive way by an order of men like this association nine years ago, instead of having Mr. Olds' standard in Milwaukee and some other standard in Chicago, another in Boston and another in New York, electric-railway men would be working on some uniform basis, and for that reason he believed the association should appoint a standing committee on standardization, appointing one member for a year or two years, another for three or four, and so on, to make recommendations at the annual meetings. This was put in form of a motion and carried.

President Baker then announced that J. B. Parsons, president of the Philadelphia Rapid Transit Company, extended the courtesies of the company, inviting the delegates to visit its power stations and shops and also the subway. He then appointed as a nominating committee, Mr. Olds, Mr. Pestell,

Mr. Green and Mr. Hile, with the privilege of choosing for themselves a fifth member. The meeting then adjourned till the afternoon.

Immediately after coming to order in the afternoon the convention proceeed to the consideration of the papers by Fred N. Bushnell, chief engineer of the Rhode Island Company of Providence, R. I., upon the subject of the "Power Station." He said that the design of a power station embodied three essentials—simplicity, subdivision of the plant into separate sections, so as to localize the effect of trouble to any part of the generating apparatus, and provision for the symmetrical extension of the plant to provide for future power requirements. Mr. Bushnell's paper was an exhaustive treatment of the subject, and was handled in a capable manner.

The last paper on the programme was by F. F. Bodler, master mechanic of the United Railroads of San Francisco, upon "An Emergency Track Brake." The author described a brake which is used on practically all the cars in San Francisco, where, on account of the many steep grades, a wheel brake alone is not adequate. It was originally intended to use the brake only in cases of emergency, but it was found so serviceable that it is now used almost as much as the wheel brake.

GENERAL VIEW OF EXHIBIT HALL AT PHILADELPHIA STREET-RAILWAY CONVENTION.

The Question Box was next taken up for discussion.

ELECTION OF OFFICERS AND CONCLUDING PROCEEDINGS.

The nominating committee presented the names of the nominees for office, which were unanimously accepted by the convention. H. H. Adams, superintendent of construction of the United Railways and Electric Company of Baltimore, was elected president, and S. Walter Mower was continued in the office of secretary and treasurer. A complete list of the new officers was given in the Western Electrician last week.

Mr. Baker then expressed, in a few pleasant words, his thanks to the members for their cooperation during his term in office.

President Adams, First Vice-president Simmons and Third Vice-president Winsor then acknowledged the honor which had been accorded to them in their election to office and expressed their willingness and determination to do all in their power to further the interests of the organization.

A vote of thanks was then extended to the retiring president, and the convention adjourned.

American Association of Street Railway Claim Agents.

The first convention of the American Association of Street Railway Claim Agents was held in the office of the Philadelphia Rapid Transit Company on the afternoon of September 26th. W. A. Dibbs, president of the association, was absent, and the meeting was presided over by E. W. O'Connor, vice-president. The report of the secretary and treasurer showed the affairs of the association to be in a satisfactory condition.

W. H. Renaud, Jr., made an address in relation to the meeting of the executive committee of the American Street Railway Association last June and detailed the action there taken regarding the reorganization of the various associations. After a general discussion it was decided to appoint a committee of three to confer with the committee from the main association regarding a constitution and by-laws. The committee consisted of Mr. Farrell of Buffalo, Mr. Renaud of New Orleans and Mr. Pratt of Baltimore.

The convention next listened to a paper by James R. Pratt, claim agent of the United Railways and Electric Company of Baltimore, upon "Fakers, Malingerers and Ambulance Chasers," describing the methods of these damage-claim "artists" to secure money dishonestly.

Following Mr. Pratt, E. W. O'Connor read a paper in which he explained briefly his experience with fakers and the benefit which might be derived through the exchange of experiences among the various claim agents. These two papers opened an enthusiastic discussion of the best methods to pursue in balking fradulent claims.

The election of officers resulted in the choice of the following-named gentlemen: President, S. L. Rhoades, claim agent Philadelphia Rapid Transit Company, Philadelphia; first vice-president, E. W. O'Connor, claim adjuster, Savannah Electric Company, Savannah, Ga.; second vice-president, Henry C. Bradley, claim agent, Chicago Union Traction Company, Chicago; third vice-president, Andrew J. Farrell, claim agent, Interstate Railway Company, Buffalo, N. Y.; secretary and treasurer, B. B. Davis, claim adjuster, Columbus Railway and Light Company, Columbus, Ohio; executive committee, the president and vice-presidents, and James R. Pratt of Baltimore, W. H. Renaud, Jr., of the New Orleans Railway Company, and H. V. Brown of the Rhode Island Company, Providence, R. I.

The work of this association has developed rapidly since its organization in St. Louis last year, its membership having grown from six to about 60 in that time.

American Street and Interurban Railway Association.

The twenty-fourth annual meeting of the American Street Railway Association, hereafter to be known as the American Street and Interurban Railway Association, was called to order in the Philadelphia Museum on Wednesday, September 27th, by President W. Caryl Ely, who delivered the president's annual address.

President Ely in his address spoke in part of the achievements of the last year, in particular referring to the electrification of steam roads. He said that in the line of technical investigation the work of the Electric Railway Test Commission at the St. Louis Exposition is of great value. The testing began at St. Louis in the middle of June, 1904, and was continued there until the middle of November, when the corps was transferred to Anderson, Ind., where the tests continued until the latter part of March, 1905. Immediately upon the completion of the tests the commission proceeded with the editing of the report. It was expected that the printed report would be ready for distribution before this meeting, but by reason of the large amount of work done and the care required in the preparation of the published volume, it will not yet appear for some little time. It will comprise a bound volume of about 500 pages octavo, and it is believed will be of great value as a contribution of facts concerning some of the things that have been long embraced within the realm of almost pure conjecture.

The matter of fire protection in car houses has received a great deal of attention from street-railway companies and insurance companies during the last year. Tests of sprinklers have been conducted at Cleveland, Ohio, and Newark, N. J. The Newark test was attended by Mr. W. Boardman Reed, engineer of maintenance of way and buildings, New York City Railway Company; Mr. Albert H. Stanley, general superintendent, Public Service Corporation of New Jersey, and Mr. H. S. Wilgus, engineer of way and structures, Brooklyn Heights Railroad Company, representing this association. The question of insurance of street-railway properties is closely linked with the important question of fire protection. For several years attempts have been made to establish a system of insurance that would comprise exclusively street and electric-railway risks. It is a subject of the greatest importance, and the belief is becoming general that a great saving can be effected in this item of general expense. On the reorganization of this association there will undoubtedly be established an insurance committee, which, in connection with the Accountants' Association, will thoroughly investigate this matter, and undoubtedly make a report that will be of great value to all concerned.

He then went on to outline the work which had been done toward the reorganization of the association.

COMMITTEE REPORTS.

Secretary T. C. Penington of Chicago then presented the report of the executive committee, which report consisted of the minutes of the various meetings of the committee held during the last year on February 3d and 4th, June 12th and 13th and September 26th. On motion of Mr. W. P. Read of Salt Lake City, the report was accepted and ordered to be filed.

The secretary then presented his annual report. This report showed that the association in the last year had acquired 18 new members and had lost eight members, the total membership at present being 206 companies.

The report of Treasurer Penington showed the following financial transactions during the year: Receipts, $12,924.85; expenses, $6,192.65; balance on hand, $6,732.20.

Mr. Penington, in closing his report, said that in view of the fact that the executive committee of the association desired a technical man to act in the capacity of secretary, a man who could devote his entire time to the work of such office, that the present meeting was in all probability the last year that he would serve the association as secretary. In looking back over the last 10 years he could truthfully say that he had filled the office of sec-

retary to the best of his ability. Of course, errors had been made, but "to err is human," as everyone knows. He wished to take the present opportunity of thanking the many friends, old and new, whom he had made during the years of his service with the association, for their kindness and assistance.

President Ely spoke of the fidelity with which Mr. Penington had performed his duties, and he was sure that no one who had ever come in contact with Mr. Penington during the 10 years of his work cherished any feeling toward him but that of respect and warm friendship. The president stated that suitable resolutions would be reported by a committee appointed for the purpose, expressing the feeling of the members with regard to the service of Mr. Penington, with the hope that when Mr. Penington looked upon these resolutions he would know that they emanated from the hearts of his friends.

The president stated that a number of letters had been received from different persons expressing their regret at being unable to attend the meeting.

The next business was the report of the committee on the reorganization of the association. As this was a very important matter, it seemed proper that it should be presented in its entirety, so that all might understand thoroughly the great amount of work and thoughtful investigation that had been bestowed upon the question of reorganization. It was therefore decided to postpone this question till the afternoon session.

Reorganization.

On Wednesday afternoon the convention proceeded at once to the consideration of the question of reorganization and adoption of the new constitution and by-laws which had been framed at a joint meeting of the representatives of the affiliated associations June 12 and 13, 1905.

The president stated that he had addressed a letter, in his official capacity, to the presidents of the different street-railway associations and clubs, asking for suggestions in regard to the plan of reorganization of the association, and he was pleased to state that in every instance he had received replies, many of which were very interesting, approving the idea and suggesting that it might be possible to arrive at means whereby the work of the state associations might match in with the work of the American Street Railway Association and its affiliated organizations. Some of these associations had formally designated delegates to represent the associations at this meeting. Among them, the New England Street Railway Club had designated Mr. E. E. Potter; the Ohio Interurban Railway Association had designated Mr. Fred W. Coen and Mr. Harry P. Clegg; the New York State Street Railway Association had designated Mr. J. H. Pardee; the Massachusetts Street Railway Association had designated Messrs. E. P. Shaw, F. H. Dewey, R. S. Goff, E. E. Potter and H. C. Page.

The president had also written letters of invitation to the past-presidents of the association to attend, and to some of the members of the different state boards of railroad commissioners.

To assist in the work, the executive committee had secured the attendance at the meeting of Mr. Henry L. Doherty of the National Electric Light Association, who had been chiefly instrumental in bringing order out of chaos in the work of that association, and whose efforts had produced results which were very gratifying to the men in that branch of the business.

Mr. Doherty then addressed the meeting and said that he had never realized so keenly the scope and complexity of the street-railway industry as he had when faced with the responsibility of delivering an address to the association upon its work. The work in the street-railway field requires a knowledge of thermo-dynamics, mechanical engineering, electrical engineering, legal matters, materials, amusements, municipal engineering, and especially regarding paving, proper relations with state and municipal authorities, the newspapers and the general public. The association, to administer benefits to the fullest extent of its possibility, must be comprehensive and therefore probably complex and expensive.

He suggested that the association be known as "The American Traction Association," because such title seemed to be comprehensive. He urged the necessity of a well-located, well-equipped permanent headquarters under the direction of a permanent secretary.

Regarding the matter of subdividing the work of the association, Mr. Doherty thought the following divisions of self-evident value: Traction electrical engineering; accounting; park and amusement superintendence; transportation superintendence; traction laws. He considered that the adoption of a "Question Box" on a comprehensive scale was the most valuable adjunct in any association work. He referred to the great value of the question box in the National Electric Light Association and the Ohio Gas Light Association. It had been arranged that all information collected by means of the question box should be put in the hands of a competent revision committee and from it a very comprehensive hand-book would be evolved. Information held by one man can in this way be made common to the entire fraternity and the field of research and experimental work can thus be reduced to that portion which is unknown to all.

Mr. Doherty further said, in planning the reorganization of the association, that it was well to keep in mind that a special wave of antagonism seems to be passing over the country against corporations, and this wave of antagonism was particularly directed against quasi-public corporations. The corporation is held up as the tool of the rich for the oppression of the poor, while the reverse was really true.

Sooner or later those who want to see the truth prevail rather than sensationalism must take steps to give the voter the reasons why the ability of incorporation should be increased rather than lessened. Industrial associations for this reason should arrange provision for communication and co-operation among themselves. A marked tendency toward more rigid control on the part of municipal and state authorities is evident. The state or city now presumes to prescribe the service rendered by quasi-public corporations, fix the rates and assess them for taxation. Owing to faulty tax laws, individuals and firms and corporations other than quasi-public corporations can escape their just burdens of taxation by securing, through concealment or otherwise, low assessment values on their property, while the quasi-public corporation, if compelled to pay taxes and fix rates on the same valuation, is bound to secure either inadequate rates or unjust taxation burdens. For this reason the quasi-public corporations must explore the resources of political economy to provide and enforce honest taxation of all property. He mentioned this simply as an example why more intimate communication should exist between organizations such as the Ohio Gas Light Association, the American Street Railway Association and the National Electric Light Association.

As a conclusion to his remarks, Mr. Doherty made the following recommendations, based on many years of experience in association work:

"First—Listen to the recommendations of your active workers with a receptive mind.

"Second—Do not forget the fact that improvements cannot be secured except by changes.

"Third—Do not criticize unless you can see positive harm, and then sparingly, unless you can offer some better suggestion.

"Fourth—Do not oppose the man who is trying to do the work, but support him. Put a premium on interest in association affairs and work in behalf of association advancement.

"Fifth—Accept and act favorably upon the recommendations of workers aiming to secure organization upon higher and broader lines. If the plan suggested by them cannot be executed, delegate authority to either your officers or a special committee chosen by your officers to reorganize under some comprehensive plan which they may adopt and for the success of which they are willing to accept the responsibility. Give them full power to take all necessary steps, fix initiation fees, dues, accept new members, etc., and thus save waste of the most valuable thing required to secure progress, viz., time."

The president expressed the thanks of the association to Mr. Doherty, and stated that at a proper time a resolution expressive of such thanks would be adopted and spread on the minutes.

The secretary then read the proposed constitution and by-laws of the American Street and Interurban Railway Association.

Constitution and By-laws as Amended.

The following summary of the new constitution and by-laws as changed by the committee since their original publication in printed form, and as amended at the convention, gives the gist of each:

As provided in the constitution, the name of the association is the American Street and Interurban Railway Association and the headquarters are to be in New York city. The objects of the association are to be the discussion and recommendation of methods of construction, management and operation of street and interurban railways; the establishment of co-operation among members, and the acquisition of experimental, statistical and scientific knowledge on the subject.

Two classes of membership are provided—active and associate. The former are to consist of companies, lessees or individual owners of street and interurban railways, each to have one vote. The latter are to be individuals, copartnerships and corporations having had active identification with such properties and others thought desirable by the executive committee. They have no vote.

The constitution may be amended by a two-thirds vote of the members present at a regular meeting, provided the proposed amendment shall have the approval of two-thirds of the executive committee.

The important articles in the by-laws make the following provisions: The officers shall consist of a president and as many vice-presidents as there are affiliated organizations, a treasurer and secretary, the secretary-treasurer to be appointed by the executive committee.

Two articles provide for the duties of the secretary and treasurer, which are the usual duties devolving upon such officers.

The entire management of the affairs of the association shall be in the hands of the executive committee, which shall consist of the president, vice-presidents and one member appointed by each of the affiliated associations. Special meetings of the executive committee may be called by the president or any five members. The committee may assign to the allied association, the American Street Railway Manufacturers' Association, the management of exhibits. The executive committee shall report at each regular meeting.

Regular annual meetings of the association shall be held at such time between the 15th day of September and the 15th day of December, in each year, as the executive committee may decide to be best suited to the locality in which the meeting is to be held; the time to be decided upon and each member notified of the selection by the first day of May in the year in which the meeting is to be held. Special meetings may be held upon the order of the executive committee.

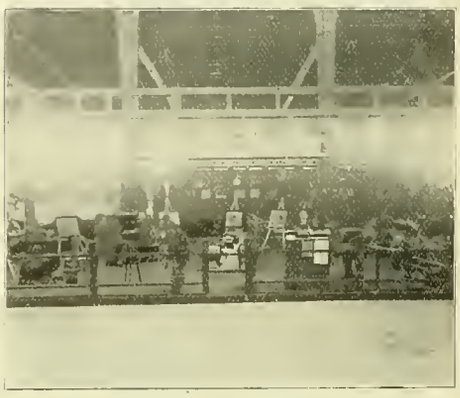
In order to secure continuity of work, a committee on subjects shall be appointed each year by the executive committee to suggest topics for the parent and affiliated associations for a year in advance. This committee is to consist of one member from each of the affiliated associations and a number from the parent association equal to the number of affiliated associations.

Article 12 reads as follows:

"This association shall do all in its power to

Electric Storage Battery Company.

Allis-Chalmers Company.



National Electric Company.

BOOTHS AND EXHIBITS AT PHILADELPHIA STREET-RAILWAY CONVENTION.

promote the welfare of other associations organized with its approval to investigate technical matters connected with street and interurban-railway construction and operation. To this end it will, in the following way, and in others which may be determined by the executive committee, assist in the work of such affiliated associations:

"a. By authorizing the formation and approving the constitutions of such associations.

"b. By admitting to the executive committee a member from each of such associations.

"c. By granting financial assistance to such associations for specific purposes.

"d. By editing, printing and binding the reports of the proceedings of such associations.

"e. Through its secretary and committee it will assist in arranging for conventions, suggesting suitable subjects for investigation; it will file information for reference and distribution, and in every way endeavor to stimulate interest in all of the affiliated associations."

The remaining article of importance relates to the fees. According to this article active members are to pay an admission fee of $10 and annual dues based upon their gross earnings, ranging from $15 upon gross earnings of $50,000 up to $600 for earnings of $10,000,000 or over.

Discussion.

Considerable discussion was given leading up to the adoption of the constitution and by-laws.

C. S. Sergeant of Boston called attention to the fact that it is provided in the by-laws that the vice-presidents shall equal in number the number of affiliated associations and in another place it is provided that the executive committee shall consist of the president, the vice-presidents and one member appointed by each of the affiliated associations, and that it was provided further that the executive committee may admit affiliated associations, which he understood to mean new associations. The question then raised in his mind was at what time they can be admitted. If they could be admitted only at an annual meeting he saw no trouble, but if they were to be admitted at any other time he did not see how the vice-presidents could be made to correspond with the number of affiliated associations.

Mr. Beggs answered that the admission of affiliated associations could only be considered at the annual meeting and that there would be no trouble on account of the points raised by Mr. Sergeant.

H. H. Vreeland of New York said that it had been evident to every member of the association for a number of years that some change was necessary in the form of organization and the method of conducting the business of the association; a great change had come in connection with the properties which the association originally represented. At the time of the organization of the association it had to do with horse cars and horse-car problems. There has been a very rapid evolution from that, and business has advanced in every direction save that of the methods of conducting the association. It was recognized that when the association met in New York city some years ago that it would be impossible for the association to go ahead under the then existing method of holding meetings in cities to which it was invited by the local street-railway companies, such companies being required to assume practically all the expense of entertaining the association. He said that the time had now come when it was considered that a decided change should be made in regard to the method of running the association. It had been evident to everyone who had been connected with the association for some years past that if they were only paying $25 a year in dues they were not getting more than $25 worth of value out of it. Everyone had an opportunity of considering and discussing the changes in view, as the question had been up for the last two or three years.

Mr. Vreeland referred to the fact that the organization of the American Railway Association, with which he was connected for a number of years, and its affiliated associations, is identical with the plan proposed here, and in the case of the American Railway Association it had produced the very best results—instead of some one in the East groping on a proposition and another man on the Pacific Coast groping on the other end of it, they took all questions up and endeavored to establish a uniform standard. Among other things they established a uniform standard time for the United States for the operation of railroads and established a uniform system of rules and regulations for the operation of trains and telegraph orders, so that an engineer in Maine could run an engine in California or in any other state.

President Ely said that sometimes an erroneous impression prevailed concerning the thought that underlies such work as this. On behalf of those who have been laboring on the proposition, the present executive committee and the past executive committees, and others, he wished to disclaim any idea of doing an academic or theoretical thing. What they desired to get was something intensely practical; they had been moved largely by monetary considerations. The plan presented had a commercial purpose. The questions of what was going to be secured by the plan, what it was going to cost, and where the money was to come from with which to defray the expense were three hard business propositions that have exercised the minds of all who had worked upon the subject. The personnel of the executive committee for the last two years who had worked upon the problem was that of men who had little time for sentiment; it was a hard business proposition, pure and simple. He said a gentleman who has a great system of street railways wrote to him that it could well afford to pay the association $1,000 a year for a proper bureau of information to supply the information that was asked from his company, in addition to the dues, and that money would be saved to his corporation in that way.

Concluding Proceedings of Wednesday.

Secretary Penington announced that the Engineers' Club and the Manufacturers' Club of Philadelphia tendered to the officers and members of the association the privileges of the respective clubhouses for the week.

Frank G. Jones, who occupied the chair, announced the appointment by President Ely of the following committee on nominations: Messrs. J. B. Parsons of Philadelphia, H. H. Vreeland of New York, C. S. Sergeant of Boston, Stebbins of Columbus, Ohio, and W. P. Read of Salt Lake City. He also announced the appointment of the following committee on resolutions: Messrs. Allen of Utica, N. Y.; John A. Rigg of Reading, Pa., and Smith of Omaha.

H. J. Davies of Cleveland stated that in line with the suggestion in the address of the president and the recommendation of the executive committee he wished to move the appointment by the president of a standing committee of five upon insurance and fire protection; the duties of which committee shall be to gather statistical information and to study the subject of fire insurance, and more particularly the protection of street-railway property against loss by fire, and the consequent loss to business. The more important part of the duties of the committee would be the subject of the better costruction of car houses and better protection against loss or damage by fire, for the loss to the business of the company consequent upon fire is much greater than the amount which is likely to be collected from any insurance company after the fire. Fire protection is more important than fire insurance. Properly protected car houses can be insured at a much lower rate than car houses as they now exist as a rule.

The motion was carried.

Papers Read and Discussed on Thursday.

The first papers considered on Thursday were the two upon gas-engine design and construction. They were: "Notes on the Design of Large Gas Engines with Special Reference to Railway Work," and the "Application of Gas Power to Electric-railway Service." They were prepared, respectively, by Arthur West and J. R. Bibbins, both experienced engineers of the Westinghouse company. The reading of these papers, which are considered elsewhere in this issue, together with a long discussion, occupied the greater part of the forenoon. In the afternoon the two remaining papers were taken up. One of these was entitled "The Single-phase Railway System," by Charles F. Scott of Pittsburg, and the other was "Electric Railway Equipment," by W. B. Potter of Schenectady, N. Y.

Election of Officers.

The officers of the association elected for the ensuing year consisted of the following-named gentlemen:

President—W. Caryl Ely of Buffalo.

First vice-president—John I. Beggs of Milwaukee.

Second vice-president—Calvin G. Goodrich of Minneapolis.

Third vice-president—James F. Shaw of Boston.

Later, at a meeting of the executive committee, Prof. B. V. Swenson was elected secretary and treasurer of the association.

The executive committee is to be made up as already outlined in the by-laws of the association.

President Ely made a few remarks upon acceptance of his office. He said that he believed that if every member of the association did his duty that the organization which would result in a couple of years would be so big and useful to every member that the common sense of all connected with the association would lead them to say, "Why did we not inaugrate this 10 years ago? What were we doing?"

Mr. Beggs pledged to Mr. Ely his best support in assisting him in what was to be done. He understood fully the burdens which the president was assuming and he desired to pledge to the association the best efforts he could give to its advancement. He did not know whether Mr. Goodrich was present at the session or not, but he was glad that Mr. Goodrich had been continued as vice-president in the association; that those were coming into office who were familiar with what was intended to be accomplished under the new form of constitution and by-laws.

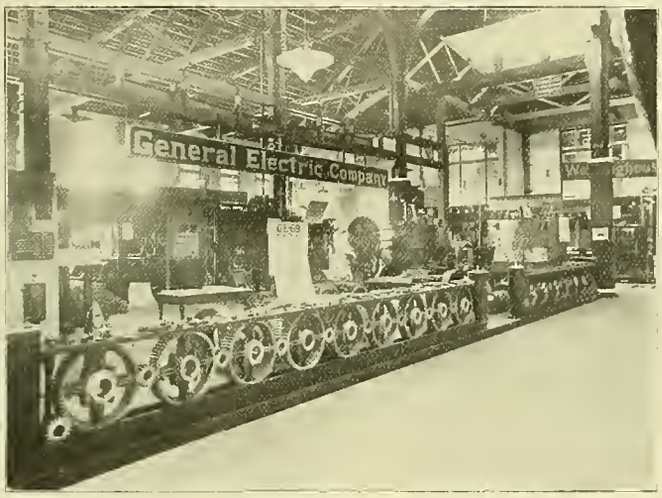
Final Business.

Numerous resolutions were passed before the convention closed. A vote of thanks was extended to the authors of the papers. The committee that had been appointed to prepare suitable resolutions of thanks to Secretary Penington for his past services paid high tribute to his work, which expressions were recorded in the minutes.

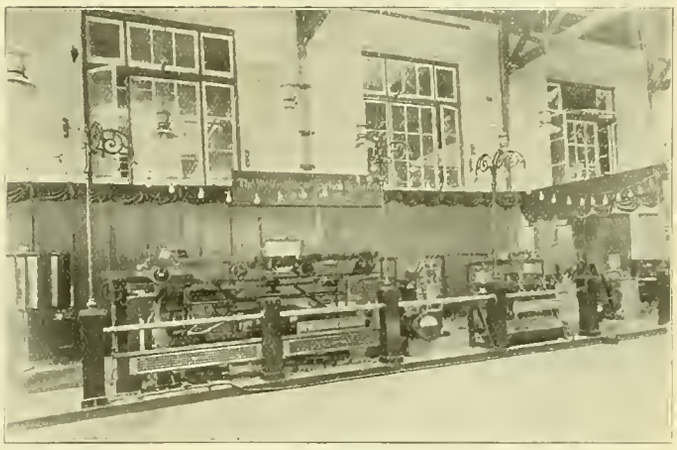
A committee of three consisting of Mr. Beggs, G. Tracy Rogers of Binghamton, N. Y., and P. F. Sullivan of Boston was appointed to urge upon the postmaster-general and the committee on postal affairs in Congress the necessity of providing a larger compensation to street and interurban railways for carrying the mails.

The convention then listened to the report of the committee on rules submitted by the chairman, Mr. E. G. Connette.

The president appointed as a committee on insur-



General Electric Company.



Westinghouse Companies' (Partial View).

EXHIBITS AT PHILADELPHIA STREET-RAILWAY CONVENTION.

ance Messrs. H. J. Davis, E. W. Olds and T. C. Penington.

The convention then took a recess until after the close of the last session of the Accountants' Association, after which it was adjourned sine die.

Street Railway Accountants' Association.

The first session of the Philadelphia convention of the Street Railway Accountants' Association was called to order on the afternoon of September 28th by President W. G. Ross.

President Ross in his address reviewed the work of the association since its organization in 1897. There were then 25 companies enrolled, which number has been increased to 152. "In connection with the various forms and records," he said, "one of the important matters still to be followed up and dealt with is the taking up of these forms and records with the departments they affect, and as new associations are formed, such as the Claim Agents', the committee of our association appointed for this purpose should follow this matter up vigorously so as to endeavor to arrive at a standard set of forms that can as far as possible be used by all companies."

Tribute was also generously paid in the president's address to the high-class efficient service which had been rendered by W. B. Brockway, who had been secretary of the association since its beginning until his retirement from office last winter.

Elmer M. White, secretary of the association, reported 13 new members for the year.

Concerning the department of blanks and forms the secretary said there had been sent out nearly 50 collections with something over 800 blanks, which those receiving them reported to have been of great assistance.

Messrs. W. F. Ham, P. V. Burington, J. S. Simpson and Irwin Fullerton were appointed a committee on nominations, and Messrs. P. S. Young, A. S. Wilde and C. S. Clark a committee on resolutions.

At the sessions on Friday morning and afternoon the following reports of committees and papers were taken up and discussed, the name of the chairman being given in each case: "Annual Report of Standing Committee on Standard Classification of Accounts," by C. N. Duffy, secretary and auditor, Chicago City Railway Company; "Annual Report of Standing Committee on Standard Form of Report," by W. F. Ham, comptroller, Washington Railway and Electric Company; "Report of Committee on International Form of Report," by C. N. Duffy; "Report of Committee to Attend Convention of National Association of Railway Commissioners, held at Birmingham, Ala., November 15, 16, 17, 1904," by C. N. Duffy; "Report of Committee to Attend Convention of National Association of Railway Commissioners, held at Deadwood, S. D., August 15, 16, 17, 1905," by W. F. Ham.

The Question Box was taken up and then these papers:

"The Cost of Carrying a Passenger," by C. L. S. Tingley, second vice-president, American Railways Company, Philadelphia, Pa.; "Interurban Fare Collections," by Irwin Fullerton, auditor, Detroit United Railway, Detroit, Mich.; "Interurban Ticket Accounting," by J. H. Pardee, general manager, Rochester and Eastern Rapid Railway, Canandaigua, N. Y.; "Accounting with Four Departments," by H. M. Beardsley, secretary and treasurer, Elmira Water, Light and Railway Company, Elmira, N. Y.

The usual resolutions of thanks were passed and the following-named gentlemen were elected officers for the ensuing year:

President, Walter B. Brockway, general auditor, Nashville Railway and Light Company, Yonkers, N. Y.; first vice-president, P. S. Young, comptroller, Public Service Corporation of New Jersey, Newark, N. J.; second vice-president, Robert N. Wallis, treasurer, Fitchburg and Leominster Street Railway Company, Fitchburg, Mass.; third vice-president, H. A. Ferrandau, auditor and treasurer, New Orleans Railways Company, New Orleans, La.; secretary and treasurer, Elmer M. White, assistant treasurer, Birmingham Railway and Light Company, Birmingham, Ala.

Executive committee—W. G. Ross, managing director, Montreal Street Railway Company, Montreal, Canada; C. L. S. Tingley, second vice-president, American Railways Company, Philadelphia, Pa.; F. Dabney, assistant treasurer, Seattle Electric Company, Seattle, Wash.; J. H. Pardee, general manager, Rochester and Eastern Rapid Railway Company, Canandaigua, N. Y.

Manufacturers' Association.

The first exhibit which the American Street Railway Manufacturers' Association has handled, and which was held at the Exposition Hall, was a credit to that organization and to Daniel M. Brady, chairman of the Manufacturers' executive committee. The same may be said of the entertainments. The membership of this association now includes 254 manufacturers, dealers and others interested. George Keegan was re-elected secretary of the association.

Three of the five retiring members of the executive committee were re-elected for three years and the committee now comprises the following-named gentlemen: J. R. Ellicott, Westinghouse Traction Brake Company; John A. Brill, J. G. Brill Company; Charles Knickerbocker, Griffin Wheel Company; Fred S. Kenfield, Kenfield Publishing Company; Charles K. King, Ohio Brass Company; George J. Kobusch, St. Louis Car Company; Charles C. Peirce, General Electric Company; Howard F. Martin, Pennsylvania Steel Company; James H. McGraw, McGraw Publishing Company; John W. Nute, St. Louis Car Wheel Company; Frank C. Randall, National Electric Company; Newcomb Carlton, Westinghouse Electric and Manufacturing Company; William Wharton, Jr., William Wharton, Jr., & Co.; W. H. Whiteside, Allis-Chalmers Company; E. M. Williams, Sherwin-Williams Company.

Benjamin Electric Manufacturing Company.

Chicago Pneumatic Tool Company.

Crouse-Hinds Company.

EXHIBITS AT THE PHILADELPHIA STREET-RAILWAY CONVENTION.

Entertainment Features at the Convention.

The Manufacturers' Association provided abundantly for the entertainment of the delegates and guests. The opening social event was a reception and dance in the ballroom of the Bellevue-Stratford on Tuesday evening, which was attended by a large number of delegates and ladies.

On Wednesday evening a large majority of those in attendance filled the new Lyric Theater to hear "Babes in the Wood." This formed a pleasant diversion from the routine of the convention duties.

The annual banquet was held Thursday evening in the Bellevue-Stratford. The menus for the occasion were particularly pretty and appropriate. The cover design portrayed Benjamin Franklin holding the string of his kite in one hand and a key in the other. He was shown as standing on the roof of a modern interurban car lettered A. S. R. A.—Philadelphia-San Francisco.

John B. Parsons of Philadelphia was toastmaster. The list of speakers included Hon. John Weaver, "Franklin's Day and Our's;" W. Caryl Ely, "The Association;" George Tate Blackstock, K. C., "Our Canadian Brethren;" Thomas N. McCarter, "Corporations and the Commonwealth;" John I. Beggs, "Street-railway Management;" Gen. Eugene Griffin, "The Trolley;" James Rawle, "The Ladies."

Friday afternoon those who desired indulged in a trolley trip provided by the courtesy of President Roberts of the Fairmount Transportation Company. In the evening there was provided a vaudeville performance in the banquet hall of the hotel which was highly appreciated.

New Officers of the Associations.

The American Street and Interurban Railway Association elected for its first president W. Caryl Ely of Buffalo, who so ably administrated the affairs of the American Street Railway Association for the last two years of its existence. Though a lawyer by profession, Mr. Ely has been for years more or less interested in electrical affairs, having been until recently president of the International Railway Company of Buffalo and being one of the original promoters of the Niagara Falls Power Company. His interest in street-railway affairs in particular is great and he is an extensive promoter of these properties. Mr. Ely was also connected with the management of the Pan-American Exposition at Buffalo.

As first vice-president the Street and Interurban Association elected John I. Beggs, who is president and general manager of the Milwaukee Electric Railway and Light Company and president of the United Railways Company of St. Louis. He has always been deeply interested in the affairs of the association and was second vice-president at the time of his advancement. He is closely allied with a number of street-railway undertakings and a man of large ability.

Bernard V. Swenson, the new secretary and treasurer of the association, recently connected with the Indiana Union Traction Company, was for a number of years assistant professor of electrical engineering at the University of Wisconsin. He was prominently connected with the street-railway testing commission at St. Louis, spending nearly a year superintending the tests, and is joint editor with Prof. H. H. Norris of the results of these tests. He was born in Chicago and graduated from the University of Illinois, and was the joint author with Mr. Budd Frankenfield of "Testing Electromagnetic Machinery." He has frequently acted in the capacity of consulting engineer in the design and construction of various power plants, and is well fitted for his new position.

H. H. Adams, who for the last year has successfully filled the office of first vice-president of the American Railway Mechanical and Electrical Association, was elected to be president of that organization. Mr. Adams is a man of recognized ability in the mechanical end of the street-railway business and holds the position of superintendent of shops for the United Railways and Electric Company of Baltimore.

The Street Railway Accountants' Association of America elected W. B. Brockway as its president. Mr. Brockway filled the position of secretary of the association very acceptably for eight years up to last year. His home is in Yonkers, N. Y.

The American Association of Street Railway Claim Agents elected as its president S. L. Rhoades of the Philadelphia Rapid Transit Company.

Convention Notes.

Okonite was represented by Capt. Candee and George T. Manson, who came on from New York to take in the show.

Western Electric Company made an exhibit of a full line of railway overhead material, and was represented by R. H. Harper of the New York house, F. D. Killon of the Chicago house, and F. C. Jaeger of Philadelphia.

Goldschmidt Thermit Company, New York city, displayed various classes of welds, such as are applied chiefly to street-railway work. The company was represented by E. Stütz, vice-president and treasurer, and R. F. Kelker, Jr., engineer.

Elmer P. Morris Company of New York city exhibited a line of electric-railway materials and supplies, including commutators, overhead material,

trolley poles, etc., and was represented by Elmer P. Morris, president; E. D. Hinman and W. V. Sweeten.

President and General Manager John S. Speer of the Speer Carbon Company, St. Mary's, Pa., as usual was on hand looking after the company's interest, and exhibited at the handsomely arranged booth the well-known Speer brush, which to mention only, he claims, is "nuf said."

Crouse-Hines Company, Syracuse, N. Y., exhibited arc and incandescent headlights, guy anchors, switches, Norbitt lamp sockets, carpenters' bench clamps and Hawley time-register clocks. It was represented by Nathan Shute, Frank Buchanan, W. D. Hawley and James H. Hurd.

Osburn Flexible Conduit Company, New York city, exhibited a full line of standard Flexduct from one-quarter inch to three inches. Special demonstrations were shown of its toughness, flexibility and smooth interior. The company was represented by C. E. Corrigan and W. P. Ambos.

W. N. Matthews & Bro., St. Louis, manufacturers of the Stombaugh guy anchors for street railway, electric-light and telephone trade for anchoring poles, fences and smokestacks, were represented by W. N. Matthews, and shared the reception room and quarters of the Mayer & Englund Company.

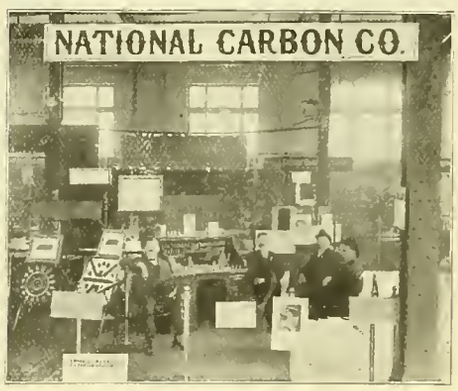
Standard Paint Company exhibited the well-known P. & B. insulating tape, insulating compound, preservative paint, Flexide metal-preservative paint, S. P. C. iron paint, Ruberoid roofing and Ruberoid color roofing. It was represented by Paul M. Wade, Charles Earnshaw, J. N. Richards and R. N. Shainwald.

The "Benjamin wireless cluster" (manufactured by the Benjamin Manufacturing Company of Chicago, New York and San Francisco) was there. Special stress was laid on the improved type of car cluster, such as used by the Metropolitan Street Railway Company, Interborough Rapid Transit Company and St. Louis Rapid Transit Company. A full line of out-door lighting fixtures with enameled steel shades was shown with attaching devices for poles or walls. The "turn-down feature" of the arc-burst was also exhibited. Basil G. Kodjbanoff, M. E., manager in New York, was in charge of the exhibit.

Dearborn Drug and Chemical Works.

D. & W. Fuse Company.

Joseph Dixon Crucible Company.



National Carbon Company.

EXHIBITS AT THE PHILADELPHIA STREET-RAILWAY CONVENTION.

Green Fuel Economizer Company of Matteawan, N. Y., had no exhibit, but was ably represented by William Downs, J. H. Barron, and A. H. F. Viehl. The many advantages claimed for this company's product are well known, a saving in fuel giving a larger percentage of steam and many other valuable points.

Joseph Dixon Crucible Company, Jersey City, N. J., had on exhibition a line of greases, lubricating graphite, paint, crucibles and pencils. The following-named representatives from the Philadelphia office were in attendance: Herman Price, Morris Willets, John J. Tucker, DeWitt C. Smith, Levis Moore and R. M. Darling.

Gaxton-Daniels Company, Keokuk, Iowa, had on exhibition lightning arresters for direct-current and alternating-current railway service, and the controller regulator manufactured under the trade name of the automotoneer. The exhibit was in charge of J. V. E. Titus, president; W. P. Casper, general sales agent, and J. R. Bliss.

National Electric Company, Milwaukee, had on exhibition the recently improved type of air-brake equipments, notably air compressor for operation on single-phase and direct current, the new compact, low-temperature, direct-current motor, and also standard air-brake equipments of the type adopted by the Chicago City Railway Company. The following-named gentlemen were in attendance: S. I. Wailes, general manager; W. W. Power, Philadelphia office; Joseph Cunningham, New Yowk office; J. Frank Perry, Chicago office; W. L. Waters, chief engineer; J. H. Denton, general superintendent; Charles G. Burton, general sales agent, Chicago.

Buckeye Engine Company, Salem, Ohio, had a prominent booth on one of the main aisles of the exhibition hall, where daily distributions were made of "souvenirs from nature." Mr. C. H. Weeks, vice-president of the company, was in attendance, assisted by Paul Bigelow of New York; H. E. Troutman from Chicago, and also Messrs. Machold and Riddell of Philadelphia.

D. & W. Fuse Company of Providence, R. I., had on exhibition at its booth a full line of fuses of various types, cut-out boxes, transformer cut-outs, service switches, etc. Special demonstrations of the usefulness and advantages of Deltabeston magnet wire were made daily at the booth and attracted much attention. The exhibit was in charge of W. S. Sisson, secretary, and C. F. Harmon.

Electro-dynamic Company, Bayonne, N. J., exhibited its five-horsepower, 550-volt, variable-speed, inter-pole motor, belt-connected to 220-volt, five-horsepower generator, showing sparking and speed-control, conditions under normal load and 100-per cent. overload. Representatives in attendance were G. H. Condict, vice-president; Mr. Peck, sales manager; F. G. Bell and Mr. Brown, manager of Philadelphia office.

Sterling Varnish Company, Pittsburg Pa., made an elaborate exhibition of its product and distributed among other things handbooks relating to insulating compounds, their care and manipulation. The exhibit was in charge of A. S. King of the company's eastern territory and C. L. Cool of the western territory, and in attendance were James Todd, president, Dr. Walther Riddle, vice-president, and Arthur Hartwell, general manager.

Gould Storage Battery Company of New York made an exhibit of its large size lead-lined battery, also a display of various types of plates for stationary and vehicle batteries, also many photographs of installations recently made in the electric-railway field. Its recent battery installation at Topeka, Kan., is described in Bulletin No. 6 and is of considerable interest. The company was represented by Dr. W. Winship, W. S. Gould and Frederick Hulme.

One of the welcome visitors at the convention and exhibition was General Manager Thomas R. Mercein of the Electrical Trades Exposition Company, Chicago. Mr. Mercein made the trip to Philadelphia with the idea of interesting as many exhibitors as possible in his company's big electrical show, that will be held in Chicago at the Coliseum next January. He reports a gratifying reception of the project by a large number of the exhibitors at Philadelphia. Mr. Mercein is well equipped for this undertaking, as he is an old central-station manager and has been for some time a broker in electrical securities, to say nothing of his having managed most successfully the Milwaukee exposition.

Southern Exchange Company of New York was represented by E. G. Chamberlin, president and manager; A. J. McKinnon, vice-president, and W. E. Mitchell, manager of sales. This company makes a specialty of southern white-cedar round poles, long-leaf-pine octagonal poles and Georgia long-leaf-pine cross-arms. Its booth was attractively arranged and decorated for the reception of its friends, showing sections of the woods which it produces. Mr. Chamberlin reports an excellent business in 1905, and the prospects for 1906 are very encouraging.

Continuous Rail Joint Company of America, Newark, N. J., had an exhibit including continuous joints fitted to various sections of T-rail from 35 pounds to 100 pounds, and girder rails from six to nine inches high, shanghai rails from five inches to eight inches high, compromise joints, showing various T and girder rail combinations, and joints showing use of various types of bonds; also special tram shapes and special joints used by Philadelphia Rapid Transit Company. B. M. Barr, W. A. Chapman, W. E. Clark, E. A. Condit, Jr., D. J. Evans and G. W. Smith were in charge of exhibit.

Chicago Pneumatic Tool Company, Chicago, made a very elaborate display of its products, showing a complete line of electric drills of various sizes and capacities, electrically driven air compressors, a complete line of pneumatic tools adapted to street-car repairs, air jacks, automatic oiling devices, speed recorders, etc., as well as Little Giant storage batteries. These storage batteries, contained in cells of the Duntley washable type, or plain rubber or glass cells, are adapted for automobiles, central-station plants, isolated power plants, lamps, railroad signals, telephones, telegraph, train lighting and all work of this character. The principal feature of this battery is the Duntley washable cell, which may be thoroughly cleaned without disturbing the elements, the device which permits this being extremely simple and effective. The company was represented by G. A. Barden, manager of the Philadelphia office, and Howard Small and Julius Keller, engineers.

Dearborn Drug and Chemical Works, Chicago, exhibited specimens of scale formations, also boiler tubes, showing actual corrosive action on the iron; lubricating oils and compounds and photographic views of its laboratories. The company had an elaborately arranged booth, where all callers were very hospitably received. The company was represented by Robert F. Carr, vice-president and general manager; W. B. McVicker, second vice-president and eastern manager; George W. Spear, third vice-president; R. R. Browning, assistant secretary and treasurer, and Thomas Brannon of the Philadelphia office.

National Carbon Company, Cleveland, exhibited a line of motor and generator brushes. The principal feature of the exhibit was the Columbia brush, treated in a way which renders it entirely lubricant, saving both brush and commutator. This brush has become quite popular with the street-railway people on account of saving both in money and time. The company also exhibited various other styles of brushes, including ordinary National and Partridge products; also circuit-breaker carbons. It is now in position to supply brushes with pigtail attachments of every description, also carbons for arc headlights. It was represented by N. C. Cotabish, sales manager; James Partridge of the Partridge Works; A. D. Spear, A. G. Summerell and A. E. Carrier.

As usual, the H. W. Johns-Manville Company of New York was well represented. Its exhibit was attractively arranged and included a complete line

of overhead line material, a number of new devices of high-potential design that have recently been produced, a full line of Noark, standard and National Electric Code standard fuses, blocks, service and subway boxes and accessories, and a diversified line of moulded insulating materials, consisting of Vulcabeston, Monarch and molded mica compounds. In addition to this the exhibit included some of the well-known asbestos and magnesia pipe coverings, asbestos roofing, asbestos, Vulcabeston and Kearsarge gaskets and packings. The exhibit was in charge of J. W. Perry, manager of the electrical department, New York, and the following-named gentlemen in addition were in attendance: H. E. Manville, secretary, New York; T. T. Lyman, general sales manager, New York; D. T. Dickson, manager Philadelphia branch; H. M. Voorhis, manager electrical department, Philadelphia office; H. M. Clymer, Philadelphia office; J. B. Meek, general representative, New York, and C. N. Manfred, manager advertising department, New York.

The exhibit of the Lord Electric Company of Boston and New York in section J attracted the attention of all the railway men who visited the Exhibition Hall. In its space, which was tastefully decorated in olive green and crimson, the Lord company displayed an attractive sample board about 4½ by 10 feet, made in the form of its trademark; this sample board was finished in white enamel and on it were shown samples of the various types and sizes of Thomas soldered rail bonds. Around the booth were distributed a variety of rail sections to which bonds had been applied to illustrate the adaptability of the several types under different conditions. Another well-known specialty exhibited by this company and which attracted a great deal of attention was the Shaw non-arcing lightning arrester. Two new bulletins—a 24-page on rail bonds and a 16-page on lightning arresters—were distributed. Those in attendance at their exhibit were: Edward M. Hamlin, general manager; Henry M. Shaw, New York office; George W. Smith, Baltimore office; W. R. Garton, Chicago office; George B. Crane, Boston office. The Lord Electric Company was well pleased with the result of its exhibit and considers the exhibition and convention highly successful.

Osburn Flexible Conduit Company.

Southern Exchange Company.

EXHIBITS AT THE PHILADELPHIA STREET-RAILWAY CONVENTION.

Allis-Chalmers Company, finding it impracticable to erect and exhibit for one week a 6,000 or 8,000-horsepower engine and generator, or any of its large apparatus, confined its efforts to welcoming visitors in a large and attractive reception room, which it fitted up at the foot of the stairs leading to the Convention Hall. Here and also at the Bellevue-Stratford, where its representatives dispensed courteous hospitality throughout the several days of the meeting the Allis-Chalmers badges and watch fobs, reproducing in oxidized silver the Liberty bell and bearing the company's well-known "four powers" trademark, were worn by hundreds of the visiting railway men. The Allis-Chalmers representatives at the convention were: F. C. Randall, manager New York office; G. B. Foster, manager Chicago office; George H. Berg, manager Boston office; J. W. Murray, manager Pittsburg office; W. S. Doran, manager power department, Milwaukee; B. A. Behrend, chief electrical engineer, Cincinnati; Charles E. Lord, electrical patent counsel, Cincinnati; David Hall, assistant chief electrical engineer, Cincinnati; A. H. Whiteside, manager Philadelphia office; C. C. Butterfield, Philadelphia office; H. A. Moore, Philadelphia office; D. W. Pulver, manager Buffalo office; L. C. Marburg, Milwaukee, Wis.; Arthur Warren, manager publicity, Milwaukee, Wis.

Electric Storage Battery Company of Philadelphia had an exhibit which naturally attracted much attention from the delegates and visitors, embodying, as it did, the latest improvements in storage-battery manufacture and the collateral appliances invented and manufactured by this company. A cell of the type R-71 was shown, this being the type to be installed by the New York Central and Hudson River railroad in the series of eight large batteries contracted for by the railroad company of 20,000-horsepower capacity. A booster of 75-kilowatt capacity occupied one side of the booth, and together with several switchboards equipped with the Electric Storage Battery Company's recently perfected carbon regulator designed for controlling the booster used in connection with regulating batteries in railway service. Among other devices shown were the automatic cell filler, the recording hydrometer, compensating hydrometer and the signaling hydrometer. These appliances enable battery attendants to accurately check the condition of charge and discharge of their batteries. The company was represented by Charles Blizard, manager of the sales department; District Manager Frank J. Stone, Boston; District Manager Albert Taylor, New York; District Manager, G. H. Atkin, Chicago; District Manager H. B. Gay, Cleveland; Edward R. Reynolds, manager of the Pennsylvania sales office, and J. Lester Woodbridge, engineer sales department; R. C. Hull, district engineer, and F. L. Kellogg of the New York office.

The General Electric Company's display covered a large space in the main aisle of the large hall in the north of the building. The company exhibited many of its latest products in the railway field, and for the first time at a street-railway convention showed a Curtis steam turbine. The exhibit included a specially mounted car equipment for use on either direct or alternating current, with air compressor, motors and control in operation. The air compressor is designed for operation on alternating current and supplies air for the braking system. GE-605 motors are supplied with this equipment. The necessary alternating current for the motors was furnished by a 200-kilowatt rotary converter running "inverted" from the 550-volt direct-current circuit. On another frame was shown a two-motor Sprague-General Electric multiple-unit control. In addition to railway-motor equipments various General Electric railway single motors were shown, including the GE-80, GE-87, GE-66 and GE-69. A motor-driven air compressor of the General Electric direct-current type was also shown in operation. Railway supplies were also on exhibition. These included field and armature coils in various stages of construction. Aside from this car-equipment material, a 500-kilowatt Curtis steam turbine was shown dismantled. The entire exhibit was lighted by the new GE-M lamps and enclosed arcs. Two mercury arc rectifiers operating in parallel supplied current for the sign and general lighting effects. The General Electric Company's representatives at the Philadelphia convention included General Eugene Griffin, J. R. Lovejoy, W. J. Clark, W. B. Potter, B. E. Sunny, J. G. Barry, L. R. Pomeroy, C. C. Pierce, J. C. Calisch, G. D. Rosenthol, A. H. Armstrong, F. H. Case, H. L. Monroe, J. H. Livsey, J. W. Buell, W. G. Carey, J. J. Mahoney, S. W. Trawick and F. H. Gale.

The exhibits of the Westinghouse Electric and Manufacturing Company and the Westinghouse Traction Brake Company at the convention were notable for their feature of complete operative demonstration. The natural interest shown in the exhibit of two types of Westinghouse single-phase railway motors—Nos. 107 and 108—with which a number of interurban lines in the South and West have been equipped in the past year, was enhanced on Wednesday upon the announcement of the epoch-making order of the New York, New Haven and Hartford railroad. The various parts of the Westinghouse electro-pneumatic control for single-phase traction service were shown with the motors; and the Westinghouse multiple-unit control for direct-current railway service, with the latest type of rectangular switch group introduced in the equipment of the new cars of the Long Island railroad, was shown in operation. One of the most interesting features of the Westinghouse electrical exhibits was a 30,000-volt demonstration of the protection afforded by the Westinghouse multipath MP lightning arresters to either direct-current or alternating-current railway systems. The most important new traction brake equipment shown in the space of the Westinghouse Traction Brake Company was the AMS type, now in service on the Oak Square cars in Boston, automatic-air application, with provision for straight-air release, for motor and trailer service. Among the exhibits of the car-building companies was a car for the Long Island railroad equipped with Westinghouse motors and with the Westinghouse AMR traction brake, an automatic type, with provisions for gradual release, and one of the 160 new Brill cars for Baltimore for which the Westinghouse traction brake is to be furnished. The Westinghouse reception headquarters in the Bellevue-Stratford blueroom was well filled throughout the week, and Walter M. McFarland, acting vice-president of the Westinghouse Electric company, was in almost constant attendance to act as host. Joseph R. Ellicott, eastern manager of the Westinghouse Traction Brake Company; F. M. Nellis, the New England representative, and Frederick V. Green of the New York office were prominent among those at the brake exhibits. Among the books and the pamphlets given out by the Westinghouse companies was a small map folder, mentioning numerous Westinghouse engine and electrical installations in Philadelphia.

8,000-kilowatt Power Plant for Congressional Buildings.

Bids were opened on September 30th for the machinery and erection of a large central plant to be erected in Washington, D. C., to supply heat and electric light and power to the Capitol, the Congressional Library and the Senate and House office buildings, the latter two now under construction. It was required that all bids should be for the erection of the complete plant. Every bidder was also required to furnish a certified check or an indemnity bond for $50,000, to be returned to unsuccessful bidders and to the successful bidder on execution of the contract. Contract must be executed within 20 days after award; work must be started within 30 days thereafter, and completed within a year and a half after date of contract. The contractor must give bond for faithful performance in the sum of $500,000.

The building and foundations will be furnished by the government. The power house will be located in Garfield Park. There are to be 16 water-tube boilers of not less than 520 horsepower each, with damper regulators, mechanical stokers, three boiler-feed pumps, feed-water heaters, coal and ash-handling apparatus, condenser outfits and the necessary piping. There are to be four 2,000-kilowatt alternators, driven by four direct-connected engines, with switchboards, transformers, underground conduits and cables, transformers, rotaries, station wiring, etc. Piping, insulation, appliances and conduits for supplying heat from the central plant to the four buildings mentioned are also to be furnished. There is to be an electric traveling crane in the engine room. The specifications are drawn in general terms; detailed specifications are to be furnished by the bidders. Working plans are to be made by the contractor.

Cables carrying current must be provided of sufficient capacity to transmit 2,250 kilowatts to the Capitol, 1,260 kilowatts to the Library Building and 1,500 kilowatts each to the House and Senate office buildings. Transformers and rotaries are to be installed in these buildings to transform the alternating current of generation and transmission to 125-volt direct current for lamps and motors. Congress has appropriated $750,000 for the entire plant, which is to be erected under the supervision of Elliott Woods, superintendent of the Capitol building and grounds.

Electrical Exports for August.

Electrical exports from the United States for the month of August amounted to a total value of $1,131,503. This is an increase of $304,887 when comparison is made with the corresponding month last year. Both classes of goods—electrical appliances and electrical machinery, the former including telegraph and telephone instruments—show a good gain for August, 1905, as compared with August last year, as will be seen from the following figures: Electrical appliances—August, 1904, $340,254; August, 1905, $542,270. Electrical machinery—August, 1904, $486,361; August, 1905, $589,233. Good gains are also shown for the first eight

months of this year, during which time the value of electrical appliances exported amounted to $3,573,583, as against $2,769,010 for the corresponding period last year. For the same period electrical machinery shows an increase from $4,188,382 in 1904 to $5,010,531 in 1905.

Considering electrical machinery only, the following figures show the value of that class of goods exported to certain countries which represent the principal buyers during the month of August, 1905: British North America, $184,073; Mexico, $95,299; United Kingdom, $81,221; Japan, $43,628; British Australasia, $41,605; France, $35,490; Brazil, $17,476; British Africa, $14,160; Germany, $7,968; Argentina, $5,718; British East Indies, $4,697; Philippine Islands, $4,685; Cuba, $2,451.

Improved American Arc Lamp.

The American Arc Lamp Company of Kalamazoo, Mich., announces that it is now ready for business in its new and well-equipped factory. When this company succeeded to the business of the Lea Electric Manufacturing Company, formerly of Elwood, Ind., it devoted almost a year to the further improvement of the lamp formerly made by the Lea company, which had been in practical use for over 10 years. After doing this the new company presents a lamp (Fig. 1) which has been thoroughly tried. It makes a specialty of direct-current multiple lamps for use in shops, factories, etc. These lamps are of simple construction, consisting of but five parts. The swinging covers are readily opened without the use of tools, permitting access to the interior of the lamp from every side.

FIG. 1. IMPROVED AMERICAN ARC LAMP.

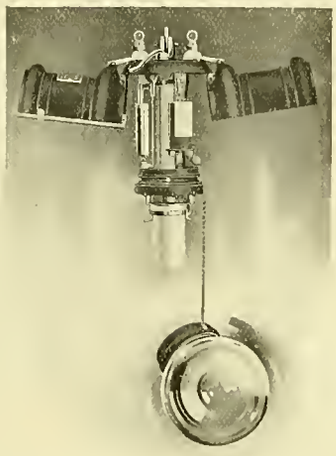


FIG. 2. AMERICAN ARC LAMP WITH COVER REMOVED.

These lamps are equipped with a magnet coil, which is practically indestructible.

The self-locking switch is an important improvement. This switch is manipulated by a lever or handle on the top cover, the same as in the old-style lamp, but in the switch itself there is a radical change. When the switch is opened by the ordinary movement of the lever it remains open, locked in position, and no amount of pressure will cause it to fly back or short-circuit. When closed it remains locked in position, forming a perfect contact. It is not affected by vibration or rough usage. This overcomes an annoying feature, noticeable in the old type of lamp.

This company has achieved a difficult problem in a simple way in securing for its lamp a great length of carbon life, the direct-current lamps running about 240 hours without trimming. The means employed in securing this result are shown by the cut of the interior of the lamp with covers removed (Fig. 2). On account of the extreme simplicity of the construction of the lamps it is possible for the user to make all repairs and practically rebuild the lamp and keep it in use for many years.

Kansas Light and Street-railway Meeting.

The eighth annual meeting of the Kansas Gas, Water, Electric Light and Street Railway Association will be held in Kansas City, Kan., on October 13th and 14th. Headquarters will be at the Mercantile Club. The committee appointed on revision of the constitution and by-laws will report at this meeting. Arrangements for visits to interesting plants, and various social features in the way of entertainment have been provided.

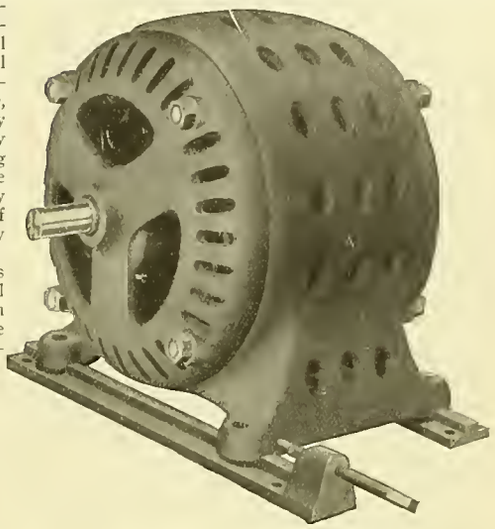
Papers on the programme are as follows: "The Tantalum Lamp," by Prof. B. F. Eyer of Kansas State Agricultural College; "Producer Gas," by R. M. Sutton of Wichita; "The High Efficiency of High-candlepower Lamps," by J. F. Schaefer of Kansas City, Mo.; "Need of Sewage-disposal Plants in Kansas," by R. E. McDonnell of Kansas City, Mo.; "Co-operation in Management of Gas, Water, Electric-light and Street-railway Companies," by C. R. Maunsell of Topeka; "Public Utilities and Municipalities," by Prof. E. H. S. Bailey of University of Kansas; "Purification," by E. S. Springer of Leavenworth; "Relative Heat-producing Values of Natural Gas, Oil and Coal," by Prof. Erasmus Haworth of University of Kansas.

On account of the convention railroads have offered a rate of one-half-fare plus $2. R. C. Johnston of Lawrence, Kan., is president, and J. D. Nicholson of Newton is secretary.

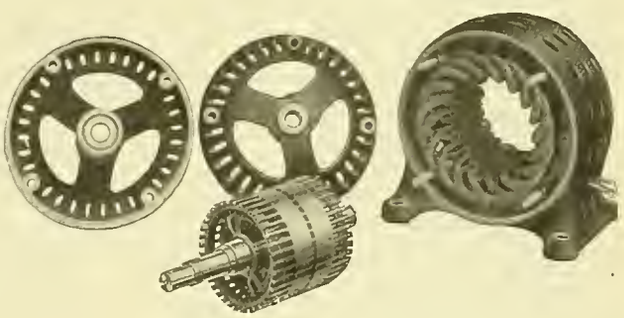
New Type of Induction Motor.

An induction motor of extremely heavy and substantial construction is shown in the two accompanying pictures, one of which illustrates the machine as a whole and the other showing the various elements. This motor is built by the National Electric Company of Milwaukee, which is well known by its products in the electrical and street-railway field, and for the Christensen air brake, which it manufactures. The motor illustrated may be operated from floor, side wall or ceiling by changing brackets which carry the bearings. Owing to the high speeds at which it operates and the small space between stator and rotor, an extremely heavy shaft is used, while the bearings are of large area, eliminating as much as possible any variation in the air gap.

The frame is made of cast-iron, into which is assembled the laminations. The windings are all form-wound by automatic machinery, and between each coil air space is provided to take care of the heating. The ventilation has also been given careful consideration, there being numerous openings provided in the frame, and also ventilating spaces between the laminations.



NEW TYPE OF INDUCTION MOTOR.



ELEMENTS OF NEW INDUCTION MOTOR.

The rotor is of the squirrel-cage type, with copper rods inserted in the slots. This is built up of laminations of mild steel assembled on a spider and held firmly in position by end plates. All bearings are self-oiling and have wearing surfaces of ample proportions.

An auto-starter is furnished with the squirrel-cage type, consisting of transformers connected across the line, with voltage taps suitable for starting the motor under different conditions of load. A switch of suitable construction is provided for throwing the motor from one voltage to another. All of this apparatus is immersed in a tank of oil, which makes it sufficiently reliable to operate at high voltages and which takes care of any heating due to starting under heavy torque.

Tape-line a Means of Fatal Shock.

Jeffries Donohue and Harry Ripson, employes of the Northwestern Telephone Exchange Company of Minneapolis, were killed by an electric shock in a peculiar manner a few days ago near Stillwater, Minn. The accident occurred at the junction of the telephone line and the 30,000-volt power line of the Apple River Power Company. With a small linen tape-line in his hand, Ripson climbed the telephone pole to measure the distance between cross-arms. He tossed the end of the tape-line over the transmission wires, and when he again took hold of the tape death resulted almost instantly. Donohue, who stood on the ground and held the other end of the tape-line, was also killed. The hands of both men were scorched and Donohue's feet were pierced as if from small shot. In searching for the cause of the accident fellow-workmen discovered that extending longitudinally through the tape line were small steel wires which served to keep the line from stretching, and which no doubt conducted the fatal current.

International Brotherhood of Electrical Workers.

The ninth convention of the International Brotherhood of Electrical Workers, the first few days of which were reported in the Western Electrician last week, was brought to a close in Louisville, Ky., on September 28th after a 10-day meeting. The convention was the most interesting and lively one in the history of the organization, the most important work done being the revising of the constitution on many important points.

An important change was the electing of officers this time for a term of four years instead of two. The executive offices will also be removed from Washington, D. C., and a referendum vote is to be taken to decide the location between Springfield, Ill., and Indianapolis, Ind. The next meeting place will be at Los Angeles, Cal., or Toronto, Canada, to be decided by vote of the members; the conventions will be held every four years in the future.

The amendment to the constitution which places all the branches of the different electrical work under two heads, inside and outside workmen, instead of 28 different heads, was finally adopted. This, it is asserted, greatly simplifies matters in the organization.

A resolution was adopted advocating that more stringent laws be enacted for the protection of electrical workmen. It is the desire that danger signs in the way of different colored cross-bars on outside poles should be in vogue, as, it is said, the work now is too hazardous. A resolution was also adopted favoring the exclusion of Chinese laborers from this country.

Much interest centered in the election of officers, which resulted in the re-election of F. J. McNulty as grand president and the defeat of H. W. Sherman, who has been grand secretary for eight years. A full list of the new officers is as follows:

Grand president, F. J. McNulty of Newark, N. J.; grand secretary, Peter W. Collins of Boston, Mass.; grand treasurer, F. J. Sullivan of Cleveland, Ohio.

Grand vice-presidents—First district, James J. Reid of Erie, Pa.; Second district, James Noonan of St. Louis; Third district, M. J. Sullivan of San Francisco.

Executive board—First district, G. C. King of Buffalo, N. Y.; Second district, John J. McLaughlin of Boston, Mass.; Third district, James J. Meade of Philadelphia; Fourth district, J. E. O'Connor of Annapolis, Md.; Fifth district, James Fitzgerald of Des Moines, Iowa; Sixth district, Walter N. Graham of Houston, Texas; Seventh district, Charles Lofthouse of Los Angeles, Cal.

Delegates to the American Federation of Labor—F. J. McNulty; W. E. Kennedy of Washington, D. C.; Stephen Fay of Chicago.

Delegate to the International Building Trades Council—Samuel Grimblodt of Chicago.

Chicago Freight Tunnels Seen Through Foreign Eyes.

Rather interesting as indicating a presumably unprejudiced outsider's impressions is the unsigned article on the Chicago freight tunnels in the London Times Engineering Supplement of September 20th. Following are extracts:

"During the past four years Chicago has been occupied in providing itself with a system of shallow tunnels on lines which differ broadly from underground means of transport followed in other cities. The most congested quarter of the city is, being duplicated some 33 feet below the road level by the construction of underground passages following the plan of the streets, constituting what may suggest lower stories of the thoroughfares above. Their special feature is that they are only to be utilized for the conveyance of goods. Up to July 31st last practically 33 miles of these tunnels were completed, and the work is now being pushed forward at the rate of about 500 feet a day. The mileage completed does not mark a limit to this curious network of freight tunnels, and they will probably reach more than double the length in course of time."

"The Chicago city authorities are now alive to the importance of seeing that the work is properly performed, and have appointed a number of engineers to supervise it. But to whatever extent the tunnels have so far been constructed without due regard to exactitude of design and thoroughness of methods, at least their promoters are attempting to deal with a knotty traffic problem, as to which, it may be pointed out, the Royal Commission on London Traffic made no recommendations at all—that is, the question of goods transport. As it is the slow, heavy-laden vehicles carrying merchandise which really create the congestion of traffic in London, the omission to consider this phase of the question seems remarkable. The Chicago citizens have set about coping with the difficulty without first appointing a commission of inquiry to devise comprehensive plans which may never be realized. The result, at any rate, is that something has been done, however short of perfection the plan might be, and it struck the writer when, during a recent visit to America, he was afforded the opportunity of going through these tunnels, that they were a feature of underground freight transport which admitted of adoption in other cities. * * * Underground railways exist, it is true, but the diversion of traffic from the streets by such means does not effect much, and in the case of London the difference either in passenger or vehicular traffic is not noticeable.

"Chicago, however, claims to have discovered a golden rule for modern urban transit, namely, 'streets for the people, tunnels for goods.' On the face of it, underground roads of this kind seem more suitable for goods than for human transport. No passengers, in fact, are to be carried in the Chicago tunnels. How far the freight tunnels of Chicago will effect a clearance of the vehicles which overload her business quarter remains to be seen; but the project at any rate appeals to common sense, and the wisdom of the experiment cannot be questioned. It may be remarked, however, that the compact area of the city's industrial center lends itself to the establishment of a network of freight tunnels beneath it. Were the business quarter spread over a wider area, somewhat segregated in parts, and generally less concentrated, as is the case with many other cities, a system of freight tunnels would not perhaps be so practicable. This 'downtown' district, it may be mentioned, although only 1½ square miles in area, is regarded as the most congested in the world. Therein is stated to be centered 35 per cent. of the railway mileage of the United States, 14 per cent. of the entire world's mileage, the termini of 25 trunk lines, and in and out of it are shipped 40,300,000 tons of goods in one year. These figures may slightly err on the side of exaggeration and admit of some correction; but there is no doubt that the traffic is far too great for the small area containing it."

"Unlike tube lines designed for passenger traffic, the tunnels do not even reveal their existence by emerging into stations at the street level. There are, in fact, no stations; as what may pass for such are merely lifts connecting with the cellars of large establishments by means of spur tracks along the line. Down these lifts the goods will be sent for dispatch through the tunnels to the railway termini, where there are also connecting lifts, as well as at the main and branch postoffices and goods depots. The plans of new buildings now in course of construction even go further by fixing the foundations on the same level as the tunnels, so as to admit of the basement answering the purpose of a freight railway station under the ground. When in Chicago the writer was shown several of these 'basement stations,' for that is what they practically are."

"The permanent way is of two-foot gauge, laid with 56-pound flange rails, over which five-ton electric locomotives are being run experimentally, taking their power from an overhead trolley wire; but some parts of the system are equipped with a third-rail conductor. The tunnels have bright incandescent lights, and a slow service is contemplated, in which no signals are to be used, and all the switches at the cross-over points will be worked by hand. The operation of the traffic, in short, will be more applicable to slow movement of street cars in crowded parts of a city than to steam railways."

Wages and Hours of Labor in Manufacturing Industries.

The nineteenth annual report of the commissioner of labor has been published, making a book of 976 pages in which are presented the results of an extensive investigation into the wages and hours of labor in the leading manufacturing and mechanical industries of the United States during the period from 1890 to 1903, inclusive. The investigation was designed to cover thoroughly the principal distinctive occupations in the leading industries belonging to the manufacturing and mechanical group in all sections of the country with a view to securing data which should be representative of conditions and show the trend of wages and hours of labor during the period covered. Occupations like transportation, mining and agriculture, are not covered in this investigation, because the force available for the work did not permit of extension to these pursuits. But practically all the leading manufacturing and mechanical industries are represented in the report. The number of industries covered is 67, while data were secured for 519 distinctive occupations and from 3,475 establishments.

The report shows that there has been a large increase in the various industries in the number of employes in 1903 as compared with 1900. Many of the industries show a decrease in the number of hours of weekly labor, and in practically all cases the wages per hour are greater in 1903 than in 1900.

In the manufacture of electrical apparatus and supplies, data were taken in only four departments—armature winding, brass finishing, machine-shop and pattern making. As records in many cases were not preserved for the entire period from 1900 to 1903, the number of establishments considered is limited. The figures below are based on data taken from but four establishments in the first and third departments named, and from one establishment in the second and fourth. Evidently, too, returns were received from shops of only comparatively small size.

The number of armature winders employed in 1890 in the four establishments was 28, which number increased to 91 in 1903—an increase of 225 per cent., and an increase of 122 per cent. over the average number employed in the 10 years from 1890 to 1899, inclusive. The number of hours per week of work decreased from 58.29 in 1900 to 54.63 in 1903. In 1900 the average wages per hour for these men was $0.2116, which increased to $0.2427 in 1903, or 14.7 per cent. The wages for 1903 also show an increase of 12.8 per cent. over the average wages paid in the 10 years from 1890 to 1899, inclusive.

There were eight brass finishers employed in 1900 in the one establishment cited against 42 in 1903. The average number employed between 1890 and 1899 was 16. Men in this department worked 59 hours a week in 1900—which was also the average for the first 10 years of the report—and 55 hours in 1903. For the 10 years from 1890 to 1899 they earned an average of $0.2534 an hour, which increased to $0.2667 in 1903, or 5.2 per cent.

Machinists were employed to the number of 68 in four establishments in 1900, which number gradually increased to 357 in 1903. Hours of labor per week were reduced from an average of 57.37 in 1900 to 55.15 in 1903. Wages per hour increased 7.6 per cent, or from $0.2499 per hour in 1900 to $0.2689 in 1903. For the first 10 years the wages averaged $0.2473 per hour.

Pattern makers show a large gain both in the number of men employed and in wages, although the data given are taken from only one representative establishment. In 1900 there were two men employed against 10 in 1903. For the 10 years from 1890 to 1899 the average was four men. The hours of work per week were reduced from 59 to 55. Average wages per hour increased 23.7 per cent.—from $0.30 per hour in 1900 to $0.3710 in 1903. The average wages per hour for the first 10 years of this period was $0.3191.

Bulletin No. 59 of the Bureau of Labor, just issued, contains further data on wages and hours of labor, giving the figures for 1904, which, in the electrical industry, show slight changes from those here given for 1903. The bulletin also contains data on retail prices of food. The two subjects treated in the bulletin are the beginning of a regular series of bulletin articles to be published annually, supplementing and continuing the two reports named.

The Auburn and Northern Construction Company of Syracuse, N. Y., has been incorporated with a capital stock of $5,000 to construct railroads, electric-light plants, etc. The incorporators are Harold C. Beatty, Harry J. Clark and Claude Bonstead, all of Syracuse.

Engineering Features of Indianapolis Federal Building.

The spacious and beautiful classic structure built by the government for a postoffice and courthouse in Indianapolis, Ind., at a cost of $2,000,000, is now occupied and all the departments are in working order. Beautiful as the new building is, inside and out, beauty has been made rather secondary to convenience. In a general way it is said that the new Indianapolis postoffice building is second to no other structure of its kind in the country.

The work and equipment of the new building have many new features. One of these is a private-branch telephone exchange for each of the telephone companies of Indianapolis. The switchboard installed by the Indianapolis Telephone Company is a sample of the most recent developments in work of this character. The equipment is mounted in a two-position, solid mahogany cabinet, finished to match the mahogany finish in the postmaster's general office, where the board is located.

The equipment consists of 50 local stations, 10 trunk lines, 10 local cord circuits and two operators' positions, each equipped with breast transmitters. The desks are arranged so that one operator can handle both positions if desired. Common battery for operating the entire plant is supplied from the storage battery in the main exchange of the Indianapolis Telephone Company, which is only 500 feet distant. The instruments are of the latest type, common-battery, two-conductor desk sets, and when connected through to the Main exchange on any one of the 10 trunk cords, the telephone user is directly in control of the supervisory signals at the Main exchange. This not only enables him to obtain a second connection if necessary without notifying the private-branch operator, but when he hangs up his receiver the supervisory signal is instantly displaced on the Main exchange switchboard, thus giving the operator an opportunity to free the trunk line for another connection.

The exchange installed by the Central Union Telephone Company is similar to that of the Indianapolis company, except it is a one-position cabinet and has fewer trunk lines. Each company has 36 telephones in the building.

The heating plant is of the Webster system, consisting of boiler plant, economizer, draft fan, house pumps, air compressors and filter tanks. The ventilators are operated by electric motors. The elevators are also of the electric type. There are four 250-horsepower Heine boilers. The electric-light system was installed by the Marine Engineering and Machine Company of New York and connects with the Home Heating and Lighting Company for its source of supply. The lighting equipment is complete in every particular, and the fixtures are of the latest and most artistic design.

Swedish Railroad Electrification.

The experimental service on the Värtan railway, preparatory to a general electrification of the Swedish state railways, has now been six months in course of construction, and next year it is proposed to extend the electrification as far as Stockholm Central Station. During the tests on the Värtan railway the current was raised to 25,000 volts with apparently satisfactory results. In June last the first electric locomotive of American manufacture (illustrated in the Western Electrician of April 15, 1905), and of comparatively small size, was put into operation, and this has since been tested on various trial runs. Another locomotive from Berlin, and of greater power is expected, in addition to which several others are being manufactured at the Swedish state railway workshops at Tomteboda. As soon as the electrification to Järfva has been completed and connected with Stockholm it is intended to use electric traction for the heavy traffic between these points.

Detroit Edison Company Expanding.

The Detroit Edison Company of Detroit, Mich., has purchased the electric-light plant of the village of Grosse Point Farms, a summer home of some of Detroit's wealthiest people, located on Lake St. Clair. The service lines will be connected with the new down-river plant some time this winter. The Edison company has been for some time acquiring small plants in villages and towns near Detroit and connecting and furnishing them with power from its central plant. Arrangements were recently made to light Delray, a suburb of Detroit, to be annexed to the city soon. A like arrangement will be followed in Birmingham.

The Indiana Union Traction Company has issued an order, it is said, requiring all its motormen to wear gloves while on duty. The order is the outcome of the severe case of poisoning of Harry Hendricks, a motorman on the Anderson city lines. He has been unable to work for some time on account of poisoning, thought by some to be caused by the brass handle on the controller.

Grand Rapids' Automatic Telephone Service.

The annual report of E. B. Fisher, secretary of the Citizens' Telephone Company of Grand Rapids, Mich., for the year ended June 30th makes a very creditable showing for that company and speaks well for the automatic system. The net growth of the entire system, local and long-distance, was 3,404 telephones, making the total number of instruments in the system at the end of the year 19,742. Outside of Grand Rapids the system embraces 80 exchanges, of which 21, with 883 subscribers, were added during the year named. Mr. Fisher says: "The net growth of the city exchange was 1,028 telephones. This remarkable increase proves that the new automatic service is giving satisfaction to its users. This will become more apparent to you when it is stated that the net addition to the city exchange during the last six months of the fiscal year was 591 telephones, as compared with the 437 of net growth in the first six months of the year; and this large growth, it should be remembered, is at prices for service which are $6 per annum higher for both business and residence telephones than the prices charged by our competitor in Grand Rapids."

The long-distance lines were increased during the year by about 25 per cent., so that on July 1st there were 1,352 miles of poles, 1,948 miles of copper circuits and 1,060 miles of iron circuits.

The earnings for the year were $418,441, an increase of $75,049 over the preceding year. Operating expenses were $105,125; maintainance, reconstruction and depreciation, $101,882, and dividends of $139,552 were paid. The capital stock of the company at the close of the year was $1,910,985.

New York Independent Telephone Company.

The New York Independent Telephone Company has filed a certificate in Albany showing an increase of capital stock from $500,000 to $50,000,000. The stockholders signing the certificate are Harrison C. Durand, Harry C. Sickels, William F. Dwyer, J. Henry Howe, Arthur C. Frith, George S. Bixby and George R. Fuller.

There has been considerable activity of late in Independent telephone circles in the East. Especially in New York city, it is reported, there is a movement in the direction of telephone competition, and recently three or four companies have made application for franchises, offering reduced rates. Persons who have large interests in the Independent movement are quoted as saying that the large increase in the capital of the New York company is evidence that an important move is about to be made. When the announcement of the financial backing is made, it is said, the list of shareholders will contain representatives of strong financial institutions.

Pittsburg and St. Louis men are frequently mentioned as being among those interested in the new movement, and if reports are true it may develop that a large holding company in which the principal Independent companies will be interested will soon be in the field for a concerted move to develop the long-distance business and gain entrance to some of the large cities not yet reached.

TELEPHONE MEN.

F. S. French, manager of the Randolph (Mass.) exchange of the New England Telephone and Telegraph Company, was hurled from the top of a pole where he was working on September 27th by coming in contact with a live electric-light wire and received fatal injuries. He was taken to the Brockton hospital, where he died shortly afterward.

Frederick S. Dickson, president of the Cuyahoga Telephone Company of Cleveland, has just completed a book on "Telephone Investments—and Others" in which he compares the securities of all kinds of corporations with those of telephone companies and shows wherein the latter are preferable. The book is well written and the arguments are forceful.

Speaking of the success of the semi-automatic telephone service in Traverse City and Cadillac, Mich., parts of the system of the Citizens' Telephone Company of Grand Rapids, the secretary of the Citizens' company in his annual report says: "In a considerable degree the innovation of such service is due to the ability and inventive genius of Mr. Edmund Land and Mr. C. E. Tarte of this company, and may be said in a way to mark an epoch in the art of telephony in this country."

The International Railway Company has purchased the franchise rights of the new Electric City Railway Company of Niagara Falls, N. Y. This latter company secured a franchise through various streets of Niagara Falls, and then the Common Council duplicated the consent to the International railway. The Electric City had quite a little track laid. This is the second time that the International railway has bought up a prospective competitor in Niagara Falls.

Indiana Telephone Items.

The Bryant telephone system in Jay County, heretofore operated independently, has entered into a 10-year contract with the Central Union Telephone Company. The company still has Independent contracts running three years.

The sale of the Tippecanoe Telephone Company investment to the Central Union Telephone Company for $22,000 has been effected, and by the absorption the Central Union gets control of a system extending from Lafayette to Crawfordsville, through Romney and Linden. The Tippecanoe lines have heretofore been considered a part of the Independent system in Tippecanoe and Montgomery counties, connecting with the Independent system in Lafayette. The system taken over is 180 miles long. O. P. Freiburg, manager of the Lafayette Telephone Company, says that the sale of the Tippecanoe company will not hurt the Independents in the least; that two competing Independent companies, covering the same territory, have by far the greatest part of the business.

The Converse Telephone Company, which for the last five years has been a sub-licensee of the Central Union Telephone Company, has severed its connection with the Bell interests and now connects only with the Independent systems. O. L. Barger, manager of the company, says that he found it would be of advantage to his patrons at the expiration of the contract to enter into a long-time contract with the New Long-distance Telephone Company of Indianapolis and the Delaware and Madison Counties Telephone Company of Muncie for service over their respective toll lines and connecting exchanges.

The meeting of the fourth district of the Indiana Independent Telephone Association, composed of Benton, Clinton, Fountain, Montgomery, Tippecanoe and Warren counties, was held in Lafayette on September 29th. About 40 companies were represented in the meeting, and O. P. Freiburg, president, expressed much gratification at the interest manifested. The work of the convention consisted of a general exchange of ideas and review of the situation, and it was shown that, notwithstanding the defection of the Frankfort and Romney companies, the Independents of the district were stronger and more united than ever before. With possibly two exceptions, all the companies of the district have become members of the state association.

Prominent Independent telephone men of Indiana believe that the increasing of the capital stock of the New York Independent Telephone Company to $50,000,000 in Albany, N. Y., last week, means the beginning of an aggressive competitive movement in New York. Mr. Holweg, president of the New Long-distance Telephone Company, said that while the Ohio and Indiana Independent companies were not directly interested in the enlarged system, they would doubtless be greatly benefited by obtaining long-distance service with many eastern points hitherto not reached. S.

Ohio Telephone Notes.

A meeting of the telephone managers in the Eighth district was scheduled to be held at the Boody House, Toledo, on October 4th, when a number of interesting topics were to be taken up. It is probable that the district meetings will come in regular rotation as they did last year. They have resulted in securing many improvements in the local exchanges and a more satisfactory system of operation in connection with each other and with the long-distance lines.

Miss Grace Brennemen, daughter of the manager of the Lindsey Home Telephone Company of Lindsey, is the subject of a little article in one of the Cleveland papers. The exchange at that point is small and it is said that Mr. Brennemen looks after much of the outside work as well as the management. Falling sick, the daughter, 18 years of age, took up his work and has succeeded in doing it to the satisfaction of all.

The Toledo Home Telephone Company has removed the old building on the Huron Street side of its property and will erect a modern structure. The front portion will be rented, while the rear will be used for storage purposes by the company.

The Selective Telephone Manufacturing Company of Springfield, incorporated a few days ago, will manufacture a lock-out device for use on party lines. The persons interested in the company have been working on the invention for some time and for the present will retain their shop in the factory of the Rogers Tool Company.

The Citizens' Telephone Company has made a proposition to install and maintain a complete fire-alarm and police telephone system in Covington, Ky., for a period of 10 years at the annual rental of $50 per box. The proposition has not yet been accepted.

In a fire that occurred at Alexandria, Licking County, a few nights ago, the telephone exchange was destroyed.

The Northwestern Mutual Telephone Company of Elmira has been incorporated with a capital stock of $10,000 by J. H. Ferrel, J. F. Reeves and others. C.

Telephone News from the Northwest.

Weather forecasts are being sent out by long-distance telephone to the farmers of the Northwest. A special ring on rural lines calls for the weather forecast and it is given for all connections at once.

The negotiations at Albert Lea, Minn., for the purchase of the local exchange have terminated in the sale of the plant to the Northwestern Telephone Exchange Company, which will make improvements to cost $20,000. The Twin City interests have also been active bidders for the local company, and it is a fair presumption that the owners received a pretty good figure for their property.

The Western Telephone Company of Casselton, N. D., has been formed by the Dalrymples, the extensive land owners, who will build a telephone system from Hope to Anselm.

The Mississippi Valley Telephone Company has completed its new line from Burlington, Iowa, to New London and Mt. Pleasant and will extend it from the latter city to Des Moines.

The Sioux City (Iowa) Telephone Company is preparing to extend its service across the Missouri River into Nebraska. This will be accomplished by carrying a cable across the combination bridge upon a staff supported above the draw spans.

The Northwestern Telephone Exchange Company announces a revision of rates for Winona, Minn., to become effective November 1st. The system has been made a central-energy one and will have individual and party-line service, the price to be graded according to the service rendered. The Northwestern company and the Winona Telephone Company are in a lively contest for business in Winona, the home company taking advantage of its competitor's revised rates, and is canvassing for additional subscribers. The Northwestern company has canvassed Foley, Minn., and has secured contracts for a good list of telephone users and will install a local exchange. This, it is said, is expected to forestall the Twin City Telephone Company, which recently bought the local exchange at Foley. R.

A Long Underground Telephone Circuit.

The American Telephone and Telegraph Company is at work in the town of Orange, Conn., laying underground wires for its long-distance system, the needed rights-of-way having been secured after some delay. When the Orange stretch is finished, about six miles in length, the long-distance wires between New York and New Haven—a distance of about 70 miles—will have been all placed underground. There are 90 wires in the Orange conduits.

GENERAL TELEPHONE NEWS.

W. S. Raish has purchased the business of the Silver Creek (Neb.) Telephone Company.

There will be a called meeting of the Texas Independent Telephone Association in Dallas during the State Fair, November 6th, 7th and 8th.

The Fairbury Telephone Company of Fairbury, Neb., has increased its capital stock from $30,000 to $50,000, and will make some important improvements and extensions.

Among recently incorporated telephone companies are the Eastern Utah Telephone Company, Salt Lake City; the Dresden Telephone Company, Dresden, Kan., and the Badger Telephone Company, Badger, Iowa.

The Citizens' Telephone Company of Hopkins, Mich., has commenced the work of rebuilding the entire local exchange, which includes the township and telephones in Monterey and Watson. It is expected that the work will be completed in about six weeks.

Employes of the Bell telephone company in Kansas City, Mo., have formed a social organization. At the organization meeting 140 were present, and L. A. Mack was chosen president and Charles Bozard, secretary. It is expected to have a membership of 300.

The court at Guthrie, Okla., has dissolved the injunction against the Pioneer Telephone Company by which it was intended to prevent the company from advancing its rental rates in Oklahoma City. The advance in rates came after a consolidation of the Bell and Pioneer companies in the territory.

The Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y., reports having closed contracts for switchboards for the following places: Mt. Pleasant, Ill.; Hunter, N. D.; Union, Miss.; Harris, Pa.; Des Moines, Iowa; Roann, Ind.; Tower Hill, Ill.; Milacca, Princeton, Foley, North Branch, Rush City, Mora, Forest Lake, Grandy, Lindstrom and Braham, Minn.; Olathe, Kan.; Rochester, N. Y.; Truro, Iowa; Kalama, Wash.; Marathon, Wis.; Rose Hill, N. Y.; Watson, Mo.; Tolo, Ore., and Niagara Falls South, Ont.

CORRESPONDENCE.

Great Britain.

London, September 19.—The Glasgow corporation, as the original champion of municipal telephony, always commands attention when this matter is on the tapis for discussion. Even in Utopian Glasgow there are individuals who do not think well of the various municipal enterprises of the corporation. Hence it is not surprising that the presentation of the accounts of the telephone department was the occasion of a debate in which numerous hostile speeches were delivered. From the accounts it appears that, whereas the revenue increased by some $28,500 over the previous year, the expenditure increased to the extent of nearly $40,000. The chief bone of contention on the part of the opposition is the small sum available for depreciation, having in view the limited term of the license, and this argument is now further emphasized by the ratification of the agreement between the postmaster-general and the National Telephone Company, from which it is very clear that no further municipal licenses will be granted and no extensions to existing licenses. It was stated, on the other hand, that the company has been carrying on a cutthroat competition in Glasgow and secured 998 of the corporation's subscribers last year. The accounts were finally adopted by a large majority. The total capital expenditure on the Glasgow telephone system is $1,750,000, and the amount set aside last year for depreciation was the whole of the net profit, $7,500. The capital expenditure for the year was just under $150,000.

American engineers have heard a good deal of the South Lancashire Tramways Company, the opening of whose lines two years ago began an era of long-distance tramway communication in this country, the progress of which has been well maintained. As the name shows, the lines ran in many directions, all over the south of Lancashire, in a dense area, and the most noteworthy feature was that the company's cars ran over several municipal systems, and in order to maintain the continuity connecting lines for many miles were laid between the various towns. Thus the cars started upon the corporation lines at Liverpool, and running over a mixture of lines constructed by the company and owned by local authorities, traveled as far as Bolton, some 30 or more miles, distances much greater than hitherto attempted by trams here. It is surprising, therefore, to have to record that the company's undertaking is up for sale, as a whole. The scheme has such promise that it is not likely to be allowed to become derelict by the many tramway promoters in Great Britain.

The London County Council is again being petitioned by some of the London borough councils to introduce their proposal into Parliament next year, empowering the latter to undertake the wiring of consumers' premises on the hire-purchase system, or "free," with an additional charge for current. Why the London councils should be so persistent I do not know, for the experience in the provinces, under the most favorable circumstances, is that this class of business is a doubtful speculation. This was made very evident at the convention of municipal electrical engineers in Scotland, and certainly, whatever the opinions of the councilors may be, the heads of the electrical departments in many towns are not enamored of the "free" wired customer, owing to the extra work involved and the almost negative margin of profit to be shown.

London has never yet created a record in the number of electrically driven motor vehicles upon her streets. Fate seems against us, for the only electric motor-car company of any practical magnitude is putting its business up for sale.

The Marylebone Borough Council has made history by the events which have followed its decision to buy up the electric-light company operating in its district. All this has been comfortably settled, however, although I believe the ratepayers would disagree as to the degree of comfort as personified by their rate demands. However, the corporation is now busy converting the old low-pressure system to the more modern 240-volt supply, which is the almost universal practice in Great Britain. This change-over has to be made at the expense of the council, but certain consumers objected, and arbitration by the Board of Trade was necessary. It was not anticipated that the board would decide against the council, and the award just published settles the conditions upon which the change shall be made. Unfortunately, the conditions render further arbitration possible. Arbitration is now a household word in Marylebone, in consequence of the original one, which cost the council over $6,000,000, but from the demeanor of the opposing consumers, it would be seen that the conditions imposed in this instance would satisfy them. The instance is interesting, because of the very few cases in which it can occur in the future. G.

New York.

New York city, September 30.—The second of the twin tunnels connecting New York with Jersey City was opened yesterday afternoon with some official ceremonies by Walter G. Oakman, president of the Hudson Companies, and William G. McAdoo, president of the New York and New Jersey Tunnel Company. These tubes are intended exclusively for trolley traffic, which is likely now to be in operation within a year.

The Hudson and Manhattan Railroad Company, which is working out one of the schemes for an under-river tunnel, has taken steps to acquire property by condemnation proceedings in Cortlandt Street, the land being needed for terminal purposes.

The state railroad commissioners, after investigating the wreck on the elevated of Monday a week ago, have come to the conclusion that the towerman and the motorman were to blame for the accident.

The New York, Westchester and Boston Railway Company, which is planning to connect New York with Boston by an electric railroad, has deposited $20,000 with the city of Mount Vernon, N. Y., as a guaranty that it will commence construction within 60 days of November 1st. Captain Pratt, who is in charge of the engineering work, has everything ready for an immediate commencement.

A trial trip of a three-car electric train was made on Monday on the Long Island railroad to Belmont Park from Flatbush Avenue, and everything being satisfactory heavy 10-car trains will be run for the racing on October 2d. The speed of these trains will be 50 miles an hour.

The New York City Railway Company has put in an automatic electrically operated switch at Lexington Avenue and Twenty-third Street. A motorman on a train can throw this switch and the services of a switchman will no longer be required at this point. A similar switch is to be put in at Twenty-third Street and Broadway, and a policy is announced that will gradually abolish all hand-operated switches.

One of the newest schemes for electric traction in the northern suburbs of Greater New York is that of the Bronx, Yonkers and White Plains railroad, which has applied for a franchise.

The New York Edison Company, anticipating an increased demand for electric light and power in the most northerly parts of Manhattan, has bought a tract of about 30 lots, bounded by Academy Street, Two-hundred-and-first Street and the Harlem River. The plot has an extensive water front both on the Harlem River and Sherman's Creek Basin. It is said that the company is not likely to begin the construction of the new plant for at least a year or two, or until the development of the surrounding territory seems to warrant it.

A commencement has been made on the work of constructing the United Engineering Building on West Thirty-ninth Street, near Fifth Avenue.

The United States cruiser Columbia, returning to New York port on Monday, reported that she had destroyed a derelict schooner, the position of which had been reported by means of space-telegraphy. D. W. W.

New England.

Boston, Mass., September 30.—Considerable interest is attached in this section to the fact, printed in the Western Electrician last week, that the New York, New Haven and Hartford railroad has ordered from the Westinghouse Electric and Manufacturing Company 25 electric locomotives, which will be used in operating trains between Woodlawn and the Grand Central Station in New York. The adoption of the alternating-current motor, and its adaptability to long-distance use, is considered an indication that the purpose of the management is to eventually convert the whole system from steam to electric traction. It will surprise nobody hereabouts to learn of the gradual transformation of the road and the ordering of more locomotives in the near future in furtherance of such a plan.

Toward the end of October there will be completed and in operation, it is announced, the largest and most complete power-developing plant in Western New England. The Chittenden Power Company's station at East Pittsford, Vt., which has been under construction for some time, is nearly finished. Its cost is about $4,000,000. Three large turbines in the main station will be fed at a head of 208 feet, developing for use in the surrounding section, including the city of Rutland, a high-tension current of 13,300 volts, through three 400-kilowatt revolving-field generators. The company is allied with the Rutland Street Railway Company, and one-third of the power generated will be utilized in running its trolley cars, the remainder being designed for commercial purposes of a general nature.

A number of New England street-railway men were in attendance at the Philadelphia convention, the Massachusetts Street Railway Association having chosen as delegates at its annual meeting the following-named members: Hon. E. P. Shaw of Newburyport, F. H. Dewey of Worcester, R. S. Goff of Fall River, E. E. Potter of New Bedford and H. C. Page of Springfield.

The Consolidated Railway Company of Connecticut has obtained formal possession of the Stamford Street Railway Company, the necessary transfer having been filed September 23d. The price paid was $92,240. B.

Southeastern States.

Charlotte, N. C., September 30.—The town of Belton, S. C., is being wired for electric lights, and the dam of the Belton Power Company at Holliday Shoals has been completed. It is expected that the current will be turned on not later than November 1st.

The town of Monticello, Ga., has bought the electric-light plant, the property of B. Jordan, and will operate it in connection with the waterworks system, using electric power for pumping the water.

It has been found that the big waterpower at Whitney, near Salisbury, N. C., with a dam estimated to develop 25,000 horsepower, will, on account of the larger size of the basin, be capable of developing 50,000 horsepower. The basin, it has been found, will hold the entire night run of water over to the next day. It is expected that the company, in which E. B. C. Hambley of the Whitney Reduction Company is interested, will have the 50,000 horsepower of electrical energy on the market in two years. The contracts have been let for the dynamos, waterwheels, etc., for six units of 8,000 horsepower each. It is said that when this power is developed, the company will turn its attention to another site on the Yadkin River, where power is available sufficient to raise the total output to 100,000 horsepower.

There is a revival of interest in the proposed electric railway from Athens to Carnesville, Ga., and it is said that southern capital will build the line if former offers made to Ohio capitalists will be renewed by counties to be traversed.

Poles have been placed for transmitting the electric power from Neals Shoals to the Union and Buffalo Cotton Mills at Union, S. C. A trolley line is also being constructed in the same connection.

On account of the low water, due to drought, several electric power plants in the South have been seriously crippled for some weeks, with no relief in sight.

On account of inability to get rights-of-way, it is reported that the new Charleston (S. C.) and Summerville electric railway may have to abandon plans, at least temporarily. Part of the construction outfit is reported to have been sold by the owners and promoters.

The Virginia Peninsular railway has been organized to build a railway from Newport News to Yorktown and other points, using gasoline-motor cars. The capital is $300,000, and W. A. Post is president.

Walter G. Allen, district electrical engineer of the District of Columbia, in his annual report has asked for $49,000 increase for the proper extension of the lighting system with the normal growth of the city and the opening of the subway in Washington. The sum of $12,000 is also asked for removing the old telephone switchboards and replacing them with new ones. L.

Ohio.

Cleveland, September 30.—Perhaps the most important event in electric-railway circles the last week was the incorporation of two companies which will have their headquarters in East Liverpool. From present appearances this is the beginning of a movement to merge the railway and lighting business in that section under one management, with the idea of extending the service and reducing the expenses of management. One of the companies will be known as the East Liverpool Traction and Light Company, and it will have authority to build a line from East Liverpool to Bellaire, opposite Wheeling, and connecting Wellsville, Toronto, Steubenville, Mingo Junction, Martins Ferry and Bridgeport. The other company is the East Liverpool and Youngstown Railway Company. It is said that this company will take over the portion of the road that was built by Lieutenant-governor Asa W. Jones and associates, who began the construction of a road between Youngstown and East Liverpool some years ago. It is asserted that eastern capital is back of the enterprises. The nominal capital stock of the first-named company is $6,000 and of the second, $5,000.

The Buckeye Motor Manufacturing Company of Dayton has been incorporated with a capital stock of $10,000 by John H. Rose and others.

A road from King's Mills, near Cincinnati, to Morrow will be built by the Interurban and Terminal Railway Company of Cincinnati. It will be seven miles long and will cost about $200,000.

On account of an extensive march the construction of the electric railway from Toledo to Ottawa Beach is causing the Toledo Railways and Light Company quite a little trouble. The track must be laid on a fill, and the trouble comes in getting the fill to keep its proper position.

At the annual conference of the Methodist Episcopal church at Columbus a few days ago the ministers indicated a preference for charges located along the electric railways, and it was with more than usual difficulty that the bishop was able to make the assignments.

The following persons, connected with the Cleveland Electric Railway Company, attended the annual meeting of the American Street Railway Association at Philadelphia: John Stanley, general

manager; Henry J. Davies, secretary; George Radcliffe, general superintendent; A. E. Duty, assistant superintendent; E. G. Cook, electrical engineer; Charles Clark of the maintenance-of-way department; Terrence Scullin, master mechanic, and W. G. McDole, auditor.

The capital stock of the Bullock Electric Manufacturing Company of Cincinnati has been increased from $500,000 to $3,000,000. O. M. C.

Indiana.

Indianapolis, September 30.—Articles of incorporation have been filed by the Indianapolis and Louisville Traction Company with a capital stock of $10,000 and a directorate composed of J. R. Schindle, Samuel Adams, Charles Rodman and Maurice Cabill. It is the purpose of the company to establish direct traction communication between Louisville and Indianapolis by building a line from Louisville to Columbus to connect with the Indianapolis and Columbus line. The promoters are the same as those controlling and operating the Louisville and Southern Indiana Traction Company. The headquarters of the company will be in Jeffersonville.

Convinced by its experience on the Rushville line that the single-phase alternating-current electrical system is productive of better results than the direct-current system of propulsion, the Indianapolis and Cincinnati Traction Company will place the single-phase system on the Shelbyville division. This will be done as soon as the new equipment that will be necessary can be provided. The cars have already been ordered for the new service, 10 passenger and four express cars. They will be like the Rushville cars now in use, and the contract for their construction has just been let to the Barney & Smith Car Company of Dayton, Ohio.

To start an interurban express company in a small way, is the purpose hinted in the organization of the Interurban Express Company, with headquarters in Jeffersonville, articles of incorporation for which have been filed with the secretary of state. The capital stock is $10,000. The directors are R. W. Waite, John F. Scratton and C. D. Kelso.

Through service from Fort Wayne to Lima, Ohio, over the Fort Wayne, Van Wert and Lima electric line was inaugurated last week. Samuel Murdock of Lafayette and several Fort Wayne men who are also interested in the line, with a few invited guests, made the initial trip.

The Sanborn & Marsh Electric Company of Indianapolis has secured the contract for building the electric-light plant at Cicero, and the work is now progressing rapidly.

The Warsaw gas and light plant, formerly owned by Messrs. Dick and Parker, has been purchased by the National Gas, Electric Light and Power Company of Detroit, for $150,000. Improvements will be made on the plant. S. S.

Michigan.

Detroit, September 30.—The plan of Detroit's council for a trackless trolley line across Belle Isle bridge, to take the place of a carry-all line now operated by horses, has received a setback in the opinion of the corporation counsel, which is to the effect that the Public Lighting Commission, now furnishing the street lights, was organized for that purpose only and that it would have no right to furnish power for a trolley line, even for a public park, such as Belle Isle.

The plans of the Detroit City Council for the building of tracks and turnouts on Griswold Street, to be rented by the Detroit United Railway, will be formally presented to President Hutchins of that line. If the street railway will rent these tracks it will be an opening wedge for municipal ownership in Detroit.

It is expected that early in October the contracts for the new Murphy power steam-heating and cold-storage plant will be let. The building will be located at the corner of Congress and Wayne streets, and will bring about the largest contract for steel ever placed in a single building in Michigan. Architects have been working on the plans for this building about five months, and it will be one of the most complete and up-to-date plants of this kind in the country.

The Municipal League of Detroit is sending out letters to the various members of the organization asking for expressions of opinion on municipal ownership and operation of street railways. Answers to five general questions are requested.

The Pontiac Common Council has closed a contract with George E. Fisher, president of the Standard Lighting Company, for electric street lights in the city at the price of $55 per lamp on a schedule of every night until one o'clock a. m.

The National Gas, Electric Light and Power Company of Detroit has purchased the gas plant at Niles, Mich., and at Warsaw, Ind. It is understood that the Electric Light and Power Company of Warsaw, a former competitor of the gas plant, has gone into the hands of a receiver. The officers of the National Gas, Electric Light and Power Company are James T. Lynn, president; F. K. Pelton, secretary, and Elwood T. Hance, treasurer.

The village of Wolverine has been offered electric lighting and waterworks by persons who propose to obtain the power from a dam in the Sturgeon River if a contract for the plant can be agreed upon.

The promoters of the new Detroit-Bay City Traction Company will give a banquet in Bay City next week on the occasion of the breaking of ground for the new road. It is stated that the contract for building the road has been awarded to a Chicago company, but that the Wayne Construction Company of Detroit has been organized as a subsidiary company for the purpose of doing business in Michigan. The promoters of this line are E. C. Christian and L. A. Rockwell.

The People's Automobile line of Monroe, Mich., which is managed by O. L. Mead, makes the announcement that it will furnish that town with a complete automobile street-car system, cars to be run on a 15-minute schedule.

Through the leadership of Walter B. Taylor, mayor of Kalamazoo, the council has voted that no more franchises be granted for the laying of tracks by private corporations on the streets of the town. A franchise has just been granted to the Dunkley-Williams Traction Company, but all other companies will have to come in over tracks laid by the city. The city now owns its lighting and water systems and there is a strong sentiment for municipal ownership.

The Detroit Electrical Novelty Company has filed articles of incorporation, with a capital stock of $30,000. The greater portion of this amount is represented by the value of Robert Wardle's interests in patents for an electrically illuminated clock. C. G. W.

Northwestern States.

Minneapolis, September 30.—The Watab Pulp and Paper Company of St. Cloud, Minn., has awarded the contract for the electrical machinery for its new paper mill at Watab, Minn., to the General Electric Company. The contract amounts to about $35,000.

An election will be held at Green Bay, Wis., to vote on the question of granting a 50-year franchise to the Fox River Electric Railway and Power Company.

Incandescent lamps will be substituted at Omro, Wis., for arc lamps for the street lighting.

Kurtz & Root of Appleton were awarded the contract at $9,100 for the electric-light fixtures at Menasha, Wis.

A local stock company at Miller, S. D., has bought the electric-light plant and will extend and improve the system.

The electric-light plant at Northfield, Minn., has been sold to the Cannon River Electric Company.

The St. Croix Falls Improvement Company has executed a mortgage to the City Trust Company of Boston for $2,000,000. Five per cent. 30-year bonds of $1,000 each will be issued. The company is at present engaged in developing the waterpower at Taylors Falls, Minn., with a view to bringing power to Minneapolis. The work is well under way, and it is hoped that the company will begin supplying customers shortly after the first of the year. R.

Rocky Mountain States.

Salt Lake City, September 29.—Information has been received at Lewiston, Idaho, that if funds for the Lewiston and Southeastern electric railway are not forthcoming from the firm with which negotiations are pending, the road will be financed by the Commercial Trust Company, through W. P. Hurlbut & Co. of New York. In the rich agricultural district which the projected railway would traverse the Commercial company has already made heavy investments.

The Intermountain Power Company, with a capitalization of $1,500,000 has filed its articles of incorporation in the state of Nevada. Included in the plans of the new company is the construction of four large power plants in the Salt Lake Valley, these to supply electrical energy to the mines and smelters. The company' engineer, Mr. F. C. Kelsey of Salt Lake, has already completed surveys for reservoir sites, and the company expects to at once begin construction work on at least one of the plants. Ohio capitalists are at the head of the enterprise, which is represented locally by J. J. Chambers.

A copy of the articles of incorporation of the Pend d'Orielle Electric Company of Spokane has been filed with the secretary of state at Boise, Idaho. The company plans the establishment of an electric power plant at Sandpoint.

The Moscow Electric Light and Power Company of Moscow, Idaho, has secured a contract to pump the water for the city. The plant which is to be installed for this purpose includes a three-phase generator, electric motor and pumps.

The Prescott (Ariz.) City Council has made all arrangements for the selling of $100,000 bonds. In addition to the new and improved machinery to be installed at Del Rio, the council decided to advertise for bids for a dynamo to furnish power for three Worthington pumps to be installed at an auxiliary pumping station at Willow Creek. Bids for the dynamo will be received until October 2d.

General Manager M. H. Gerry of the Helena Power Transmission Company of Anaconda, Mont., has awarded the contract for the electrical equipment of the waterpower plant to the Westinghouse Electric and Manufacturing Company. The contract calls for delivery in five months. He also awarded a contract for the steam-auxiliary equipment at Butte, Mont., to the General Electric Company.

The City Council of Artesia, Eddy County, New Mexico, has awarded to Bond & Huskey of Beaumont, Texas, a franchise for 25 years to operate an electric-light plant in that town.

The consolidation of light and power interests at Reno, Nev., has resulted in a readjustment of the distribution. The entire territory north of the Southern Pacific tracks and the town of Sparks has been placed on the line of the Washoe Power and Development Company, and within the next few days every light in Reno will be using current from the plant of the old Washoe company near Laughton's. As soon as the transfer is made the city of Reno will take its entire current from this plant. The sub-station of the Reno company in the western part of the city will be closed down and the Floriston power will be used altogether for Carson, Virginia and other towns in that section. Both Richard Kirman and John Humphreys retain stock in the new Union Power and Light Company, which is capitalized at $2,000,000.

A power plant will be constructed soon at Battle Creek, near Salt Lake City, by the Telluride Power Company, the plant to have a capacity of 25,000 horsepower. G.

Pacific Slope.

San Francisco, September 29.—It is understood that the contract for two 400-kilowatt three-phase generators for the Edison Electric Company of Los Angeles has been awarded to the General Electric Company. The installation of the main power plant of the Edison company in the Kern River Canyon will proceed promptly, the machinery having been ordered for six months' delivery. The order for waterwheels was the largest single order of the kind ever given in the West. There are four twin-impulse wheels of 10,750 horsepower each. A General Electric three-phase generator of the overhung type is direct-connected to each wheel, giving 43,000 horsepower in four units. The distance of transmission from the power plant to Los Angeles is about 105 miles.

The Ocean Shore Railway Company's petition for a 50-year franchise within the city of San Francisco has been favorably reported by the street committee of the board of supervisors. The road is to run from the county line near the ocean to Islais Creek at Illinois Street. A franchise for a cross-town line passing through Golden Gate Park to tap the Richmond district, was also recommended. It is possible that the franchise will have to be limited to 25 years in the case of the feeder, although the main-line franchise secured the same terms as a steam road. The cross-town line will pay a percentage of its gross receipts to the city and will pave the streets traversed. The main road will be 83 miles in length, extending to Santa Cruz.

The Oro Water, Light and Power Company has received bids, through Cory, Meredith & Allen of San Francisco, for two 750-kilowatt three-phase 60-cycle generators. There will be two waterwheels, direct-connected, operating under a head of 460 feet of water. The plant will be installed on the Feather River, within easy transmission distance of Oroville, Cal., where about 30 gold dredges are operated by electric power.

The San Joaquin Electric Company of Fresno has ordered, through the Wagner Electric Manufacturing Company's San Francisco office, 15 100-kilowatt transformers for the 30,000-volt line to Fresno, Cal. They will be installed in sub-stations in and around Fresno.

An application for a 25-year franchise for an electric street-railway line on Thirtieth Street, from Darmouth Street to Riddle Avenue, has been filed by the Bartlett Estate Company in Los Angeles, Cal.

Surveyors for the Kemp van Ee cement and electric-railroad syndicate have been making the final survey in San Juan Canyon, Cal. The syndicate has opened offices in the Crossley Building, San Francisco, under the name of the San Juan Contract and Finance Company.

Mayor Mott has approved the ordinance passed by the City Council authorizing the Board of Public Works of Oakland, Cal., to advertise for bids for placing the fire-alarm and police-telegraph wires underground, that is, those which are included within the underground district as fixed by ordinance.

Manager Welsh of the Citizens' Light and Traction Company of Salem, Ore., announces that eastern capitalists behind the Portland Consolidated Railway Company have purchased all the interests in the local plant heretofore owned by I. W. Anderson of Spokane and the firm of Rhodes, Sinkeler & Butcher of Philadelphia, and will take immediate possession. Their object is to connect Salem and Portland by electric railway.

The Electric Bond and Share Company of New York city has raised the sum of $4,000,000, it is said, for the purpose of installing an electric power plant

at Mono Lake, Cal., and for constructing a transmission line to Tonopah and Goldfield, Nev., a distance of 100 miles. The capacity of the plant will be 25,000 horsepower. Surveyors will be in the field within 10 days locating a route for the line. James Arkell represents the company.

The Oregon Water Power and Railway Company of Portland, Ore., has placed an order aggregating $150,000 for transformers, generators and water-wheels for the electric power plant now under construction at Cazadero. These are to be delivered in Portland by the first of the year.

W. W. Whipple, who was granted the franchise to construct a telephone and electric-light and gas plant in the city of Astoria, Ore., has complied with all the provisions of the ordinance and paid the first $500 into the city treasury. A company has been organized to put in both plants.

The Nisqually Power Company has been incorporated at Tacoma, Wash., with a capital stock of $100,000. R. L. McCormick and George S. Long, Coast representatives of the Weyerhaeuser Timber Company of Minneapolis, compose the executive board. The waterpower of the Misqually River is to be developed and mills operated by electric power.

The city clerk has been advised to advertise for bids for the construction of a waterpower electric generating plant for the city of Tacoma, Wash., the capacity not to exceed 10,000 horsepower. A.

PERSONAL.

L. A. Olmsted, Jennie Landan and S. B. Blake have incorporated as the Columbia Dry Battery Company of Chicago, and propose to manufacture electrical batteries. The capital is $2,500.

Mr. D. W. Roper, who has been for several years in the engineering department of the Chicago Edison Company as one of Mr. Junkersfeld's chief assistants, has been appointed assistant to the chief operating engineer to succeed Mr. W. G. Carlton, resigned.

The unveiling of the monument erected to the memory of Zénobe Gramme is scheduled to take place in Liége, Belgium, on October 7th, in connection with the exposition in that city. Mr. Frédéric Nyst of Liége is chairman of the executive committee of the general committee which has charge of the memorial.

As general sales manager the Canadian White Company has secured the services of Frank Hooker Alfred, member of the American Society of Civil Engineers. Mr. Alfred has been actively engaged in railroad construction from the time he finished his education at the University of Michigan and the Ohio State University.

Errett L. Callahan, manager of the Prometheus Electric Company, New York, has resigned to take charge of the electric-heating department of the General Electric Company in the Chicago territory. Mr. Callahan has been active in the electric-heating field for the last four years, having been also connected with the Simplex Electric Heating Company as assistant manager.

O. A. Stranahan, who joined the Allis-Chalmers Company in December, 1904, to become manager of the power department, has been promoted to the position of sales manager. Mr. Stranahan assumed the duties of his new place on September 1st. His headquarters are at Milwaukee. M. C. Miller has been made assistant to the sales manager. He takes charge of all matters in that department which do not require the personal attention of the sales manager.

Kenneth B. Thornton has been appointed operating engineer of the Canadian White Company of Montreal. He is a past-president of the Canadian Electric Association and is an associate member of the American Institute of Electrical Engineers and the Canadian Society of Civil Engineers. After a three-year course in electrical and mechanical engineering at the Central Technical College, South Kensington, London, England, Mr. Thornton returned to Montreal and entered the employment of the Royal Electric Company in the manufacturing, testing and drafting departments. In 1895 the Royal Electric Company was supplying light and power in and around Montreal. At that time Mr. Thornton was transferred to the operating department, and thereafter until August, 1905, he was intimately associated with the construction, operation and engineering details in connection with the generation and distribution of light and power for that company and the Montreal Light, Heat and Power Company.

F. B. Huntington, secretary of the Eastern Wisconsin Railway and Light Company of Fond du Lac, Wis., was elected vice-president of the company at a recent meeting of the directors to fill the vacancy caused by the resignation of T. F. Grover, who for a number of years had been vice-president and general manager. No general manager was appointed and the company is also without a president, owing to the sudden death last month of President F. B. Hoskins. Mr. Hoskins was a leading citizen and ex-mayor of Fond du Lac. For a few days before his death he had been especially active in connection with the work of constructing a track over the company's private right-of-way for the interurban road into Oshkosh. Death resulted from acute appendicitis. Temporarily Mr. Huntington will have full charge of the company's affairs. Mr. Grover, who is a director of the company, was present at the meeting and then left to attend the street-railway convention in Philadelphia. He has not yet made public his plans for the future.

W. T. McCaskey, who was until recently manager for Agar, Cross & Co. of London and for years before identified with Edison, Westinghouse and other electrical interests, has joined the Allis-Chalmers Company and will act as a special representative where contracts are being considered for such work as the equipping of interurban railroads, hydro-electric projects and others requiring special knowledge. Mr. McCaskey is a native of Wisconsin, having been born in Richmond County in 1863. His experience in electrical work began in 1882, when he took charge of the plant of the Eau Claire Electric Light and Power Company. Later he was connected with the Sperry Associate Electric Company of Kansas City, and he operated the first electric-lighting plant in Fort Worth, Texas, in 1885. From 1889 to 1894 he was on the Pacific Coast and connected with Edison and other interests. He spent the years from 1894 to 1899 in Chicago as a representative of the Standard Electric Company and as a general contractor, and then went to Buenos Ayres, South America, to represent the Westinghouse Electric and Manufacturing Company and Agar, Cross & Co., where he remained until 1901. He was director in Spain and Portugal for the Société Anonyme Westinghouse until December, 1903, and manager for Agar, Cross & Co. until May 1st of this year. Mr. McCaskey will make his headquarters in Milwaukee.

Willard G. Carlton, until October 1st assistant to the chief operating engineer of the Chicago Edison Company, has resigned that position and is now superintendent of power of the electrical zone of the New York Central and Hudson River Railroad Company, with headquarters in New York city. He will have charge of two generating stations, eight sub-stations and the transmission lines by which current is to be supplied for the electrical operation of railroad trains entering New York city and in the suburban service. The generating stations will produce 25-cycle current at 11,000 volts by turbo-generators. One is located at Port Morris on the East River and the other near Yonkers on the Hudson.

W. G. CARLTON.

Mr. Carlton gradnated from Sibley College, Cornell University, in 1892. He spent one year with the General Electric Company at the Lynn factory, and began work for the Chicago Edison Company in the summer of 1893. He was employed first in the construction department, later in the drafting room and operating department, and for the last five years he has been assistant to the chief operating engineer. He has had, during this time, direct charge of the installation and maintenance of all underground lines. Mr. Carlton is esteemed alike for his thoroughness as an engineer and his modesty and likableness as a man. No man among the younger electrical men in Chicago has been more highly regarded, and his departure is sincerely regretted. Mr. Carlton has taken a valued part in the meetings of technical societies in Chicago and has contributed useful papers. He is an associate member of the American Institute of Electrical Engineers. On September 26th his Chicago associates gave him a complimentary dinner at the Hamilton Club, and many wishes were expressed for his future good fortune.

ELECTRIC LIGHTING.

The contract has been let for a $150,000 power plant to furnish Las Vegas, N. M., with power and light.

M. Morrow of Peru, Kan., expects to get a franchise for an electric-light plant in Cherryvale, Kan.

The Tonganoxie (Kan.) Gas and Electric Company has been incorporated with a capital stock of $20,000.

J. B. Covington of Hearne, Texas, is about to install an electric-light plant and telephone exchange in Marfa, Texas.

John H. Bell, Jr., has secured a franchise to build and operate an electric-light and power plant in Hopkinsville, Ky.

Sealed proposals for furnishing and installing the fixtures for electric lighting in 30 sets bachelor quarters, three double sets officers' quarters, and the post exchange and gymnasium building at Fort Monroe, Va., will be received until October 16th. Bids should be plainly marked as such on envelope or outside wrapper. Address Captain R. H. C. Kellton, Q. M., Fort Monroe.

The town of Mooresville, N. C., will vote, October 10th, on the issuance of $10,000 in bonds for the establishment of an electric-light plant.

The Woodward Cotton Company has been granted a franchise by the City Council of Woodward, Okla., to furnish the city with electric lights and power for 20 years.

The City Council of Wynnewood, I. T., has decided to call an election to vote on issuing bonds in the sum of $40,000 to build a system of waterworks and electric lights.

The city of Harper, Kan., is to have a municipal electric-light plant. Plans are on file with W. K. Palmer, 718 Dwight Building, Kansas City, Mo., where bids will be received.

The stockholders of the Central Heat and Power Company of Rockford, Ill., decided to improve the lighting plant, and a new 500-horsepower engine and generator will be purchased.

The plant of the Vinita Electric Light, Ice and Power Company at Vinita, I. T., has been destroyed by fire. The loss is $35,000, with insurance of $12,500. P. L. Soper is president of the company.

ELECTRIC RAILWAYS

Promoters of the St. Joseph-Wathena (Mo.) electric railway contemplate the use of gasoline-electric motors, using a gasoline engine on each car to operate the dynamo.

Returning from the Philippines, Mr. Taft, secretary of war, says: "The most noteworthy change is the construction of the electric street railway along 33 miles of the streets of Manila. It is a paying property, greatly patronized by the natives, and has revolutionized living in the city."

In a suit brought by a Cincinnati lady against the Cincinnati Traction Company Judge Swing, it is reported, held that a $5 bill is not legal tender for a street-car fare, because excessive. The plaintiff was put off a car because the conductor was unable to change the bill and she had no other money.

George T. Bishop of Cleveland, Ohio, will go to Baltimore, Md., shortly to look after securing an entrance to that city for the Washington, Baltimore and Annapolis Traction Company, which is being constructed by the Bishop-Sherwin syndicate. The City Council, after strenuous session for several months following the great fire, adjourned last spring for a long vacation, without acting upon an ordinance that had been presented by the syndicate managers. It is thought that it will be given consideration at this time.

Colonel E. F. Mitchell of Fort Worth, Texas, one of the promoters of the Lawton (Okla.), Wichita Mountain and Western Electric Railway Company, has succeeded in interesting eastern capital in the project of his company to construct a line from Lawton to the Wichita Mountains by way of Fort Sill, and representatives of this capital will make an investigation of the project and the advantages to be derived therefrom. The company's survey touches the national game preserve of the Wichitas, leads to the principal pleasure resorts and mines and extends northwest to connect with some line of railroad beyond the mountains.

POWER TRANSMISSION.

The recent reports to the effect that the Susquehanna Water and Power Company, which was organized in New York for the purpose of building a large hydro-electric plant at Conowingo Falls, 17 miles south of McCall's Ferry, Pa., had disposed of its interests, have been pronounced incorrect, and it is stated that the plant at Conowingo will be built. The plans and specifications for the plant are being prepared. Electrical machinery capable of generating 25,000 horsepower of current will be installed. The current will be distributed in cities and towns in Maryland and Pennsylvania. At the point where the plant is to be located there is a fall of 35 feet in the river. The property and rights of the Conowingo Falls region are owned by Harvey Welsh of Philadelphia. The Susquenhanna Water and Power Company is capitalized at $4,000,000.

PUBLICATIONS.

"The Weather Forces of the Planetary Atmospheres" is the title of a pamphlet by C. Marte of Nidau, Switzerland. It contains a study of the atmospheric phenomena such as violent storms, unusually heavy rainfall, abnormal summer or winter temperatures, with an attempt to ascertain their causes.

The Dayton Manufacturing Company of Dayton, Ohio, has issued a new bulletin, No. 131, which contains for the most part the same information

that was embodied in bulletin 130, issued not long ago, the demand for which exhausted the edition. The new bulletin contains in addition a detailed description of the new SB type of storage-battery cells.

A newly designed automatic belt-tightening attachment for the standard Crocker-Wheeler form L motor is described in a small bulletin issued by that company. A good example of the attachment is shown in the bulletin, being an application of the device to a Lanston monotype machine. The device may be used wherever limited center distances between pulleys require an increased belt contact on the pulley surfaces.

The new 600-volt fuse catalogue of the H. W. Johns-Manville Company of New York has been issued. In this book the well-known Noark enclosed fused and fuse devices are fully illustrated and described. The 600-volt catalogue is one of a series of three, the other two being devoted to 250-volt and 1,500-10,000-volt devices. The three combined form a complete line of fuse devices for all voltages. The catalogue under present consideration is very conveniently arranged and well printed and is a valuable book for those ordering this class of material.

SOCIETIES AND SCHOOLS.

The Indiana Electric Railway Association, which has not met during the busy summer months, will hold its first fall meeting in the Traction Terminal Building in Indianapolis on October 12th.

As one evidence that the recent convention of the National Electric Light Association in Denver and Colorado Springs was well managed in every respect, it is a pleasure to note that R. B. Sullivan of the Denver Gas and Electric Company, chairman of the local finance committee, has returned to subscribers to the entertainment fund 15 per cent. of their subscriptions. Often there is a shortage of funds for conventions, and this record is an excellent one.

The latest quarterly bulletin of the Lowell Textile School of Lowell, Mass., tells of the additions to the equipment of the school, and besides a list of the officers, trustees and committees, gives the names of the instructors in the various departments. In the engineering department the names of Charles H. Eames, George H. Perkins and George E. Marsh appear as instructors. The power plant of the institution has been increased from 200 to 500 horsepower.

This note is from the engineering supplement of the London Times: "The combination of European with transatlantic education is becoming more and more evident, as illustrated in the example of Mr. Stanley M. Udale, a student demonstrator of the City and Guilds Institute. Mr. Udale, after passing with honors the recent B. Sc. (engineering) London, secured the 'Walker scholarship' of £150 a year from the Leicester corporation, and has now proceeded to join the Institute of Technology of Boston, U. S. A."

SPACE TELEGRAPHY.

Good results are reported from various space-telegraph stations equipped by the De Forest company. The Bureau of Equipment of the Navy Department has accepted the Pensacola station, after a series of exhaustive and difficult tests between it and the Key West station. During much of the time of these tests the De Forest two-kilowatt station at Key West was operating with the Havana station, 90 miles away. Concerning this the commandant at Key West, in the official report to the Bureau of Equipment, stated that "the connections of the De Forest syntonizer No. 3 were so adjusted that the wireless messages from Havana, 90 miles distant, were being received at the De Forest wireless station at La Brisa (three-quarters of a mile distant from the naval wireless station at Key West), while signals from Pensacola, 410 sea miles distant, were distinctly heard at this station—Havana signals were not heard at this station."

A space-telegraph outfit of his own contrivance has been placed in his large automobile by Maj. William R. Wetmore of Allenhurst, N. J. By the aid of a similar outfit in the railway station at Allenhurst Mr. Wetmore is able to keep in communication with his brokers in New York when touring New Jersey roads up to a distance of 20 miles. The transmitter is said to be crude and an ordinary telephone receiver is used, but as the experiment has been successful it is intended to increase the power of the batteries to afford communication for greater distances. Major Wetmore is himself a telegraph operator.

TRADE NEWS.

The Waco Auto and Electric Company of Waco, Texas, has succeeded to the electrical supply business of M. F. Wortham.

C. E. Lee, the well-known representative of the Electric Gas Lighting Company of Boston, was in Chicago last week. Mr. Lee reports good business, the demand for his company's product being exceptionally brisk.

The American Insulating Company, incorporated in Illinois last week, with headquarters in Chicago, and a capital of $5,000, proposes to manufacture electrical apparatus and supplies. The incorporators are Stanley Kribreener, Benjamin Samuels and J. H. Glick.

Finding its present facilities inadequate to handle its increasing business, the Rock Island Battery Company of Rock Island, Ill., will about October 20th remove its entire plant and business to 456-458-460-462 East Sixth Street, Cincinnati, Ohio. At the new location the company will have an ideal plant of over 40,000 square feet of floor space, all equipped with the latest improved modern machinery, and will be able to give its customers prompt attention.

Machado & Roller of New York have opened in Chicago, at 421 Monadnock Building, a general western sales office for the Whitney Electrical Instrument Company. H. I. Shire, from the New York office of Machado & Roller, will have full charge and act as general sales agent for Whitney instruments. Mr. Shire has been with Machado & Roller for seven years and is fully conversant with the business of the Whitney company and the technical details appertaining to the instruments. The Chicago office is in a position to make simple repairs on instruments, and is carrying a full stock of Whitney instruments, from which quick shipments can be made from Chicago as a center. Already the wisdom of the company in thus opening a branch office in the West has been demonstrated by a flattering number of orders.

All the large works engaged in electrical industries in Germany have announced to their customers that, owing to increased wages and cost of raw materials, a general advance of 10 per cent. has been made in the price of their products, including motors, generators, apparatus, fittings, etc.

BUSINESS.

H. M. Post, advertising manager of the Kellogg Switchboard and Supply Company, Chicago, has again resumed his duties after enjoying a brief vacation.

The American Electrical Supply Company of Chicago has issued a new price list of rubber-covered wires, National Electric Code Standard for 600 volts.

T. J. Cope, the well-known Philadelphia expert in conduit work and manufacturer of conduit specialties, is on a trip through the West, and will visit a number of cities, including Kansas City, Denver and Chicago, before his return. Mr. Cope's line of underground specialties is the direct result of his long and successful experience in this kind of work, and comprises conduit rods, cable racks and special machinery for handling and installing cables and wires. Recently increased manufacturing facilities make it possible to handle all orders promptly.

Fifteen years ago Rainbow packing was invented and put on the market by the Peerless Rubber Manufacturing Company. George B. Carpenter & Co. of Chicago became general western agents for the Peerless company and placed the first order, for a ton lot, which the factory ever received. The agents wish to point to the fact that Peerless products are known the world over and now occupy the front rank, and they wish to caution customers against inferior imitation packings which are constantly being offered as "just as good" as Rainbow.

The American Car and Foundry Company has recently added to its equipment at the Madison plant, Granite City, for the construction of steel and composite cars. Among this equipment is 100 Boyer long-stroke riveting hammers manufactured by the Chicago Pneumatic Tool Company. The order for these hammers was forwarded after a careful test of all the various makes of riveting hammers on the market. The Chicago Pneumatic Tool Company reports that business in general continues good and that the prospects for the remainder of the year are very bright.

The Oneida Community (Ltd.) of Oneida, N. Y., is putting on the market a special chain for raising and lowering arc lamps suspended from mast arms. This chain is made in various sizes, to fit any pattern of pulley. It is heavily galvanized and will not rust. The chain is absolutely uniform in strength, and there is no fear of the lamps falling to the street, as happens so unexpectedly when the strands of a wire cable give way, or a rope has rotted out. The Oneida Community is prepared to send a sample, complete, ready to put on an arc light, to any central station applying for it.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) September 26, 1905.

800,154 to 158, inclusive. Telegraphy. Francis W. Jones, New York city. Applications filed respectively February 7, March 11, March 31, April 3 and April 27, 1905.

The patents here enumerated embody a telegraph system in which the messages are transmitted by a series of alternating-current impulses. This is accomplished by the use of a branch circuit at each station for the transmitting and receiving devices connected to the main line by condensers. (See cut on next page.)

800,160. Multiple Switchboard for Telephone Exchanges. Milo G. Kellogg, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed November 30, 1891.

Two lines are grounded at their outer ends and connected together for conversation. In combination with a clearing-out annunciator and a battery in a circuit connection from the circuit of the lines to the ground are a battery so related to the clearing-out annunciator as to cause the magnet to attract the armature but not sufficiently to operate the annunciator and means whereby either subscriber may send over the line a current which reinforces the battery circuit to operate the annunciator.

800,161. Switchboard for Multiple Exchanges. Milo G. Kellogg, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Original application filed December 31, 1889. Divided and this application filed August 24, 1893.

Two telephone lines temporarily connected together for conversation have a calling and clearing-out generator at each subscriber's station. The clearing-out annunciator is in the main or direct circuit of the combined circuit of the two lines and in one side of the combined circuit, all in closed circuit with either subscriber's generator when operated to send the clearing-out signal. The clearing-out annunciator is operated, but the line annunciators are not being operated or caused to indicate by the current sent when the clearing-out signal is sent.

800,170. Means for Securing Electric Conductors. Carroll Potter, Philadelphia, Pa. Application filed September 16, 1902.

A clamp fitting into diverging sockets in a switchboard, for holding an electrical conductor, is described.

800,179. Electric Signaling System. Howell W. Souder, Tamaqua, Pa., assignor of one-half to W. D. Zehner, Lansford, Pa. Application filed January 27, 1905.

A magnet circuit controller for use in electric signaling system for railroads comprises a pair of independent electromagnets, separate current-supplying circuits, means operated by a passing car for supplying current to the circuits consecutively, a switching apparatus located within the fields of force of the magnets, and a resistance bridged across the supply circuits.

800,181. Method of Producing Electrodes. Heinrich Specketer, Griesheim-on-the-Main, Germany, assignor to the firm of Chemische Fabrik Griesheim Electron, Frankfort-on-the-Main, Germany. Application filed February 18, 1903.

A method of producing electrodes for electrolytic purposes consists of melting oxide of iron and casting it into suitable molds. This is done by melting technically pure non-magnetic oxide of iron, and molding the resulting mass into suitable electrodes.

800,204. Circuit-breaker. Charles H. Brigham, New York, N. Y., and John C. Francis, Weehawken, N. J.; said Francis assignor to said Brigham. Application filed March 19, 1904.

A circuit-breaker comprises two springs and an arm having an eye and supported upon one of the springs, the other spring having a hook adapted to lap the eye. Curved pieces of metal of unequal expansion are secured to the arm at one end, one of the pieces being adapted to extend through the eye and engage the hook at the other end. A heat coil is located within the curved pieces and connected with the springs upon which the arm is supported.

800,229. Rail Bond. George A. Mead, Mansfield, Ohio. Application filed December 1, 1904.

A rail bond terminal is provided with means for offsetting its surface from the rail surface in a graduated degree from one to the other edge.

800,241. Electric Hoisting Mechanism. James B. Phillips, Portland, Me. Application filed March 27, 1905.

In a friction-drum hoist are a screw for throwing the drum into engagement with the friction, a weight or other like mechanical means for operating the screw to engage the drum and an auxiliary motor for operating the screw to disengage the drum against the action of the weight.

800,246. Railway Switching Apparatus. John D. Taylor, Buffalo, N. Y., assignor to the Taylor Signal Company, Buffalo, N. Y. Appplication filed February 24, 1902.

Combined with a switch mechanism are a pole-changing switch, magnets for operating the switch, a controller and operating and indication circuits, with mechanism

for automatically reversing the pole-changing switch after the rail switch has completed its movement. Additional means under control of the operator reverse the movement of the rail switch. (See cut.)

800,247. Railway Signaling Apparatus. John D. Taylor, Buffalo, N. Y., assignor to the Taylor Signal Company, Buffalo, N. Y. Application filed January 22, 1904.

The apparatus embodies a motor, an operating wire, an indication wire, a controller, a switch in one of the wires and electromagnetic means for governing the switch. A circuit-breaker, comprising a second switch in one of the wires, is normally closed in series with the first-mentioned switch. A magnet and a shunt circuit around both of the switches are provided containing the magnet. In the event of the opening of the first-mentioned switch the magnet will open the second-mentioned switch and hold it open until the current is removed from the system.

800,286. Secondary Electric Clock. Robert J. Flint, Decatur, Ill., assignor to the Frank Curtis Company, Decatur, Ill. Application filed March 11, 1905.

An electromagnet operates the mechanism of the clock.

800,294. Trolley Pole and Stand. William W. Hallenbeck, Burville, Conn. Application filed January 12, 1905.

Details are described.

800,311. Cartridge-vent Detector. Ormond M. Lissak, Westpoint, N. Y. Application filed September 20, 1904.

In a vent detector are a support for the cartridge, an electric circuit normally open, there being a circuit closer in the circuit in line with the vent of a cartridge upon the support, means to reciprocate the circuit closer toward and from and in line of the vent and a support for the circuit closer in which the circuit closer has a movement to close its circuit when in its reciprocation it strikes an obstruction.

800,315. Circuit Interrupter. George P. McDonnell, St. Louis, Mo., assignor to the American Electric Company, East Orange, N. J. Original application filed May 10, 1902. Divided and this application filed August 5, 1903.

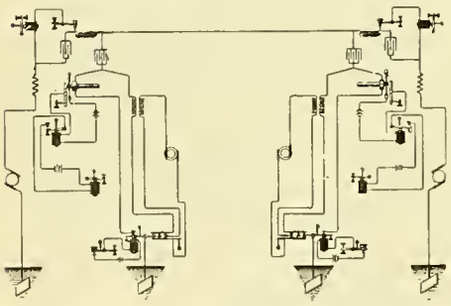
Combined with a main-line circuit is an interrupted branch circuit connected to the main-line circuit, the branch circuit having a relatively less current strength than the current strength of the main-line circuit. A motor is placed in the main-line circuit with an interrupter disk on the armature shaft provided with contact faces. A brush on the motor coöperates with the contact faces for completing the interrupted branch circuit.

800,334. Drive for Machine Tools. George E. Stevens, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 10, 1904.

A machine tool is driven by an electric motor through the agency of a friction disk.

800,364. Telegraphic Recording Apparatus. Patrick B. Delany, South Orange, N. J. Application filed January 10, 1905.

Magnets and recording levers, a source of electrical energy for operating the magnets, a circuit-completing member for completing the circuit of the magnets and a circuit-controlling switch mechanically operated by the levers for breaking the circuits of the magnets are the distinguishing feature.



NO. 800,154.—TELEGRAPH SYSTEM.

800,370. Magnetic Separator. Charles M. Green, Lynn, Mass., assignor to the General Electric Company. Application filed October 17, 1901.

In a magnetic separator are a frame, a magnet mounted thereon comprising two similar interlocking core bodies having pole pieces formed thereon, a coil inclosed by the core bodies, means for connecting the coil in circuit, a hopper for feeding material to the magnet and a revolving brush for removing magnetic material from the magnet.

800,375. Load Meter. Elton J. King, Fort Wayne, Ind., assignor to the General Electric Company. Application filed September 6, 1902.

In an alternating-current meter are a winding included in the main circuit in which the current to be measured is flowing, a resistance in series with the winding, an auxiliary winding in shunt to the resistance and arranged in non-conductive relation to the main winding, and a secondary member of conductive material in inductive relation to the main and auxiliary windings. (See cut.)

800,376. Train-lighting System. Sigvald Krohn, Berlin, Germany, assignor to the General Electric Company, Schenectady, N. Y. Application filed January 21, 1905.

A number of lamps or groups of lamps upon each of the cars of a train are provided with means for connecting the lamps of each car to a local source of current supply and means for connecting one of the lamps or groups of lamps of each car to a source of current supply upon another car and for disconnecting it from the local source of current supply.

800,382. Dynamo-electric Machine. John P. Mallett, Madison, Wis., assignor to the Northern Electrical Manufacturing Company, Madison, Wis. Appplication filed May 10, 1901.

A pole piece for dynamo electric machines is provided with a removable end piece or tip forming part of the armature face of the pole piece, the pole piece being provided with a projection which passes through the removable tip, so as to be exposed and also form part of the face of the pole piece opposed to the armature. The removable tip is of material of different magnetic permeability from the material of the pole pieces, the end piece or tip having angularly disposed surfaces to engage similar surfaces on the pole proper.

800,394. Electromagnetic Power Generator. Joseph L. Potter and Reinhold A. Miller, Indianapolis, Ind. Application filed December 31, 1904.

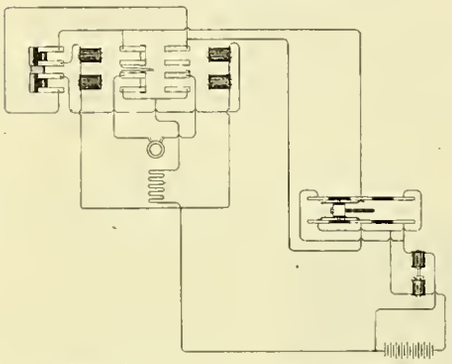
An electromagnetic power generator includes an electromagnet and a number of nesting armatures arranged oppositely to the electromagnet, the ends of the armatures being extended beyond the bodies toward the electromagnet. A mechanical connector is supplied for the armatures.

800,404. Safety Fuse Terminal. Joseph Sachs, Hartford, Conn., assignor to the Johns-Pratt Company, Hartford, Conn. Application filed December 14, 1903.

Upon a common base are blocks having openings to receive line terminals and divided or cut through at one side and having flat tops. Means connect the blocks to the common base. A fuse device has projecting terminals with means for securing the terminals to and upon the flat tops of the block directly above the line-wire terminals.

800,418. Circuit Controller for Explosion Engines. Richard Varley, Englewood, N. J., assignor to the Autocoil Company. Application filed February 8, 1905.

A circuit controller for explosive engines comprises a circuit closer and a circuit opener with means for simultaneously shifting both of them so that the instant at which they shall be actuated in the cycle of the engine may be altered.



NO. 800,246.—RAILWAY SWITCHING APPARATUS.

800,453. Music-note Recorder. Laurenz Kromar, Vienna, Austria-Hungary. Application filed January 27, 1904.

Electromagnets actuate the striking levers of the device.

800,472. Alarm System. Felix McGloin, New York, N. Y., assignor to the Automatic Fire Alarm Company, New York, N. Y. Application filed December 31, 1902.

A signal-transmitting circuit leading from the source has a single conductor made up of detachable sections, a signal device for each section being normally detached. Means connect each signal device to its section, and means controlled by the signal-transmitting circuit interrupt the mechanical operation of any operating signal device farther removed from the central station whenever an intermediate signal device is operated.

800,482. Spring-adjusting Mechanism for Electric Switches. Charles G. Perkins, Hartford, Conn., assignor to the Perkins Corporation, Hartford, Conn. Application filed October 18, 1904.

In combination with an operating spindle are a commutator rotatably mounted thereon, a spring connection between the spindle and commutator, the connection being such that the spindle may give a required tension to the spring and means for holding the spring at its required tension.

800,489. Electrical Vibrating and Massaging Device. Louis E. Richmond and Charles J. Graham, Cleveland, Ohio. Application filed April 10, 1905.

In a massaging device, a cylindrical casing and a set of magnet coils free to slide therein, timed make-and-break circuit and means to alternately energize the magnets constitute the essential parts.

800,515. Incandescent Electrical Furnace. Frank J. Tone, Niagara Falls, N. Y. Application filed December 7, 1904.

An incandescent electrical furnace having movable containing walls composed of reinforcing metal bodies or frames and refractory facing is described.

800,534. Secret-service System for Interconnecting Telephone Lines. Albert K. Andriano and Hermann Herbstritt, San Francisco, Cal., assignors to the Direct Line General Telephone Company, San Francisco, Cal. Application filed January 26, 1901.

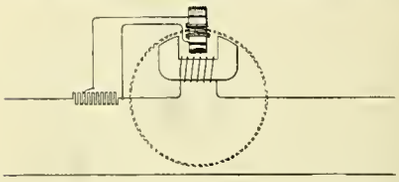
In a telephone system are a ringing circuit for the stations, means operating upon the removal of the receiver for short circuiting the ringing circuit if the station sought to be called is busy and a current making and breaking device in the short circuit.

800,538. Apparatus for Use in the Distribution of Alternating Electric Currents. Arthur F. Berry, Ealing, England. Application filed December 3, 1904.

A combined electromagnetic device and switch mechanism embodies a hollow iron case having a transverse iron plate carrying oppositely arranged iron cores, two windings arranged within the case and surrounding the cores, two connected movable iron plates arranged at the opposite ends of the case and cores, a holder for the case and a pair of bell-crank levers one arm of each of which is connected to one of said plates. A reciprocatory head piece carries insulated contacts, and insulated fixed contacts are arranged opposite to and in proximity to the movable contacts.

800,547. Signal System. William B. Bruce, Gallatin, Tenn., assignor of one-half to himself and one-half to Martin A. Ewing and Joseph H. Ewing, Gallatin, Tenn. Application filed January 16, 1905.

A signal is normally held in a vertical position by means comprising a lever and a fragile stop. Other means destroy the stop and permit the signal to be displayed, the means comprising an electric circuit.



NO. 800,375 —ALTERNATING-CURRENT METER.

800,584. Trolley-wire Coupling. Edward M. Leslie, Cincinnati, Ohio, assignor to the Kingsland-Key-Cook Manufacturing Company, St. Louis, Mo. Application filed November 20, 1903.

The coupling is made up of a tube having a longitudinally extending slot at the center, pins extending through the ends of the slot and oppositely arranged dogs pivotally mounted upon the pins and having curved toothed working faces, the dogs being within the slot and normally projected by gravity into the interior of the tube.

800,586. Electrical Rosette. James A. Mebane, South Boston, Va. Application filed August 2, 1904.

In an electrical rosette is a cap having fuse-wire grooves of a circuitous form, the base having ribs of a form corresponding to the grooves and serving to hold the fuse wires in place in the grooves when the cap is applied to the base.

800,595. Electrical Vibrator for Massaging Purposes. Louis E. Richmond and Charles J. Graham, Cleveland, Ohio, assignors to the Gra-Rich Company, Cleveland, Ohio. Application filed October 17, 1904.

Electromagnets provided with make-and-break mechanism furnish the vibratory effect.

800,603. Magnetic Clutch Mechanism. Harry A. Williams, Akron, Ohio, assignor to the Williams Electric Machine Company, Akron, Ohio. Application filed February 14, 1905.

A magnetic clutch has electrical connections whereby the clutch is energized to actuate the frictional means for driving the pulley.

800,607. Electric Winding Device for Clocks. Charles S. Burton, Oak Park, Ill., assignor to the National Self-winding Clock Company, Champaign, Ill. Application filed November 26, 1902.

An electromagnet actuates a pawl and ratchet mechanism which winds the clock.

800,609. Electric Cut-out Switch. Nathan W. Crandall, Hartford, Conn., assignor to the Perkins Corporation, Hartford, Conn. Application filed November 19, 1904.

Details are described.

800,611. Device for Controlling Motors. Frederick B. Duncan, Madison, Wis., assignor to the Northern Electrical Manufacturing Company, Madison, Wis. Application filed December 30, 1901.

A rheostat has a device for moving it by a step-by-step movement to cut out resistance. A holding device holds the rheostat arm and a releasing device releases the rheostat arm by a step-by-step movement, so that it may be returned to its initial position.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on October 2, 1905:

390,196. Device for Protecting Electric Conductors. E. G. Acheson, Pittsburg, Pa.
390,245. Electric Arc Lamp. R. H. Mather, Windsor, Conn.
390,281. Automatic Temperature Controller. A. M. Butz, Minneapolis, Minn.
390,301. Armature Core for Dynamos. W. S. Hill, Boston, Mass.
390,310. Electric Testing Apparatus. J. W. Packard, New York, N. Y.
390,318. Alternate-Current Dynamo. E. Thomson, Lynn, Mass.
390,329. Electric-Circuit Controller. A. F. L. Willatowsky, Stamford, Conn.
390,413. System of Electrical Distribution. N. Tesla, New York, N. Y.
390,415. Dynamo-Electric Machine or Motor. N. Tesla, New York.
390,428. Telephone. P. Wright, Denver, Colo.
390,440. Storm Protector for Electric Lamps. T. H. Brady, New Britain, Conn.
390,463. Distribution and Control of Electricity for Lighting. T. A. Edison, Llewellyn Park, N. J.
390,464. System of Utilizing Secondary Batteries. H. Edmunds, London, England.
390,481. Electric-Light Circuit Cut-Off Switch. W. A. Johnson, Toronto, Ontario, Canada.
390,544. Therapeutic Electrode. J. H. Woodward, Seward, Neb.
390,575. Telephonic Transmitting Instrument. R. D'Unger, Chicago, Ill.
390,597. Porous Cup for Galvanic Batteries. E. M. Hewett, Newton, Mass.

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LIBRARY OF ELECTRICAL ENG'G.

Electric Power-transmission System in Yorkshire, England.

[From a London correspondent of the Western Electrician.]

Although not the first electric power concern to be put into operation in Great Britain, the Yorkshire Electric Power Company was one of the earliest to be authorized by Parliament, and the system generally has features of novelty worthy of record. The company was organized in 1901, when parliamentary sanction was received for supplying electrical energy over an area of 1,800 square miles, comprising practically the whole of the industrial portion of the West Riding of Yorkshire. The raison d'être of electric power companies, of course, is the concentration of the generating plant in one or two large stations and the consequent reduction in the usual losses as compared with a considerable number of smaller stations—an advantage which, combined with that of the cheap supply of coal, owing to the power houses being, so to speak, at the pits' mouth, was made much of at the time of the inception of the power companies. But, although Parliament was convinced, this was not the case with the local authorities, whether they possessed electricity works of their own or not, and this prejudice to some extent is responsible for the belated appearance of the electric power companies in the field of practical operation. However, the fact that even local authorities are open to reasonable argument is being more and more exemplified in many districts, and the Yorkshire company alone has entered into agreements to supply some half dozen small district councils with current in bulk, the councils doing their own distribution. Many others are negotiating with the company, and thus it may safely be said that the future of the electric power company in Great Britain has been placed upon a substantial foundation. Before leaving the general question it may be well to point out that the power companies in England, generally, are not permitted to supply energy for lighting purposes to the ordinary customer requiring a supply for that alone, and the Yorkshire company in particular classifies its consumers as follows: Local authorities (in bulk), railways, tramways and canals, textile factories, collieries and engineering works.

Coming to the system of generation and distribution adopted by the company, it should be pointed out that authority has been obtained to erect three generating stations, but that up to the present only one, i. e., at Thornhill, has been built. Fig. 4 shows the exterior of this station. This power station, which is situated between a railway and a river, is a steel and brick structure divided into two parts, one of which comprises the boiler house and the other the engine house. Space is available for an extension of the capacity of the station to 60,000 horsepower. Provision is made for six boilers, four having been already installed. They are of the water-tube type, each capable of evaporating 20,000 pounds of water per hour from a temperature of 60° F. to steam at 160 pounds per square inch and 150° F. superheat. Each boiler has a heating surface of 5,370 square feet and a grate area of 100 square feet. The chain grates and stoker gear are driven electrically. The economical combustion of coal is watched with great care, daily tests being made of the heat value of the coal used, the composition of the flue gases, and everything bearing on the boiler efficiency. The arrangement of the steam and feed-water piping is designed so that one-half of the boiler house can be completely isolated from the other. At the end of the boiler house are situated the feed pumps, hot wells and water tank immediately under the control of the boiler-house staff. The feed pumps are the only auxiliaries that are not electrically driven.

The engine room is designed to contain a generating plant of 8,450 kilowatts capacity. Two turbo-alternators, each of 2,000 kilowatts, are already installed, and a third is being erected. One of these is shown clearly in Fig. 1. Three high-speed engines connected to direct-current dynamos of 150 kilowatts each are installed at the end of the engine room, as partially shown in Fig. 3, and serve the purpose of providing the necessary current to operate the station motors and for the local supply.

The main generating sets are Curtis turbo-alternators, these being the first machines of this size to be installed in Great Britain. The shaft and all rotating parts are carried by a hydraulic foot-step bearing; water at a pressure of 400 pounds to the square inch is supplied by motor-driven pumps, and the shaft floats on a film of water. The top and center bearings of these machines are lubricated by the gravity system, with oil at a pressure of 10 pounds per square inch pumped from a settling tank in the basement into a tank at the top of the engine house, from which it gravitates to the bearings and returns to the settling tank. The turbine runs at a speed of 1,000 revolutions per minute, and is controlled by a centrifugal governor. This governor by an electrical controller operates small steam valves opening or closing the passages to the steam nozzles as the load varies.

A separate surface condenser is provided for each turbine, and the general arrangement presents some novel points. The condenser tubes are vertical; the air pump, running at 160 revolutions per minute, is direct-coupled to a motor, and the circulating-water-discharge pipe, being submerged at its end in the river, allows the siphon action of the arrangement to be taken advantage of, and thus reduces very considerably the head against which the water is pumped. The siphon action is maintained by means of a dry-air pump, which prevents an accumulation of air in the pipes and condensers.

The centrifugal circulating pumps in the basement are controlled from the main floor. Each pump is rated to lift 160,000 gallons per hour against a head of 28 feet.

The proportionately large size of the condensing plant is necessary on account of the benefits to be obtained by working with a high degree of vacuum in connection with steam turbines. The results obtained with the present plant point to an extremely low consumption of steam per kilowatt-hour.

An electrically operated crane travels the whole length of the engine house. It is equipped with three motors, one for each motion.

The alternators attached to the turbines generate three-phase alternating current at 10,000 volts, at

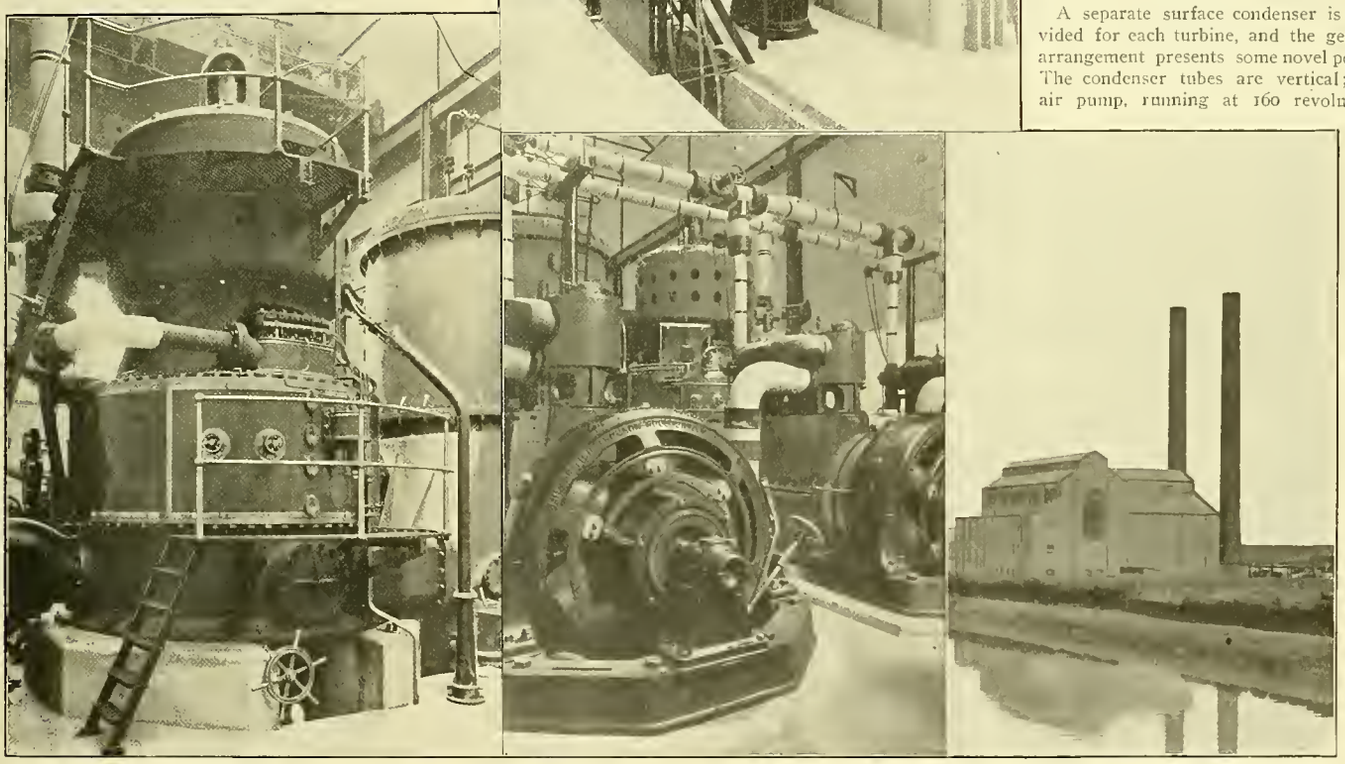


Fig. 1. 2,000-kilowatt Turbo-Alternator in Thornhill Station. Fig. 2. Transformers and Switching Apparatus in Mirfield Sub-Station. Fig. 3. Interior of Thornhill Station, Showing Direct-current Generators. FIg. 4. Exterior of Thornhill Station.

POWER HOUSE AND EQUIPMENT FOR YORKSHIRE TRANSMISSION SYSTEM.

which pressure it is transmitted to the various sub-stations. The switch gear controlling the machines and transmission mains occupies three floors of one side of the engine house and is thoroughly fireproof. Each part is separated from the remainder by a brickwork partition, and can be disconnected when required without affecting the working of the other parts.

The large amount of space occupied by the switch gear and considerations of safety call for a central control of all operations. There is, therefore, a control switchboard situated on the switch gallery. From this switchboard the whole of the main switch gear is operated by means of low-pressure current. All the high-pressure gear is enclosed, and the main switches, of the oil-break type, are worked by means of small motors. The switchboard attendant, by closing a small switch, causes the motor to open or close the main switch. Directly the operation is performed the motor stops automatically, and a lamp lights up, informing the attendant of the fact. The paralleling of the alternators is also performed on the control board, the speed of the turbines being regulated by a small switch operating a motor attached to the governing gear of the turbine.

No high-pressure current is brought near the control board; the instruments showing the pressure and current in each feeder are all controlled by low-pressure current, and the maximum of convenience and safety is obtained. The switch gear for the direct-current machinery is also on the switch gallery.

The high-pressure cables are led from the power house in earthenware ducts for a considerable distance, until they diverge in different directions, when they are laid in wooden troughs. The cables are three-core, lead-sheathed and armored and are tested to 30,000 volts, or three times the working pressure.

Fig. 2 (page 293) shows the typical transformer

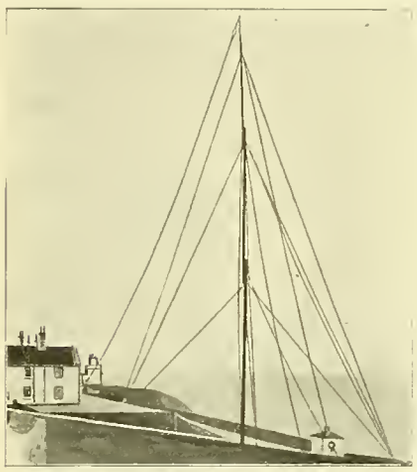


FIG. 1. AN ENGLISH MARCONI STATION.

apparatus of the sub-station of a local authority receiving a supply in bulk and doing its own distribution. As it requires direct current, the local authority transforms the alternating current to direct. As the greater part of the electrical energy supplied by the company is three-phase alternating, no rotating machinery is necessary to transform the pressure from 10,000 volts to the supply pressure.

Long Electric Railway for Holland.

A company has been organized and incorporated, known as the Holland-American Construction Company, with head offices in Rochester, N. Y. The company has franchises and concessions for the building of a trolley line in Holland, and is capitalized at $1,000,000. The directors are J. George Kaelber, John F. Alden, John N. Beckley, Charles H. Palmer and George C. Buell of Rochester, George C. Smith and Walter D. Uptegraff of Pittsburg, Newcomb Carlton of New York and Joseph H. Lukach of London, England. The proposed trolley line is to be 115 miles in length. Its western terminus is to be at Wykandozee, on the shore of the North Sea. The main line will cross Holland in a general southeast direction to Arnheim. Wykandozee is not now in direct land communication with Amsterdam, but from Zaandam to Arnheim the road will practically parallel steam roads already in operation. The road will be high speed and of the best type. Negotiations looking to the construction of the road have been in progress over a year. Messrs. Kaelber, Alden, Beckley and Palmer will go to England and Holland to supervise the beginning of construction. This will be the second American trolley line to be built in Holland.

Wireless-telegraph Masts and Antennae.

By D. McNicol.

Mr. Marconi early in his experiments deduced, empirically, a law governing the relationship between signaling distance and mast height, finding that, everything else being equal, the distance covered was proportional to the square of the height of the mast used. For example, if an aerial wire 80 feet high is, with a given set of instruments, found to be sufficiently elevated for signaling a distance of 20 miles, then an aerial of 160 feet high would be required for a distance of 80 miles, and so on. Later practice of the art of wireless telegraphy, however, has developed various situations where this law does not hold good. Constant experimentation, carried on in different localities, has brought to light so many new facts concerning the propagation of electric waves that the construction of aerial conductors has within

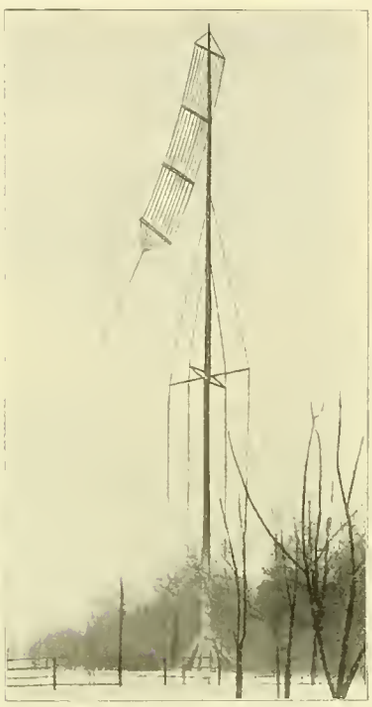


FIG. 2. CLARK STATION NEAR DETROIT, MICH.

the last few years become quite a science, and many different forms of aerials are used.

As there is but one aerial used at each wireless station, the elevated conductor serves a dual purpose—that of sending out signals in the form of transverse vibrations in the ether and of receiving, or, rather, intercepting, similar signals transmitted from a distant station.

Among the principal forms of aerials used in successful practice are the following:

(a) Single-wire aerial.

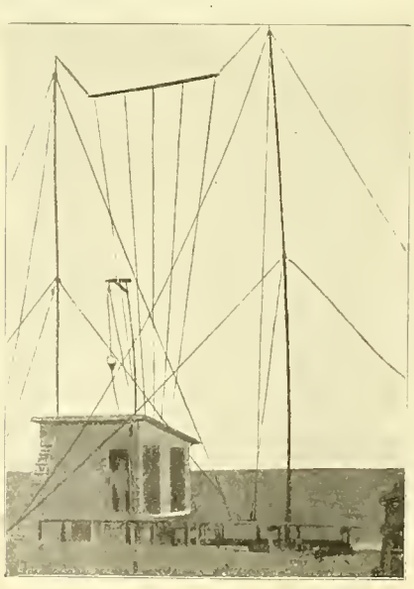


FIG. 3. FESSENDEN STATION NEAR ATLANTIC COAST.

(b) Parallel-conductor or fan type.
(c) Multiple quadrangular aerial.
(d) Multiple cylindrical aerial.
(e) Inverted pyramidal aerial.
(f) Liquid aerial.
(g) Adjustable cylinder aerial.

Fig. 1, which represents an English Marconi station, shows an installation of form (a). Figs. 2 and 3 are different forms of type (b), the former being a Clark station installed near Detroit, Mich.,

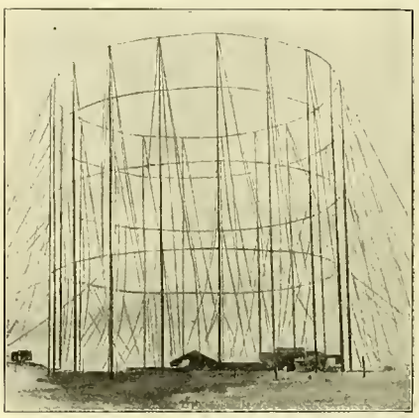


FIG. 4. POLDHU TRANSATLANTIC STATION AT CORNWALL, ENGLAND.

and the latter a Fessenden station near the Atlantic coast. Fig. 4, type (d), shows the original Marconi station at Poldhu, Cornwall. The Marconi station at South Wallfleet, Mass., shown in Fig. 5, is of type (e) construction. This installation consists of four wooden standards, 210 feet high, arranged in a quadrangle. Extending downward from the top of the structure are 400 wires in the form of an inverted pyramid. The upper terminals of these wires are thoroughly insulated from the earth, and the lower ends are joined into a single conductor of large diameter.

The question is frequently asked why wooden

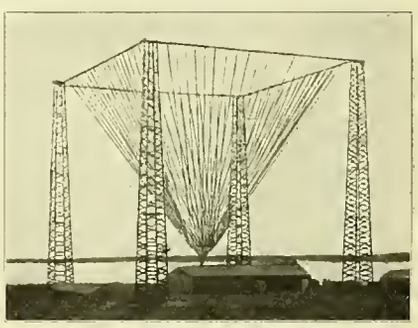


FIG. 5. MARCONI HIGH-POWER STATION AT SOUTH WALLFLEET, MASS.

poles are used in preference to iron ones in the construction of these towers. The fact that the destruction, by storm or otherwise, of the aerial plant would render an important installation inoperative for weeks makes it very important that the aerial supports be constructed of the stoutest permissible material. Doubtless iron or steel towers would withstand greater wind strain, would offer greater resistance to willful destruction, and would deteriorate less rapidly. But there is to be considered the transparency or opacity of the structure to Hertz waves. The radiating and intercepting conductors are within the square formed by the towers, and the employment of metal columns interposes an obstacle, both to the outgoing and the passing waves, so much so that reflection and refraction produce interference which seriously interferes with satisfactory operation.

Were it possible thoroughly to insulate the towers from the earth, this objection would not exist, for then the entire structure could be used electrically.

One of the latest installations of type (b) aerial is shown in Fig. 6, which illustrates the Murgas experimental station at Wilkesbarre, Pa. The antennæ are made up of 10 No. 10 B. & S. stranded and insulated copper conductors, each of which is suspended from a separate insulator, the latter consisting of a rubber rod 30 inches long and 1½ inches thick, enclosed in an outer protecting tube of polished rubber. By referring to the illustration it will be observed that the antenna wires are hung from a cross-rope stretched between the tops of

the twin masts. Thirty feet above the ground all of the conductors are again joined to a cross-rope, where they are connected together electrically, and brought to the operating room as a single conductor of large section. Each mast or tower is 200 feet high, including the extension mast at the top, the material used being pine.

The construction details of the antennæ of a type (b) aerial, such as that shown in Fig. 2, are shown in Fig. 7.

Professor Fessenden has recently secured a patent on an aerial arrangement of type (f), a theoretical diagram of which is shown in Fig. 8. This would be of value only during a naval battle, where the masts of a warship are subject to destruction.

Type (g) refers to the concentric-cylinder aerials used by Marconi. This arrangement, while only about 25 feet in height, has been found sufficient for communication over a course of 20 to 25 miles,

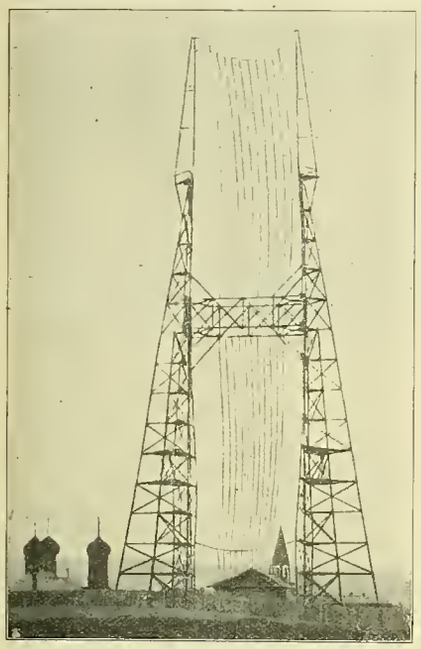


FIG. 6. MURGAS STATION AT WILKESBARRE, PA.

and when mounted on an auto car, as in Fig. 9, is so constructed that the aerial may be doubled back and laid down on the roof of the car. The sending and receiving instruments and all accessories are placed inside the car. The portability of this outfit recommends it for use in war maneuvers or for temporary service of any kind.

In short-distance signaling, where a single aerial conductor is to be used, it should be a stranded copper cable of No. 7-20 size insulated with rubber and tape. This cable should be attached to the

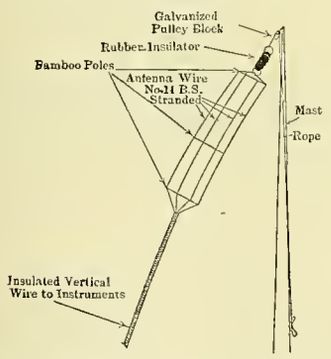


FIG. 7. DETAILS OF ONE FORM OF AERIAL.

mast at intervals of six feet, by means of heavy porcelain insulators, such as are used to support the conductors of high-tension transmission lines. These insulators should hold the conductor at least six or eight inches away from the support at all points. Especial care should be taken where the conductor is brought through the wall or ceiling of the operating room. In order to test the conductor for insulation, the sparking terminals of the transmitter should be separated to a distance where sparks cannot pass, one terminal of the transmitter being grounded. The end of the vertical wire is then gradually brought near the other terminal of the coil. Should there be any appreciable sparking between the vertical wire and the knob, the insulation is defective and should be thoroughly

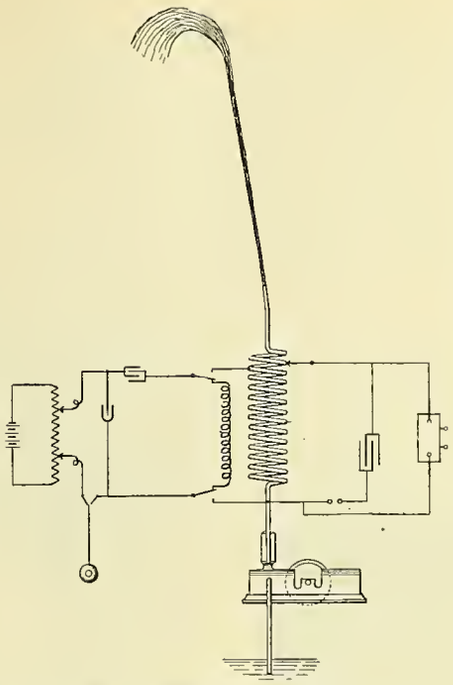


FIG. 8. FESSENDEN LIQUID AERIAL.

overhauled. The mast should preferably be a wooden one, but may be stayed with the usual galvanized-iron wire, provided each stay wire is well insulated from the ground. If hemp loops are used for this purpose they should be well tarred or waxed, so that there will be no leakage when subjected to moisture. Instead of a loop of rope, an iron ring covered with tarred rope may be used, or a double porcelain knob "break," such as is used in electric-light and railway plants.

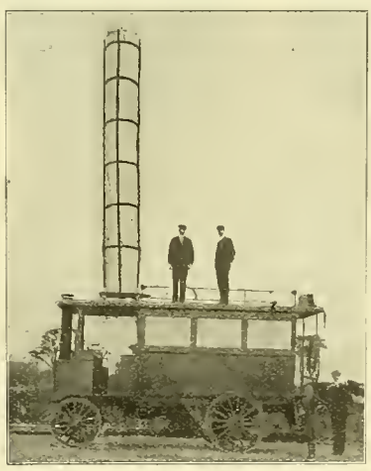


FIG. 9. MARCONI'S WIRELESS WAR CHARIOT.

These insulators should be near the ground end of the stay wire.

A 183-foot mast erected near Boston for the Stone Wireless Telegraph Company some time ago was constructed according to approved engineering methods. There are three sections of mast, the dimensions being as follows:

	Length Over All.	Length to Housings.	Butt.	Diameter Top Below Hounds.
Lower-mast.....	91 feet	81 feet	20 inches	17 inches
Top-mast.....	75 feet	67 feet	13 inches	10 inches
Top-gallant.....	45 feet	37 feet	7½ inches	4½ inches

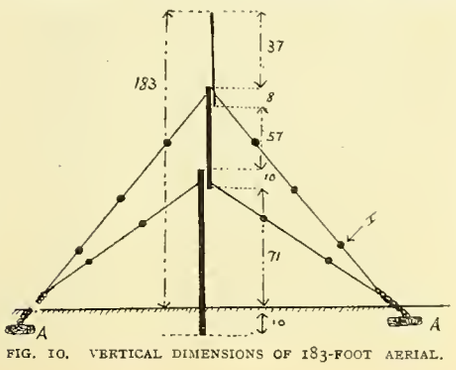


FIG. 10. VERTICAL DIMENSIONS OF 183-FOOT AERIAL.

The arrangement and vertical dimensions of this aerial are shown in Fig. 10. The anchors (A) (four in number) are placed a distance of 100 feet from the point where the pole enters the ground. These anchors are each made of a piece of Oregon pine, nine feet in length and 14 inches in diameter, and are buried at a depth of six feet in the earth. A 15-foot length of chain attached to each anchor extends to the surface and makes a convenient arrangement for attaching the galvanized-steel guy wires; the latter are one-half inch in diameter, with a combined breaking strain of 83,200 pounds. The breaks (I) shown in each guy wire are insulating joints, which divide the wire into sections, the object being to prevent the damping and shielding action common to long lengths of guy wire; 3½-inch Globe strain insulators are used for the purpose.

Fig. 11 shows the below-ground setting of this mast. The material used in the construction of this aerial, exclusive of the poles and anchor blocks, was as follows:

Twenty 3½-inch Globe strain insulators.

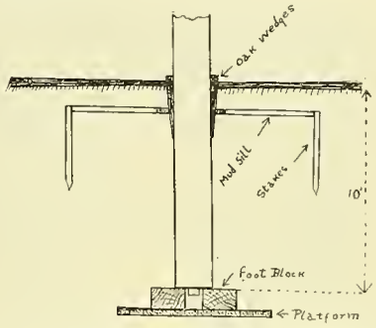


FIG. 11. UNDERGROUNG SETTING OF 183-FOOT AERIAL.

Fourteen hundred feet one-half-inch galvanized-steel strand.

Ten dozen galvanized guy clamps.

Four pieces eleven-sixteenths-inch steel chain 15 feet long, painted, each chain fitted with a four-inch ring at one end and a large link at the other end.

Two six-inch galvanized-steel blocks for antenna halyards.

Seven hundred and fifty feet 1⅛-inch circumference tarred hemp rope.

Three hundred and seventy-five feet three-quarter-inch tarred rope.

The De Forest company has also quite recently

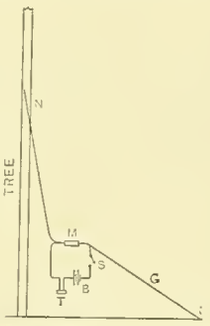


FIG. 12. CONNECTIONS FOR A LIVING-TREE AERIAL.

erected at South Boston, Mass., an aerial for long-distance operation. It is a 208-foot structure, equipped with east and south-facing fan-shaped antennæ, each consisting of 15 steel wires, suspended from 50-foot cross-pieces. The mast is made up of four sections, the lowest mast set in a concrete foundation.

Major Squier of the United States Signal Corps has, for short distances, succeeded in utilizing growing trees for aerials for wireless transmission. Fig. 12 shows the connections. (N) represents a common nail driven into the tree near its top, (M) the wave detector, (S) switch, and (G) ground connection. That trees may be utilized in this manner will be of great service for temporary service in wooded localities.

Horses' Prejudices to Be Respected.

Superintendent Shelton of the Fort Wayne and Wabash Valley Traction Company has issued an order instructing trainmen to stop the car when running near a highway if it is apparent that a horse is to be frightened by further progress of the car. If necessary, the company's employes shall go to the help of the driver of the horse. Mr. Shelton says that the rights of persons who use the public road should be considered as well as those of the company's passengers.

Ice Protection for Niagara Falls Power House.

On the face of the cliff, to the north of the power house of the Niagara Falls Hydraulic Power and Manufacturing Company at Niagara Falls, N. Y., there is considerable falling water that comes from the overflows and ice runs of the mills located on top of the high bank. Because of the presence of this water, there is a huge ice formation almost every winter between the water's edge and the top of the bank along the debris slope. The winter of 1903-04 was very severe, and the company suffered considerable damage to its power-house roof from falling ice. This accident resulted in the company taking immediate steps to protect itself from similar injury, and Chief Engineer John L. Harper designed a protection wall that was built in the summer of 1904, and which has proved a success, not only as to its location and usefulness, but also in demonstrating that it is of sufficient strength to withstand any ice conditions that may develop.

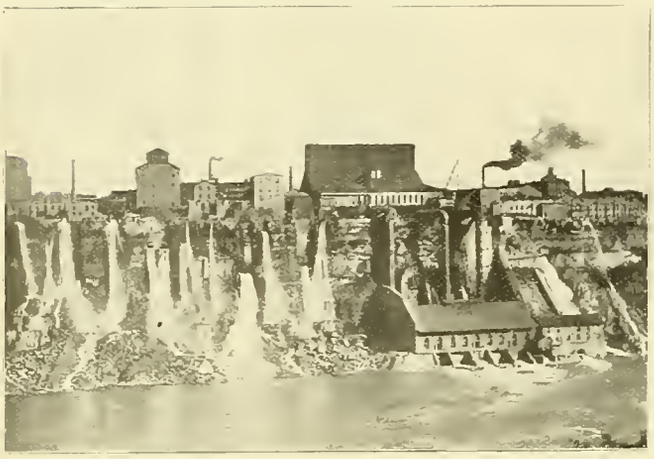


Fig. 1. Protecting Concrete Wall on North End of Power House.

Fig. 2. View Showing Protection Afforded by Wall in Winter.

ICE PROTECTION FOR NIAGARA FALLS POWER HOUSE.

This wall was built directly against the north end of the power station, as shown in Fig. 1, and extends 10 feet above the highest point of the roof of that building. It extends 150 feet from the face of the cliff to the side of the power house nearest the water. Its greatest vertical section is about 75 feet, and it has a thickness of five feet. The foundations are taken down to solid rock at all points except about 15 feet of the end next to the river. This end, however, was built out from the rock and strengthened with built-in ironwork, so that it makes practically a cantilever truss at this point. Two window openings were left in the wall to afford ventilation of the power house, and these are protected with slide structural steel shutters, which make the windows watertight in winter.

The wall is built of one-three-five concrete, reinforced where necessary with steel beams. All of the concrete used in its construction was mixed on top of the bank and taken to place by an aerial cableway, having been dumped into place by bottom-dump buckets operated from the top of the bank.

This great wall of concrete is evidence of the careful and thorough manner in which the Niagara Falls Hydraulic Power and Manufacturing Company builds and protects its works. Last winter a mass of ice estimated to weigh at least 25 tons detached itself from the cliff and went sliding down the mighty ice mounds in front of the cliff. It struck the new protection wall and stopped. The wall was not cracked or in any way injured. The excellent service performed in this one instance by the wall was looked upon by the company and also by Chief Engineer Harper as a receipt in full for the cost of construction.

Fig. 2 shows the protection wall as it appears in winter.

London Electrical Exhibition.

The Olympia electrical exhibition in London was opened by the lord mayor on September 25th. It is over 10 years since such a comprehensive show has been held in England dealing alone with electricity and its application. During recent years there have been many local electrical exhibitions, and of course the Glasgow International Exhibition in 1902. The present exhibition owes its inception, curiously enough, not to the manufacturers, but to a number of central-station authorities—both company and municipal—who were convinced that a good exhibition was necessary, not for the purpose of exhibiting engineering novelties but for demonstrating to the public in a really practical manner what electricity is capable of in its applications.

Very few shows are in such a forward state as this one was on the opening day. The opening by the lord mayor in state was quite a pompous ceremony, a guard of honor being provided by the volunteer corps of electrical engineers.

The Institution of Electrical Engineers has arranged for a series of popular lectures to be delivered during the exhibition in the exhibition buildings by some of its best-known members. These include Col. Crompton, Mr. Duddell, Mr. Swinburne, Mr. Ferranti and Mrs. Ayrton.

Special attention is being paid to electric cooking and heating, prizes being offered for these exhibits. At the inaugural luncheon pleasure was expressed that the exhibition was essentially a British one, although there are a few goods exhibited of foreign manufacture. The show will remain open until October 25th.

Affairs of the Illinois Tunnel Company.

In a statement recently made by President Wheeler of the Illinois Tunnel Company of Chicago to Comptroller McGann the present status of the company's affairs is made plain, with the exception of who the stockholders are. The only company with which the city has to deal is the Illinois Tunnel Company, the successor to the Illinois Telephone and Telegraph Company, which is the operating company.

The Illinois Tunnel Company has no operating contracts except with the United States government for transportation of mail. The extent of construction is 197,000 feet of completed tunnel. The equipment ordered is: Electric locomotives, 50; 38 delivered, balance due before January 1, 1906. Cars ordered, 1,000; 300 delivered, balance due before January 1, 1906.

The Chicago Warehouse and Terminal Company was incorporated in Illinois in December, 1904. The capital stock is $100,000. The owner of the stock is the Chicago Subway Company. This company has no business relations with the city of Chicago. It simply furnishes warehouse and terminal facilities to business men for the purpose of storing merchandise so that it may be transferred through the tunnels. The Chicago Subway Company was incorporated in New Jersey in November, 1904. The capital stock is $50,000,000; issued $40,000,000. This company is a mere stockholding company, and has nothing to do with the operation of the tunnels.

Massie Space-telegraph Coherer.

Walter W. Massie of Providence, R. I., who is well known in the field of space-telegraph invention, has patented as one of his most recent developments in this line of work a coherer which embodies means for an exceptionally wide range of adjustment. The adjusting feature consists of a filings-containing cup so shaped as to obtain considerable variation of resistance. The cup is of flaring shape, the increasing cross-sectional area from the bottom toward the top providing for a variation in upper-surface area and naturally for a variation in resistance.

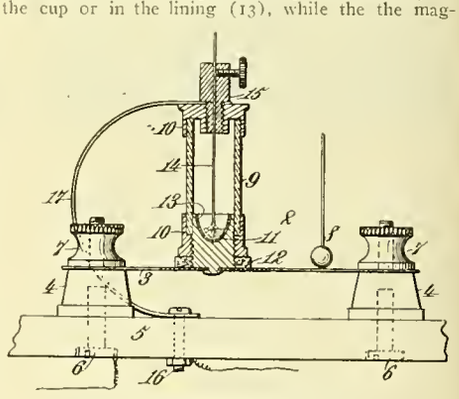
The coherer, as shown in the accompanying picture, is denoted in a general way and is supported by a bridge of some suitable conducting material. The bridge is detachably mounted, so that it, with the coherer, can be bodily separated from the supports.

The coherer (2) is shown as including in its make-up a tube (9), preferably of glass, and the opposite ends of which fit in upper and lower metallic collars, the collars having a sealed or equivalent connection with the tube.

A cup (11) is adapted to contain the filings of the coherer. This cup is surrounded by the glass tube (9), lower collar (10) and a washer (12) of felt or cork. The cup is represented as being of stud form and as rigidly connected with the bridge. The coherer involves a magnetized needle (14). The carrier for the needle, which is of some suitable conducting material, is of cylindrical form, having a bore entirely through it to receive the needle. The needle carrier also has a reduced extension externally threaded to fit an opening in the upper collar or sleeve (10).

The magnetization of the needle may be secured in several ways. For example, the needle itself may be magnetized, or its carrier (15) may be made in the form of a permanent magnet, or a permanent magnet can be placed in juxtaposition with the coherer with one pole near the needle carrier and the other under the cup (11).

The filings of the coherer, as previously stated, are situated in the lining of the cup (11). The interior of the lining (13) is preferably of progressively increasing cross-sectional area from its bottom to its top (a parabolic form is quite satisfactory, and is illustrated), by which it is possible to vary the resistance of the coherer by a variation in superficial area of the top of the filings mass in the cup. This variation, as will be obvious, will be in accord with the amount of filings in the cup. The non-magnetic filings rest directly in the cup or in the lining (13), while the the magnetic filings are supported from the needle and are embedded upon or in the non-magnetic filings.



MASSIE SPACE-TELEGRAPH COHERER.

One of the studs (14) has been described as one of the terminals of the coherer. The other terminal is denoted by (16), and consists of a screw extending through the base (5). Between the head of the screw (16) and the board (5) one end of the conducting strip (17) of resilient conducting metal, is fitted, the opposite end of the conducting strip (17) having a notch or slot to receive the reduced portion of the needle carrier (15). When the conducting strip is in electrical connection with the needle carrier, the latter will be run down to cause the upper end of the conducting strip to fit solidly against the upper sleeve (10), which is in electrical connection with the needle carrier. By running the needle carrier out of its threaded seat in the upper sleeve, (10) the upper end of the conducting strip (17) can be readily separated from the needle carrier, following which the tube (9) can be unscrewed from the lower sleeve to reach the cup (11) to clean it or regulate the amount of filings.

ILLINOIS STATE ELECTRIC ASSOCIATION.

About 110 central-station companies in Illinois constitute the membership of the Illinois State Electric Association, which held its sixth annual convention in the National Hotel, Peoria, on Thursday and Friday, October 5th and 6th. The convention was attended by 60 delegates from these companies and by about 50 other electrical men—salesmen, representatives of the technical press and visitors. It was the best convention, both in point of attendance and in the character of the proceedings, ever held by the association. Wisely, there were not too many papers on the programme. There were but four, but these were on practical, timely subjects and fully discussed. In addition, the report of the committee on insurance was a valuable feature.

President E. B. Hillman of Quincy presided and Secretary David Davis of Litchfield performed the duties of his office. Mr. Davis was promoted to the presidency at the last session. Three sessions were held on the opening day. In the morning, after calling the meeting to order, President Hillman said that the last year had been a good one for the lighting companies. Secretary Davis reported receipts of $470. Treasurer Charles A. Vallette of Edwardsville reported a balance of $188.45. The matter of membership came up, and the sentiment of members seemed to be that the list should be carefully scrutinized so that municipal plants may not come in, and that, in the case of a private plant being sold to the city, that concern be dropped from the roll. H. E. Chubbuck of LaSalle, S. S. Davis of Moline and F. W. Little of Peoria were appointed a committee to revise the by-laws, particularly in the matter of the membership status of municipal plants.

The matter of expanding the scope of the association to disseminate information, with perhaps a paid secretary, was discussed. Secretary Davis suggested that for this service members would do best to rely on the National Electric Light Association. Mr. Chubbuck was in sympathy with this idea. Small plants, he said, were not disposed to stand large assessments; but the small companies needed the association more than the larger ones. The work of the association should be for self-protection, but not too ambitious, technically. Mr. Little did not quite agree with this idea. The information wanted in Illinois could not be obtained, in nine cases out of ten, from an eastern central headquarters, like that of the national association. There might be a classification of membership, so that the larger companies of the state association could pay a larger proportion of the expenses, based on the idea of spending more money for better work. Mr. Chubbuck, however, was a little afraid of agitating the question of increasing dues. Better wait two or three years, he said. X. Cavarno of Kewanee said the Illinois association was very successful as it stands. He thought a classified membership unwise. Mr. Vallette agreed with this. H. E. Niesz of the Chicago Edison Company also thought all the companies should pay the same membership fee, that there might be no question of precedence, superiority or discrimination.

At the afternoon session H. B. Gear of the Chicago Edison Company read the first paper, "Underground versus Overhead Lines." This paper, brief but practical, is given elsewhere in this issue, with a synopsis of the discussion.

From the committee on revision of the by-laws Mr. Little reported three amendments, which were adopted. One amendment provides that any member transferring his station to a municipality ceases to become a member by that act. Another requires applications for membership to be referred to a committee appointed for the purpose, while the third provides for the election of four vice-presidents instead of three.

Power-house Insurance.

At the Decatur convention last year a committee on insurance consisting of J. J. Frey of Hillsboro and W. A. Thomas of Abingdon was appointed to consider the subject of excessive rates of insurance paid by electric-light companies in this state. This committee did good work, which promises to result in the saving of many thousands of dollars to central-station companies in reduced premiums. At Mr. Frey's request E. R. Townsend of Chicago, an engineer and inspector for the old-line fire-insurance companies of the state, addressed the association on the subject on Thursday afternoon. Mr. Townsend said that the insurance people, in view of the improvements in modern construction, felt that corresponding reduction should be made in the rate for power houses. A schedule is proposed to reduce existing rates from 40 to 75 per cent., according to class of construction. A very modern plant may have a yearly rate of from 30 to 35 cents for each $100 of insurance. These rates are in a measure an experiment with the insurance people. It is proposed to make surveys of existing plants and report to owners what credits will be allowed for suggested improvements. It is the purpose to make this investigation immediately.

Modern generators are not so susceptible to water damage as machines of the older type. Managers are themselves reducing the fire hazard by improved fuses, lightning arresters and the like. All of this makes the present plant more nearly fireproof. Therefore reduced insurance rates are in order. The subject has not had the attention in the past which its importance warranted. But now immediate results are to be apprehended, with material rate reductions on all plants, but proportionately greater reductions on the better plants.

A power house of standard construction should have brick, stone or concrete walls of certain thickness. Division walls should be carried three feet above the roof. Roofs and floors should be of noncombustible material. Generators must be properly installed. Conductors must be readily accessible or installed in approved conduits. Switchboards, resistance boxes and equalizers, lightning arresters, transformers, etc., must be of approved construction and properly installed. Waste and oil cans should be of a certain type, and the storage of oils in a separate structure or a fireproof vault should be provided. Certain appliances for fire protection, like pails of sand, should be at hand. By making some or all of these improvements and others of like character enumerated in the schedule, the companies will get reduced rates in proportionate degree. The new power-house schedule lists these requirements and will be presented to central-station companies within a month. Even a few improvements will result in greatly reduced rates.

H. E. Niesz of Chicago said that a power-house schedule adapted for modern plants had been long needed. He asked some information about the proposed rate. Mr. Townsend said that the new basis rate for standard power houses is 35 cents. This is, however, modified according to various individual conditions, such as co-insurance, 80 per cent. liability and the like, as well as physical condition of plant.

J. N. C. Shumway of Taylorville said the electrical men were more competent to make power-house schedules than insurance men. The electrical men should act in concert and secure a fair, square inspection of the plants and have the benefit applied on the rates.

The subject of insurance was taken up again on Friday morning, when Mr. Frey, chairman of the committee on insurance, made a verbal report, showing that 75 central stations in Illinois (members of the association) in the last five years had paid out $124,000 in premiums and had received only $4,000 in losses. The new power-house rate now accepted by the underwriters would have meant a saving of $60,000 to $80,000 to the plants considered during this period. This, of course, with the understanding that the improvements asked by the underwriters were made. Many of these improvements are inexpensive, such as providing pails of sand, improved oil and waste cans with tight-fitting lids, and the like. The losses on average fire-insurance risks is about 55 per cent. of premiums paid, but in electric-light plants in the state of Illinois it is only four per cent. Mr. Frey was applauded at the conclusion of his valuable report.

W. A. Thomas of Abingdon, also a member of the committee, made a supplementary report. He said the insurance men disputed the accuracy of the statement that the electric-light loss was only four per cent. of premiums. But the figure was based on returns made by members of the Illinois State Electric Association and was no doubt substantially accurate. On the showing made by the committee's investigation the insurance companies had offered the new power-house schedule with the reduced rates.

Of the 75 companies reporting 30 carry tornado insurance. Here the insurance companies paid out more money for damages than they received in premiums. Sixty companies carry steam-boiler insurance, 23 employes' liability insurance and two flywheel insurance.

Mr. Niesz said that in the last five years the Chicago Edison Company had paid about $100,000 in premiums for fire insurance and had received for losses about $2,000. Of the latter sum $1,200 was due to a fire in a coal pile from spontaneous combustion. He complimented the committee on its work; the subject is an important one, as the figures show. The proposed new rates are a great step in advance. Insurance companies can well afford to make them, the change being due to the active work of the association and its committee.

By a rising vote the committee was given the thanks of the association and continued for another year, with instructions to look into steam-boiler and liability insurance.

S. S. Davis of Moline, Mr. Shumway and Frank J. Baker of Chicago discussed the subject further, all agreeing as to its importance. Speaking of public-liability insurance, Mr. Baker thought that it was an important form of insurance. One fatal accident with damage loss of $10,000 would almost wreck a small company and be a serious loss to any company. Mr. Frey remarked that if 100 plants took public-liability insurance they could secure a reduction in cost; the rate now offered is about five per cent.

Heating Values of Illinois Coals.

Prof. S. W. Parr of the University of Illinois gave a paper on "The Composition and Heating Values of Illinois Coal," illustrated by charts. He devoted his remarks entirely to soft coal. He considered the proportions of ash, clinker, moisture and volatile constituents. The last commonly constitutes about 35 per cent. of the coal. Perhaps a third of this is worthless. Slack may have 50 per cent. of non-combustibles. Often everything but ash and moisture in coal is considered as fuel, but an error may creep in here. An analysis is valuable to show what percentage of the volatile constituents are non-burning. Taking percentages of actual fuel to total weight of coal, Pocahontas has 91, the average of 10 Illinois coals is 71 and the average of a number of lignites is 61.

Answering R. S. Wallace of Peoria, Mr. Niesz and others, the professor said that as to the storage of coals, there seems to be considerable difference as to loss of efficiency between different coals. The kinds holding the volatile constituents—the hydrocarbons—lightly loose more during storage than the more hard, dense coals.

Interurban Transmission.

W. R. Pinckard of the Chicago office of the Westinghouse Electric and Manufacturing Company next read his interesting paper on "Interurban Transmission." Mr. Pinckard's paper is given elsewhere in this issue. He treated an unhackneyed subject in a clear and interesting manner and was listened to with attention. George H. Lukes thought the subject an important one, greatly influenced, of course, by financial considerations. Others taking part in the discussion were George Cutter of South Bend, Ind., Mr. Frey, Mr. Gear and E. L. Brown of Elmwood. Some doubted whether the ordinary farmer was a good customer, owing to the expense of serving him and the comparatively small returns. Mr. Gear said there were two 9,000-volt transmission lines in Chicago about nine miles long that were practically interurban in character. There should not be two plants in small towns within eight or 10 miles from each other, when the current could be generated in one place, a transmission plant serving the other. President Hillman said he believed the time was near at hand when small towns will be supplied electrically from a central point. Mr. Frey said that his line at Hillsboro was 16 miles long, 16,500 voltage and cost $6,000.

[Continued on page 300.]

J. N. C. Shumway, First Vice-president. David Davis, President. H. E. Chubbuck, Secretary.

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DATES AHEAD.

Kansas Gas, Water, Electric Light and Street Railway Association (annual meeting), Mercantile Club, Kansas City, October 13th and 14th.

Ohio Society of Mechanical, Electrical and Steam Engineers (annual meeting), Canton, Ohio, November 17th and 18th.

Automobile Club of America (annual exhibition), Sixty-ninth Regiment Armory, New York City, January 13th to 20th.

Chicago electrical exhibition (first annual exhibition of Electrical Trades Exposition Company), Coliseum, Chicago, January 15th to 27th.

FACILITIES for the welfare and comfort of telephone operators are almost invariably found in American telephone exchanges of any considerable size. The operator has her private locker for articles of clothing; comfortable and cozy rest rooms are provided where she may spend her "off-duty" periods, and in many of the exchanges there are facilities whereby excellent luncheons may be had at cost. But in this country efforts have not extended outside of the exchange building, and a new scheme which has been proposed in Paris will no doubt be found of interest to telephone companies here. The plan contemplates the establishment of a place of residence for women employed in the telephone, telegraph and postoffice departments of the government, and a company has been formed for the purpose. The co-operative form was adopted, and a fixed price was charged for the shares which was placed sufficiently low to enable the employes to invest largely in the enterprise. A plot of ground was obtained, and the plans call for a handsome six-story building to be erected at a total cost of $160,000. Here will be located kitchens, laundries, living rooms, a large hall and restaurant and all the conveniences of a modern hotel at a price to the guests much lower than they could obtain similar conveniences for elsewhere. The whole scheme as worked out in Paris seems very promising, especially as the women are united by the common bond of like occupation. It can necessarily, however, only be attempted in cities of large size, where the number of operators is great enough to permit of successful execution of the plan. Hotels for workingwomen are not unknown in this country, but the idea has been carried out only in a timid and hesitating way. Perhaps where the boarders are all of one occupation, however, with much in common, the plan may prove successful.

FOR many years the fire-insurance companies have been exacting from the central-station companies rates which were high even in the early days of the art, when everything about the business was crude and experimental. The fine modern stations are almost fireproof; nevertheless the old power-house schedule was adhered to, with slight modifications. But at last the worm—if disposed to be facetious one might say the glow-worm—has turned and has made such a showing that the insurance people have promised sweeping reductions in rates.

It was the Illinois State Electric Association that turned the trick with its committee on insurance (J. J. Frey of Hillsboro and W. A. Thomas of Abingdon), which reported at last week's convention in Peoria and which was continued for another year to "watch out." This committee showed, by returns from 75 companies among the members, that that number of electric-light companies in the state of Illinois had paid out in premiums on their stations during the last five years $124,000, of which less than $4,000 was returned to them in losses. The Chicago Edison Company alone paid out $100,000 in that period to protect itself from a loss of about $2,000.

These figures are fairly astounding and show that it was high time the electrical interests woke up and insisted on a sweeping reduction in rates. It is true that the underwriters question the accuracy of the committee's returns, but the latter are based on actual reports from the central-station companies, and we do not doubt their substantial accuracy. Indeed, by immediately proposing a new power-house schedule, reducing rates from 40 to 75 per cent., the insurance companies "acknowledge the corn."

If the Illinois State Electric Association never does anything else for its members, it has demonstrated its value to them by the work on insurance. Let other states profit by its example.

MUNICIPAL OWNERSHIP may run into a rather unexpected snag by the attitude of the trades unions. Street-railway men, for instance, reflect that no one ever heard of a strike of policemen, firemen or letter carriers, no matter what their grievance. If the street railways were municipally operated, would not the men, without any guaranty of better hours or wages, or, at any rate, any guaranty that would outlive changing administrations, be deprived of their great privilege as American citizens of going on strike? And without the potential menace of a strike, would the trades unions amount to much in furthering the practical, material interests of their members? These questions give pause to the organized workers. Just a day or two ago President Mahon of the Amalgamated Association of Street Railway Employes warned the members against listening too credulously to the roseate promises of politicians as to the blessings of the municipal ownership of traction properties. President Gompers of the American Federation of Labor is even more strongly opposed to handing over the local transportation business to politicians controlling local governments. Mr. Gompers is reported to have said that "municipal ownership in its present state is impracticable for organized workmen. It is inconsistent with the aims of the working people, and so it is a question that must be considered at great length."

Undoubtedly the employes will do better to make their bargains with private owners in disposing of their services. If this fact should be generally recognized by the trades unions in Chicago, for instance, the pluralities that heretofore have been given for municipal ownership might be reversed at future elections. This possibility, with the attitude of the City Council—an honest City Council—gives some reason to hope that the sane view of private ownership, properly safeguarded and regulated, may yet carry the day in this city.

SOME surprise has been created in England by Prof. Ayrton's recent statement that the dependable power of the Victoria Falls of the Zambesi is probably only about one-tenth of that of Niagara Falls. We have not heard the discrepancy estimated at so great a proportion before; but of the general proposition that the available all-the-year-round power of Niagara is much greater than that of Victoria Falls American power-transmission experts have long been cognizant. As the Western Electrician has heretofore pointed out, Niagara, although smaller in height and width, has a tremendous and steady volume of water the year through from an unrivaled series of reservoirs in the Great Lakes, and is likely to continue for many years the most useful waterfall in the world.

In his lecture before the British Association at Johannesburg last August Prof. Ayrton went into more exact figures. The flow at Niagara, the lecturer explained, varies at different times of the year from about 62,000,000 to 104,000,000 gallons a minute. At the Victoria Falls the flow can be one-twelfth of the lesser quantity, for it was that at the time of the lecture; and some authorities, well acquainted with the spot, stated that at the end of another three months (that is, about December 1st) the flow would only be half of even that. The mean available drop at Niagara is about 160 feet; at the Victoria Falls it is about 380 feet. Hence, while the minimum Niagara flow represents about 3,000,000 horsepower, the present Victoria flow represents about 580,000 horsepower, or only about one-fifth. Further, if those were true prophets who predicted the flow of the Zambesi would sink to something like 2,500,000 gallons a minute in November, the Victoria Falls would then only give out about 300,000 horsepower, or, say, one-tenth of the minimum that Niagara produces.

Prof. Ayrton was not very favorably impressed with the commercial possibilities of power transmission from Victoria Falls. He could not recommend a transmission line from the Victoria Falls to Johannesburg, because it did not appear to him that along the route there was at present sufficient demand for power to justify so large an expenditure of capital as would be compatible with a transmission line 586 miles long as the crow flies, and which would be no less than 745 miles in length if made along a railway through Pietersburg and Gwanda, should a line between these two places ever be constructed. As to the probability of a great demand for power within, say, three miles of Victoria Falls, by building up important industries, it is difficult to make a forecast. The prospect is a doubtful one.

Mayor Dunne's "Contract Plan" Knocked Out.

Mayor Dunne's "contract plan" for street-railway ownership in Chicago seems to have received its quietus. This was a plan for incorporating a private company to build street-railway lines to be turned over to the city of Chicago for direct municipal ownership and operation at some future time when the city could raise the price. Dividends were to be limited to six per cent., all net earnings above that to be set aside as a purchase fund or expended for betterments. The capital stock was to be held in trust and trust certificates issued against it to be sold to raise the capital to build the lines. (See Western Electrician of July 15th last for fuller details.) The plan is regarded as impracticable by business men, and a majority of the local transportation committee of the City Council is opposed to it. At a meeting of the council on October 9th, by test votes of 41 to 22 and 45 to 18, the aldermen indicated their adherence to the view of the majority of the committee and their hostility to that of the mayor.

In a communication to the council at the meeting of October 9th the mayor laid great stress on the vote at the municipal election of last spring adverse to the passage of any ordinance to any street-railway company. He wanted the council to order its local transportation committee to cease further consideration of ordinances proposed by the Chicago City and Union Traction companies and to report the ordinance submitted by the mayor and commonly known as the "contract plan." An alderman moved that this order be referred to the committee itself. This of course meant killing it. The mayor, who presided, ruled that the motion was out of order. "It would be ridiculous," he said, "to refer an order of this kind to the committee whose actions the order is intended to direct." On an appeal from the decision of the chair the mayor was overruled by a vote of 22 in his favor and 41 against him. Then Alderman Werno, the mayor's friend, moved that the rules be suspended so that the order could be acted on directly by the council without reference. This motion was defeated even more decisively, the vote being 18 for the motion and 45 against it.

It is believed that after this defeat the mayor will bring forward his alternative or "city" plan. This contemplates the acquirement by purchase or condemnation of all the lines of the existing street-car companies—the form of "immediate municipal ownership" advocated by Mayor Dunne during his campaign for election. But nobody knows where the money is to come from.

In the meantime the local transportation committee has before it an ordinance submitted on October 4th by the Chicago City Railway Company, which, in all essential particulars, agrees with that proposed by the Chicago Union Traction Company. This ordinance comprises 30 sections. Some of these sections are summarized below. The third section provides that the underrunning contact or "underground trolley" is to be used in State and Clark streets, north of Van Buren and Polk streets, "if proved to be practicable and satisfactory." If the ordinance is ever adopted this section will no doubt be modified to widen the area of the underground trolley and to make its adoption more certain. Following are summaries of sections:

Sec. 1. Twenty-year franchise, providing that city may purchase at any time after three years.

Sec. 2. Company shall reconstruct tracks and roadbed.

Sec. 3. The company (except temporarily during construction) shall operate all of its street railways in the city, during the term of this grant, by electricity. It is authorized and required to operate its cars on State street, north of Van Buren Street, by electric power received from conductors carried in conduits below the surface of the street and between or underneath the rails, which conduits shall be drained at frequent intervals; and upon the completion of such underground system it shall be subject to operative and other tests, continuing for a period of not less than two years, and if at the expiration of this period the underground system shall have proved to be practicable and satisfactory the company may be required to install it for the propulsion of its cars on both State Street and Clark Street north of Polk Street, and on the downtown loops therefor; otherwise the company may operate all of its lines by overhead contact trolley wires suspended from poles.

Sec. 4. Trolley poles shall be of iron or steel, ornamental in design, and kept well painted. They shall be set in concrete, at the curb line, on the average of not less than 11 feet apart, and so as not to obstruct cross streets, alleys and private driveways.

All trolley lines shall be of hard-drawn copper, phosphor bronze, silicon bronze or some other material of strength equal to hard-drawn copper. They shall be hung not less than 18½ feet above the rails and there shall be at least two insulations between such trolley wires and each supporting pole.

Sec. 7. All of company feeder wires in central portion of city shall be laid underground and same rule shall apply to all feeders carrying over 1,000 volts in all parts of city.

Sec. 9. All new track construction hereafter laid in streets or public ways paved with asphalt, granite, brick, creosoted block or other similar material shall be laid with modern improved rails of the grooved type, known as the "Trilby" rail, weighing not less than 85 pounds per yard, in which, when new, the difference between height of lip and tread does not exceed six thirty-seconds (6-32) of an inch. In all streets or ways not paved as aforesaid the girder type of rail, having a height of not less than seven inches and weighing not less than 75 pounds per yard may be used.

Sec. 11. All passenger cars hereafter built or purchased shall be of the best and most approved finish, style and design; shall have center aisles; shall be without running footboards along the sides, and shall be equipped with sufficient motor capacity. In case cross seats are used they shall face forward. All closed cars shall be vestibuled and shall be supplied with a sufficient number of electric bells, connections and buttons to enable passengers without inconvenience to notify the conductor of their desire to leave the car, and shall also be equipped with the most serviceable form of fender devices, headlights and sand boxes. Each double-truck car shall be equipped with two sets of brakes, one of which shall be a hand brake and the other an efficient power brake of modern improved type.

Sec. 12. Funeral cars, postal cars and cars for the carriage of parcels and packages may be operated by the company.

Sec. 20. Compensation fixed by following percentages of gross receipts: First three years, annually, three per cent.; next two years, annually, five per cent.; ensuing 10 years, annually, seven per cent.; last five years, annually, 10 per cent.; general average, a fraction under seven per cent. annually. Compensation is to be in lieu of all licenses and all franchise taxes, including taxes on capital stock.

Sec. 25. City Council may compel company to extend its lines at the rate of not more than three miles of double tracks annually, providing at least 150 families live within one-quarter of a mile of the street along every mile of the proposed extension.

146-mile Single-phase Railway for Washington and Idaho.

A contract has just been closed by the Spokane and Inland Railway Company for the equipment of an electric road, the present terminals of which will be Spokane, Wash., and Moscow, Idaho, 146 miles apart. The roadway is completed from Spokane to Waverly, a distance of 34 miles, and operation will be begun on this as soon as possible. The road is a home enterprise, the stock being held entirely by men living in the district through which the line passes—business men, professional men and farmers. The directors of the company are J. P. Graves (president), F. A. Blackwell (vice-president), F. Lewis Clark, John Twohy and Alfred Coolidge, all men of wealth, who have been long identified with enterprises of magnitude.

In selecting the equipment for this road, both the alternating-direct-current and the single-phase systems were considered, but after careful comparison the single-phase alternating-current system was adopted. Not only did the estimates show a large saving in initial investments and in annual operating expenses in favor of the single-phase system, but a form of heavy traction is made possible which would be practically unfeasible with the alternating-direct-current equipment. Besides the passenger traffic, the company is preparing to do a heavy freight business and also to carry mail and express.

Power for the operation of the road will be purchased from the Washington Water Power Company, which will supply three-phase current at 4,000 volts, 7,200 alternations, to a frequency-changing station approximately 1½ miles from the generating station. Seven 750-kilowatt oil-insulated water-cooled transformers will step down the voltage from 4,000 to 2,000 volts, the potential for which the induction motors of the frequency-changing sets are wound. There will be four of these motor-generators or frequency-changers of 1,000-kilowatt capacity each at normal rating. Each consists of a 1,000-horsepower three-phase 2,000-volt 60-cycle induction motor, a 1,000-kilowatt single-phase 2,200-volt 25-cycle revolving-field alternator and a 750-horsepower 550-volt direct-current generator, which is to float on the storage battery, acting alternately as a motor and generator. The three machines will be mounted on a single bed-plate with seven bearings. Exciting current for the alternators will be supplied by three sets, each consisting of a 75-horsepower three-phase 2,000-volt induction motor and a 50-kilowatt direct-current generator.

Nine 675-kilowatt oil-insulated water-cooled transformers will step up the voltage from 2,200 to 45,000 volts, at which pressure it will be transmitted to the 15 static transformer sub-stations, each containing two 375-kilowatt 45,000-6,600-volt oil-insulated self-cooling transformers. A 23-panel switchboard, electrically operated automatic oil circuit-breakers, and protective apparatus complete the equipment of the frequency-changing station. Low equivalent lightning arresters and choke coils are provided for both primary and secondary circuits in all sub-stations.

The transmission lines will consist of two No. 2 copper wires, and the trolley wire will be of the standard catenary construction, using a No. 000 wire and carrying current at 6,600 volts.

Each passenger car will be equipped with four 100-horsepower motors, capable of maintaining a schedule speed of 35 to 40 miles an hour. In the freight service four 150-horsepower motors will be used on each car. For the heavy-freight service double locomotives weighing approximately 70 to 80 tons will be used, each consisting of two parts, and each part a complete 35 to 40-ton locomotive. Two or more of these locomotives may be coupled together and operated from the front cab as a single unit. The motor cars and locomotives will all be operated by the Westinghouse multiple-unit control system. The motors will operate under three different conditions—6,600 volts alternating current in the interurban districts, 700 volts alternating current in the smaller towns, and 575 direct current in the city of Spokane.

The equipment for the road will be furnished by the Westinghouse Electric and Manufacturing Company of Pittsburg.

American Electrical Salesmen's Association.

During the convention of the Illinois State Electric Association at Peoria last week the salesmen present organized a new electrical society under the name of the American Electrical Salesmen's Association. Although nearly every other branch of the electrical industry has one or more organizations for mutual benefit, the salesmen, while frequently meeting at associations and elsewhere, have had none. The new association is designed to fill this vacancy and to be national in scope. Its motto is "Fraternalism," and the object is the uplifting of the standard of salesmanship and the general advancement of the electrical interests. The idea is that the members may strive mightily, but fairly, for business and still eat and drink as friends.

All salesmen selling electrical apparatus of whatever nature are eligible to membership and are invited to join. "Shop talk" is strictly barred at all meetings by the by-laws which have been adopted; the paramount idea is social intercourse and mutual improvement. There are to be no dues. Each new member is to pay a dollar for an emblem, which will be ready in about two weeks. Minor expenses, as printing and postage, will be paid from the profits on these emblems. There is no insurance feature or other expense, save the dollar for the emblem. A man once a member is always a member unless he resigns or changes his vocation. One general meeting is to be held each year; the first one will be held in Chicago next January during the Electrical Exposition. But at these meetings there will be no exhibit or advertising of any manufacturer's goods. This provision is, of course, essential.

It is hoped, by making the organization as simple as possible and omitting all obligations, that the association will help its members to become better salesmen and better citizens, loyal and zealous in their employers' interests and yet manly and honorable in their treatment of fellow members.

Following are the names of the officers of the new association:

President—Vincent Gray, St. Louis.

Vice-presidents—H. N. Remington, Peoria; A. A. Morton, Chicago; J. T. McNair, Yonkers, N. Y.; C. R. Wood, Moline, Ill.; A. L. Pond, Chicago.

Secretary—George H. Erich, 218 North Court Street, Rockford, Ill.

Among the members, besides, are such well-known supply men as W. R. Pinckard, Francis Raymond, J. A. Corby, J. Robert Crouse, E. Dryer, Thomas G. Grier and F. N. Boyer.

E. E. Rines of 2420 Indiana Avenue, Chicago, has charge of the arrangements for the next meeting in Chicago.

The city of Enid, Okla., has granted a franchise for an electric street railway to Daniel S. Roberts of Baltimore.

Illinois State Electric Association.

[*Continued from page 297.*]

Frank J. Baker said that private right-of-way was more desirable than using the highway. This plan has many advantages, which outweigh the objection of less accessibility in case of repair.

After the appointment of X. Cavarno of Kewanee, R. S. Wallace of Peoria and R. H. Abbott of Petersburg as a nominating committee adjournment was taken until evening.

Incandescent Lighting in Various Aspects.

At the evening session F. W. Willcox of the General Electric lamp works at Harrison, N. J., read a paper on "Large-unit Incandescent Lamps for General Illumination." The hall was brightly lighted by six 125, 187 and 250-watt lamps of the new "metallized" carbon-filament style in frosted bulbs and backed by Holophane shades. These lamps were the ones to which Mr. Willcox's paper was mainly devoted. Every seat was filled, and great interest was manifested in the paper and the lively discussion which followed it.

Mr. Willcox began by an eloquent eulogy of the incandescent lamp, "the most ideal piece of apparatus with which the central-station man has to deal." Of some other lamps he said: "We find the new tantalum lamp materially handicapped on alternating current, giving satisfactory service only with direct current. The mercury-vapor lamp is a direct-current lamp only, and its limitations, by reason of its color, are very severe, as is well known. The Nernst lamp is available for alternating current only (in this country at least), unsuitable with low frequencies, handicapped at lower voltage than 200 and not satisfactory or efficient in small sizes (below two-glower sizes). In arc lamps the alternating-current and direct-current lamps are two different lamps; 40 cycles is the limit of frequency, and small units of light are unsatisfactory." The speaker believed that the incandescent lamp will prevail over all other electric illuminants. The efficiency of the incandescent lamp can be improved in two ways—by a more efficient use of lamps and by a filament capable of operating at a higher temperature with the same life as the present filament. Considering the second method, Mr. Willcox then proceeded to describe the new "metallized filament" brought out by his company this summer. (See "A 2.5-watt Incandescent Lamp," Western Electrician of July 8, 1905, page 34, and "A New Carbon Filament," by John W. Howell, read before the Asheville convention of the American Institute of Electrical Engineers, and given in the Western Electrician of July 15th, page 53.) The following from Mr. Willcox's paper will be of additional interest:

"Additional processes are employed to produce the new filament, and these processes include the heating of the filament in the electric furnace at a temperature of from 3,000° to 3,700° Centigrade. This additional process is termed 'firing' and is

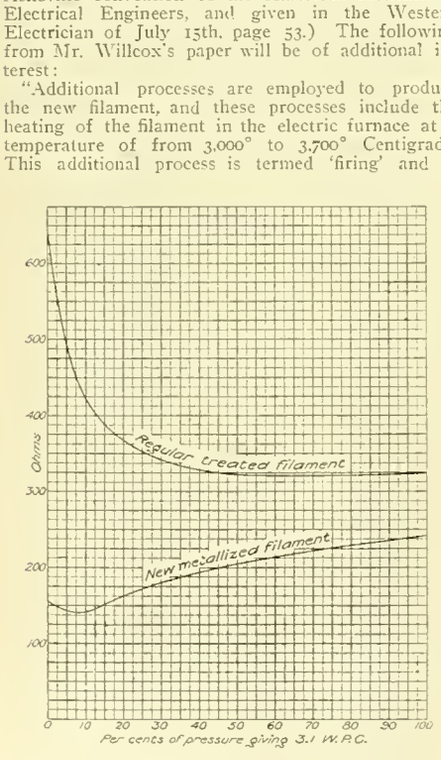


FIG. 1. RESISTANCE CURVES OF METALLIZED AND ORDINARY FILAMENTS.

applied to the filament before and after treating. As a result of this 'firing' an exceedingly pure form of carbon is obtained having considerable less specific resistance and much greater density than the present filament. What is specially interesting is that the process changes the temperature coefficient of the carbon filament from negative to positive, and by reference to Fig. 1 the difference between the resistance curves of the present and new filament may be clearly seen. As is well known, the present carbon filament decreases in resistance as it grows hotter, acting in this way directly contrary to metal conductors, which increase in resistance with increase in temperature. The new filament, on the other hand, follows the law of the metals and increases in resistance with increase of temperature, this increase in resistance, however, being nowhere near as rapid as that of the metals.

"The resemblance of the new carbon filament in this and other respects to the metallic filament has suggested the term 'metallized,' which is now employed to describe the new filament, although there is no metal in the filament. The practical effect of subjecting the filament to the intense heat of the electric furnace is to produce a filament whose carbon resembles the diamond, and therefore is very refractory and capable of withstanding a much higher temperature with the same rate of deterioration than anything heretofore used. By operating at a higher temperature the filament is able to give a greater amount of light per unit of surface and therefore secures an improved efficiency.

"The actual gain in efficiency is 20 per cent. over the present efficiency of incandescent lamps. This is a remarkable gain, equivalent to a development of 10 to 15 years, and one that can be more

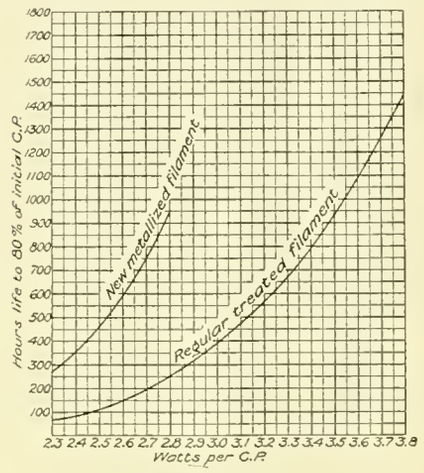


FIG. 2. CURVES OF USEFUL LIFE OF METALLIZED AND ORDINARY FILAMENTS.

readily appreciated by reference to curves in Fig. 2. These curves show the useful-life performance at various efficiencies for the new and old filaments, and the radical improvement in life values at equal efficiencies is graphically portrayed.

"The color of the new metallized filament is dull gray. One special feature of merit over the ordinary carbon filament is that it blackens the bulb much less, and is much more stable at high temperatures."

To various questioners Mr. Willcox said the new filament has a double loop and its life is the same as that of an ordinary filament. It is made for voltages of from 100 to 130; the 220-volt lamp with metallized filament is in the future. The frosted bulbs are used for their desirable appearance and because they give a white, soft light at a slight sacrifice in quantity. However, with high ceilings clear bulbs may be used. The benefits of the new filament apply in still greater degree to series lighting.

Mr. Niesz pointed out that a question of policy was involved in advocating the use of the high-efficiency lamps. As they give more light for the same current, their use is equivalent to a reduction in rate. But that doesn't necessarily mean a reduction of income. In general, it is to the advantage of the central-station company to introduce all improvements in the art as they come along. Better light, more satisfactory service, means increased consumption of current in the aggregate, even if individual consumers take less. The public should be educated to use electric light. Greater light for the same current consumption will be an inducement. The subject should not be considered in a narrow sense.

President Hillman said the tendency was to give more light for a given expenditure.

The discussion drifted into a running debate on the old question of free lamp renewals. The fact was developed that while the larger stations are unanimously in favor of free renewals, most of the small companies are opposed to it. Mr. Willcox made an earnest plea for free lamp renewals. Mr. Baker said the customer will burn less light if he has to buy his lamps. Many sockets will be found empty or containing burned-out lamps. By filling dead sockets, he had found in his experience with the North Shore company, current consumption may be increased 20 per cent. Change the lamp as often as the customer wants it changed. It is best to give service without incidental charges. Free renewals induce a liberal use of current and is much the wiser policy in the long run.

Mr. Gear said that it was the plan of the Chicago Edison Company, on complaint of poor service, first to see if the pressure was right; next to see if the lamps were clean; but if the lamp was unsatisfactory it was renewed gladly. On testing returned lamps it was found that 10 per cent. were good. These were sent out again, after being cleaned up.

Mr. Vallette of Edwardsville said that in small country towns it demoralized the business to give something for nothing.

R. A. McLaughlin of Galesburg told how they sold lamps at cost in that city to drive out poor lamps purchased elsewhere and which gave unsatisfactory service.

Mr. Shumway said: "The coal man doesn't throw in stoves with his coal; the steam-heating man doesn't supply radiators; the gas company doesn't give away burners or mantles. We electrical men sell electricity. Why should we furnish free lamps? Many of us sell both gas and electricity. If we give lamp renewals, we will have to give Welsbachs too." Mr. Shumway, who is the most gifted story-teller of the association, related several anecdotes in the course of his remarks, and these were received with great applause. Apropos of the examination of returned lamps, he said it reminded him of the time when he was a grocer's clerk and candled eggs for his employer. Some eggs were clear and were sold as "strictlies;" some were more dubious and were reserved for Thanksgiving and Christmas puddings; "but," concluded the speaker, "we never threw an egg away!"

Mr. Willcox pointed out that Welsbach renewals and incandescent-lamp renewals were not in the same class. The Welsbach mantle is fragile and might be purposely ruptured to get a new one. In returning a lamp the bulb must be intact.

Mr. Abbott of Petersburg (3,500 population) said in his town they gave free renewals to meter customers and sold lamps to flat-rate customers. They found that this policy paid.

Mr. Zimmerman said that in Sycamore (4,000 population) and DeKalb (8,000 poulation) a free-lamp-renewal policy had been adopted. The first lamps are sold, but afterward free renewals are given. Some of the turned-in lamps are used about the plant itself; some at places nearer the station, where the voltage is higher, and some in places like blacksmith shops, where good light is not so essential as in barber shops, for instance.

Election of Officers.

At Friday's session, after votes of thanks had been extended to the retiring officers, to the authors of papers and to the electrical interests of Peoria for the entertainment extended, these officers were elected:

President—D. Davis, Litchfield.
First vice-president—J. N. C. Shumway, Taylorville.
Second vice-president—E. L. Brown, Elmwood.
Third vice-president—E. McDonald, Lincoln.
Fourth vice-president—E. H. Gray, El Paso.
Treasurer—W. J. Day, Bement.
Secretary—H. E. Chubbuck, LaSalle.
Executive committee—W. B. McKinley, Champaign; E. G. Schmidt, Springfield; F. J. Baker, Chicago; S. S. Davis, Moline; E. B. Hillman, Quincy.

David Davis, the new president of the association, is secretary and manager of the Litchfield Gas and Electric Company. He was one of the organizers of the Illinois State Electric Association and served for several years as treasurer and last year as secretary. He has always taken a great interest in the work of the association and is enthusiastic on the subject. Mr. Davis is a native of Litchfield and young in years. His promotion in the association comes as a reward for faithful service, which his fellow-members have appreciated. An active, effective worker, but modest withal, the new president is well liked and is sure to have a successful administration.

J. N. C. Shumway of Taylorville, first vice-president of the association, is a lawyer by profession, but was obliged to abandon that pursuit by reason of delicate health. He turned his attention to more outdoor, active work, and is general manager of a number of electric-light and gas companies throughout the state. He has been secretary and manager of the Taylorville Electric Company since 1889. He is a native of Illinois, and with the exception of several years spent in college and in traveling his life has been passed in his native town. He has been state senator and was a member of the Illinois Commission to the Louisiana Purchase Exposition. He organized the first building and loan association in Taylorville and has been its secretary for 21 years. He is a director of the First National Bank of his city and of several other companies. Mr. Shumway is energetic, progressive and public-spirited. He is a ready speaker, a capital raconteur and one of the most popular members of the association.

H. E. Chubbuck of LaSalle, who has been persuaded to accept once more the secretary's portfolio, is an electrical man by inheritance. His grandfather, S. W. Chubbuck, built the first instruments for Morse and organized the old Telegraph Manufacturing concern. His father, A. S. Chubbuck, followed in the business, and H. E. Chubbuck, too, did his first electrical work in this factory. In 1882 H. E. Chubbuck entered the employment of the Thomson-Houston Electric Company, and for many years he was connected with that company and its successor, the General Electric Company.

He installed or managed plants in Auburn, N. Y.; Springfield, Ohio; Omaha, Neb., and Pueblo, Colo., and also did special work in the home office. Seven years ago he accepted a position with Mr. W. B. McKinley, the head of the well-known "McKinley Syndicate," and now has charge of the Quincy street railway, the electric, gas and street-railway interests of Galesburg, the Illinois Valley Traction Company (which is building an interurban railway through the valley of the Illinois River) and the Citizens' Lighting Company of LaSalle. Mr. Chubbuck is an associate member of the American Institute of Electrical Engineers and a man of varied experience, excellently qualified to fill the position of secretary, as he has previously demonstrated.

Following is a list of the names of the central-station men at the convention:

E. B. Hillman, Quincy; D. Davis, Litchfield; X. Cavarno, Kewanee; R. H. Abbott, Petersburg; C. A. Vallette, Edwardsville; S. S. Davis, Moline; J. N. C. Shumway, Taylorville; Frank J. Baker, Chicago; H. E. Cbubbuck, La Salle; Homer E. Niesz, Chicago; H. B. Gear, Chicago; R. S. Wallace, Peoria; Charles Hahn, Ottawa; W. A. Thomas, Abingdon; E. McDonald, Lincoln; J. J. Frey, Hillsboro; H. E. Haag, Bend; R. A. McLaughlin, Galesburg; F. C. Duncan, Galesburg; Ben C. Parkinson, Kewanee; E. D. Faucett, Kewanee; F. W. Little, Peoria; John R. Staley, Joliet; R. I. Davis, Evanston; G. H. Lukes, Evanston; Fred W. Iosull, Oak Park; E. L. Hyatt, Chicago Heights; John S. Reesman, Evanston; John G. Learned, Evanston; W. H. Few, Delavan; R. H. Bigger, Carrolton; L. Owen, Peoria; C. F. Soyder, Bloomington; E. P. Reeder, Paris; Charles Kuster, Sullivan; A. V. Schroeder, Springfield; C. E. Sharpe, Moline; W. B. Decker, Fairbury; N. J. Foster, Fairbury; E. L. Brown, Elmwood; H. D. Rodgers, Waverly; W. J. Irwin, Cambridge; F. V. Samuelson, Orion; A. Johnson, Altoona; E. H. Gray, El Paso; W. M. Willett, Aurora; R. L. Flanigan, Springfield; W. J. Day, Bement; Harry J. Firth, Watseka; B. G. Smith, Kankakee; J. L. Neloon, Paris; J. R. Harrington, Edinburg; William Lomis, Morrisonville; O. B. Hayden, Keithsburg; E. E. Butterfield, Lewiston; W. J. Achelpohl, Galesburg; H. P. Grove, Utica; R. A. Butterfield, Winchester; J. H. Crickenberger, Henry.

Convention Notes.

Bryan-Marsh lamps were talked about by J. S. Corby.

Moloney transformers formed the burden of the song of J. J. Mullen.

The Ewing-Merkle interests of St. Louis were looked after by J. T. McNair.

The American Electric Supply Company was present in the person of E. J. Johnson.

The Central Electric Company was well represented by George H. Erich and L. Privat.

Vincent Gray represented the Columbia Incandescent Lamp Company at the convention.

Thomas Graham Grier—no less—did the honors for the American Circular Loom Company.

The National Electric Company was represented by its Cook County sales agent, Arthur Jones.

C. P. Wood of the Moline Lamp Company was among those corralled by the Hustling Hundred.

Buckeye incandescent lamps, "31 inspections," and Jandus arc lamps were boomed by W. R. Bonham.

The Stanley-G. I. Electric Manufacturing Company had as representatives Louis Friedmann and A. A. Morton.

The Monarch Electric and Wire Company of Chicago was represented at the convention by Edward Kearns.

The Western Electric Company was represented by W. H. Tompkins of Chicago and C. L. Clary of the St. Louis office.

"Wesco" was the word most frequently in the mouth of E. E. Rines, who was one of the diligent workers at the National.

F. D. Schwartz and H. N. Remington were on hand for the Electric Appliance Company. They exhibited a Sangamo direct-current wattmeter of the new type.

Blue numbered ribbon badges were provided for members and red for visitors. The stickpins for attaching the badges bore miniature incandescent lamps with opal bulbs.

Francis Raymond III., with his unfailing smile, represented the Moloney Electric Company, American Conduit Manufacturing Company, Switchboard Equipment Company and D'Olier Shade Company.

George Cutter is an old convention hand, and he couldn't resist the temptation to run over from South Bend, Ind., where his factory for the manufacture of overhead-construction material is located.

J. Robert Crouse of the National Electric Lamp Company arrived on Friday. Mr. Crouse is greatly interested in the subject of central-station advertising, which he discussed with many of those present.

Peoria being the home town of the Diamond Meter Company, it did not fail to make an exhibit, consisting principally of wattmeters for direct and alternating circuits and in charge of H. B. Gilbert and H. W. Sayles.

J. M. S. Waring, engineer of the Chicago office of the Electric Storage Battery Company, looked after the interests of his company, which installed a battery plant of considerable size in the power house of the Peoria company.

Clarence E. Delafield, district manager for the Wagner Electric Manufacturing Company of St. Louis, was in attendance for his company and made an exhibit of instruments and transformers and distributed some attractive literature.

Prepayment wattmeters shown in operation were the feature of the exhibit of the Fort Wayne Electric Works, which was in charge of John H. Raymond and A. L. Pond of Chicago and W. C. Knight, manager of the St. Louis office.

Allis-Chalmers interests were ably looked after by Ervin Dryer and C. L. Brown of the Chicago office, who distributed literature relating to the electrical and mechanical apparatus of their company, including polyphase induction motors.

The Nernst Lamp Company made its exhibit with the Westinghouse company, being represented by A. C. Wales. A three-glower and six-glower lamp were in operation, running on the small converter coil which has lately been put out for use where 220 volts is not available.

The electrical interests of Peoria were cordial and hospitable. There was a complimentary excursion on the Illinois River, or the widened portion of it known as Peoria Lake, on Friday afternoon. Mr. Wallace of the local company was on board and was solicitous for the comfort of the visitors. A dinner at the Country Club and a theater party followed. The weather during both days of the convention was delightful.

At exactly the psychological moment the Hustling Hundred was organized, and of course "Tommy" Grier was conspicuous in his successful efforts to get everybody present to join this unique organization, which waxed great as though the promoters possessed the wizard wand of Merlin. Jesse Scribner is president and Mr. Grier secretary, and there are other officers galore, including a high priest and a rainmaker. Financially, the new organization is a follower of the strenuous school now so popular, and there is some talk of an investigating committee.

The General Electric Company was represented by F. N. Boyer, manager of the supply department, Chicago; F. W. Willcox, Edison Lamp Works, Harrison, N. J.; G. E. Crossley, J. Scribner, P. A. Rogers and J. A. Nicholson of the Chicago office, and C. R. Croninger of the St. Louis office. An extensive line of General Electric heating devices was shown and demonstrated, and the new high-efficiency incandescent lamp was also on exhibition. The exhibit was advantageously placed in a room opposite the headquarters of the association and attracted much attention.

Between the morning and afternoon sessions of Thursday many of the visitors under the guidance of Vice-president Little and Superintendent Wallace of the Peoria Gas and Electric Company visited the generating station of that company. The capacity of this plant, which is placed on the shore of the Illinois River at the foot of Liberty Street, is 2,500 kilowatts in alternating-current generators. Two G. E. 800-kilowatt, 2,300-volt, three-phase generators, driven by slow-speed horizontal steam engines, are the principal units now, although a 1,000-kilowatt Curtis turbo-generator is about to be installed and is to be followed by other steam turbines. Motor-generators furnish 500-volt direct current, and there is a storage battery of considerable size. The plant is modern and well equipped, the switchboard work being particularly excellent.

The Westinghouse Electric and Manufacturing Company occupied a room on the parlor floor in which it made quite an extensive exhibit of some specialties, among them induction motors, both for single-phase and polyphase. There was also a direct-current motor, type R, which has recently been placed on the market. Arc lamps were shown in operation and included both direct-current and alternating-current multiple and a series alternating-current lamp. There was also shown a 6,600-volt transformer, with suitable lightning arrester and choke coil, the whole particularly adapted for interurban transmission work. One of the interesting exhibits was a prepayment wattmeter in actual operation recording the current consumed by the apparatus which was in operation. Samples of integrating wattmeters for single-phase alternating-current and the new direct-current wattmeter were also shown. But what may be considered the crowning feature of the exhibit was the line of handsome portable instruments, including voltmeters, ammeters, wattmeters and portable transformers therefor. These instruments are all mounted in highly finished mahogany cases and the workmanship and finish are of the highest character. This company was represented by W. R. Pinckard, Jos. W. Busch and A. L. Millard. Mr. Pinckard, who was accompanied by Mrs. Pinckard, read a good paper on "Interurban Transmission."

An election will be called November 14th to vote on a bond issue of $60,000 for an electric-light plant in Dallas, Texas.

A New Guy Anchor for Telephone and Electric-light Poles.

A new anchor for guying telephone or electric-light poles has recently been put on the market and is attracting much attention. The name, the D. & T. anchor, was taken from a description of its operation, the D and T being the first letters of the words drive and twist. This anchor, which is illustrated in Figs. 1 and 2, is driven into the ground with a sledge or maul to a depth of about five feet. The shaft is then twisted to the right three revolutions, by threading the bar through the eye. The revolution of the shaft spreads the blades to an angle of 90 degrees with the shaft itself. This spreading of the blades is caused by the peculiar shape, which is something like that of the blade of a screw propeller.

Fig. 1 shows the anchor as it is driven into the ground. Fig. 2 shows the anchor after it is driven into the ground and the shaft twisted three revolutions. The photographs from which these interesting pictures were obtained were taken after driving the anchor into the ground and then digging the dirt away from the plane of the anchor to a distance of about six feet on either side. They well illustrate the unique idea of the anchor. Fig. 1 shows that the ground is not disturbed in the least by driving the anchor into the soil. In Fig. 2 may be seen the great holding power which the anchor will have in undisturbed ground.

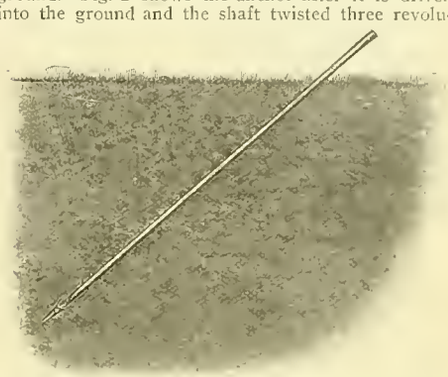


FIG. 1. GUY ANCHOR IN SOIL BEFORE BLADES ARE SPREAD.

The anchor is made up in four sizes for light, ordinary and heavy work and dead-ending cables. The No. 1 is made with a five-foot five-eighths-inch steel shaft formed into a ring at the top, carrying at the bottom the wings, which spread eight inches and are 2½ inches wide. They are supported on the shaft by a five-sixteenths-inch pin made from tool steel. No. 2 is made with a seven-eighths-inch solid steel shaft, six feet long, formed into a ring at the top, carrying at the bottom the two wings, which spread 11 inches and are 2½ inches wide. These are supported by a five-sixteenths-inch tool-steel pin. No. 3, which is commended for toll-line work, is made with a six-foot seven-eighths-inch steel shaft, with the bull ring at the top, carrying wings which spread 12 inches and are 3½ inches wide. The pin supporting the wings is one-half-inch tool steel. No. 4 is the same construction as No. 3, excepting that the wings spread 18 inches. In order to save the stock around the pin, a hole is made for the pin by spreading the rod in place of drilling the hole. In this manner the entire strength of the heavy shaft is saved.

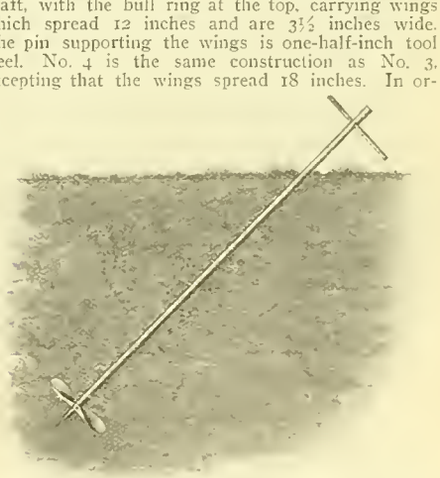


FIG. 2. GUY ANCHOR AFTER BLADES HAVE BEEN SPREAD.

The company asserts that on account of the unique manner in which the blades are spread at a depth in the ground, that this type of anchor has an unusual holding power; also that it can be installed in 60 seconds. It reports that one construction foreman who has used the No. 2 anchor states that he has installed it in ordinary solid sand in 20 seconds. This ease of installation makes the cost of placing the anchor in the ground remarkably low.

The D. & T. Anchor Company of LaCrosse, Wis., which manufactures these anchors, will be pleased to send circulars showing their merits and also a souvenir model upon application.

Interurban Transmission.[1]

By W. R. Pinckard.

For the sake of brevity I have used the above title, and this paper will be devoted to the consideration of the transmission from existing central stations of electricity for power and lighting to be used in small towns and rural communities. It is undoubtedly as feasible to do this as it is to transport passengers by electric railways through the same sections of country. This, however, depends largely upon the location of the central station in regard to fuel and water supply and also upon the population and the character of the inhabitants in the proposed territory. Since this paper is mainly for the benefit of the smaller stations in cities of from 3,000 to 10,000 inhabitants, and assuming that their systems are generally single-phase, with a frequency of 7,200 or 16,000 alternations, I will not go into the question of transmitting large amounts of current by the two or three-phase system at very high voltages for power purposes. That is a field by itself and would require the consideration of an expert on the subject.

Almost the entire territory of the state of Illinois presents attractive opportunities in this direction for the expansion of the business of the plants referred to. It is probably true that where water-power is available, current for power and lighting can be distributed over a wide territory at a cost which could not be met by steam power under ordinary conditions. However, there are central stations favorably located for fuel at a low price, with ample water for steam and condensing purposes, which might find it profitable to transmit current within a radius of about 20 miles, for the purpose of supplying outlying communities of from 200 to 2,000 inhabitants, and possibly also furnish large farmers along the transmission line with current at profitable rates for lighting and power. This idea is now being tried in several localities in this state, two of which are quite ambitious, but they are neither of them yet in operation, though they probably soon will be. In one case the objective point is a town of about 1,500 inhabitants, 16 miles from the central station. This place has a steam plant in which they will abandon everything inside the station with the exception of the switchboard. Thereafter their series alternating-current street arcs and the incandescent lighting for stores and residences and such motor service as they may be able to secure will be supplied by the central station 16 miles away. It is commonly accepted as the rule that the voltage on such a line should be at the rate of about 1,000 volts per mile of line or circuit; therefore, in this case, the power is to be transmitted at 16,500 volts.

With such a business as a nucleus, the central station has access to some other business adjacent to its transmission line. There are in many localities progressive farmers who desire the convenience and safety of electric light in their homes and barns, and such service could be supplied to them without entailing too great a cost for apparatus, since a transformer is all that would be required. I know of at least one instance in this state where there is a large dairy farm provided with an electric-light plant of its own, driven by a gasoline engine and furnishing current for about 200 incandescent lamps. The engine is used during the daytime for grinding feed, pumping water and other power required about such an establishment. This farm would be glad to take current from an interurban line should there be one near by, as the use of the gasoline engine is dangerous and requires the services of an expert to keep it in order. In addition to the lighting, it might be found profitable to furnish such farmers with the power required in threshing, shelling corn, sawing wood, etc.

I believe that several manufacturers of transformers now furnish, as a standard line, oil-insulated transformers in sizes from one to 50 kilowatts for 3,300, 6,600, 11,000 and 16,500 volts primary, arranged for either 1,100 or 2,200 and 110 or 220 and 220 or 440 volts on the secondary side; therefore, being standard, they can be secured within a reasonable time and at a reasonable price. However, owing to the necessity of providing insulation required for the high voltage, the cost of such transformers is considerably higher than those wound for only 1,100 or 2,200 volts primary. Some of these transformers are provided with multiple-ratio taps, so that the secondary can be raised five or 10 per cent., thus compensating for that amount of drop in the line. The step-up and step-down transformers at the ends of the line should be located in substantial fireproof buildings, wherein should also be installed the necessary lightning arresters and such switchboard apparatus as may be required. Intermediate transformers along the line may be suspended from poles in the usual way, but on lines above 6,600 volts the fuse boxes are, I think, not made for outdoor service and would have to be mounted under cover.

The line should be of bare copper wire. I quote from an authority on this subject the following data on the resistance of hard-drawn copper wire, giving but a few sizes which are most likely to be used. The table also includes a comparison of the reactance and impedance effect at 60 and 125 cycles and at different spacings:

Data on Copper Wire.—Reactance and Impedance in Ohms per mile of Wire at 60 Cycles.

Size B. & S.	Resistance in Ohms per Mile.	12 Inches Apart.		18 Inches Apart.		24 Inches Apart.	
		R	I	R	I	R	I
4	1.313	.606	1.448	.656	1.467	.690	1.480
6	2.088	.633	2.180	.685	2.200	.720	2.210
8	3.320	.662	3.380	.712	3.390	.742	3.400

Reactance and Impedance in Ohms per mile of Wire at 125 Cycles.

Size B. & S.	Resistance in Ohms per Mile.	12 Inches Apart.		18 Inches Apart.		24 Inches Apart.	
		R	I	R	I	R	I
4	1.313	1.26	1.820	1.37	1.890	1.44	1.940
6	2.088	1.32	2.460	1.43	2.510	1.49	2.560
8	3.320	1.38	3.590	1.48	3.630	1.55	3.660

The drop of potential in volts per ampere per 1,000 feet of copper wire is given as follows:

Number 8 B. & S..... 0.65
Number 6 B. & S..... 0.41
Number 4 B. & S..... 0.26

For example, in transmitting 50 kilowatts at 16,000 volts 16 miles on No. 8 B. & S. copper wire we would have 169,000 (feet) by 3⅛ (amperes) by 0.65 (volts per 1,000 feet) equals 343 volts loss, or about 2⅛ per cent.

The reactance is approximately double and the impedance about 10 per cent. more at 125 cycles than it is at 60 cycles, thus showing the advisability of adopting 60 cycles for such service.

"Reactance can be reduced in two ways—one is to diminish the distance between wires. The extent to which this can be carried is limited in the case of a pole line to the least distance at which the wires are safe from swinging together in the middle of a span. The other way of reducing reactance is to split up the copper into a greater number of circuits and arrange those circuits so there is no inductive interaction."

Great care should be exercised in the selection of poles, cross-arms and insulators. The poles should, of course, be so placed and of such a height that they will clear all trees, and where necessary the limbs of the trees should be cut away so that they will not come in contact with the lines.

Another important point to consider is the protection of such a line from injury by lightning. For this purpose several manufacturers furnish lightning arresters for the protection of high-voltage transformers, and these should be installed in all cases. One arrester will be required for each line of the circuit and at each end of the circuit on the high-tension side. If there are transformers located along the line they, of course, should also be protected. It should be borne in mind that the most expensive lightning arrester affords no protection without a good ground connection.

There are other factors to be considered under certain circumstances. For instance, "When more than one transmission line is strung on the same poles the alternating current in each line induces electromotive forces in the other lines and affects the line drop. This interference of one line upon another is, however, obviated by crossing or transposing the lines at frequent intervals." Some engineers, however, do not recommend this practice. Another consideration is the power factor of the load. In the case of incandescent lighting only, this amounts to practically nothing and need not be considered, but in the operation of alternating-current arc lamps and motors, creating a bad power factor on the line, it would have to be taken into consideration. Core loss, efficiency and regulation of transformers should also receive consideration.

I have given merely a general outline of a possible way to increase your business. It will probably necessitate an increase in your present central-station equipment and a considerable investment in the necessary transformers and pole line, and to what extent it is profitable to do this depends entirely upon the revenue to be secured. It is a subject well worthy of study by any who may have reached the limit of business in their own communities and who find it necessary to go outside after more business or else be content with what they have. I have been unable to secure sufficient data on this subject to show whether this method of securing business is profitable or not, but I trust that I have given some of you ideas which may prove beneficial.

1. Paper read before the Illinois State Electric Association at Peoria, Ill., October 5, 1905. Mr. Pinckard is connected with the Chicago office of the Westinghouse Electric and Manufacturing Company.

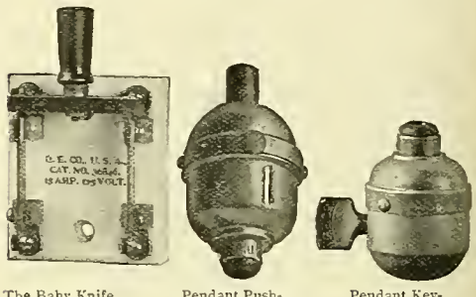
The County of London (England) Electric Supply Company has drawn up a new scale of charges for electric energy supplied for power and heating in its northern and southern areas. The new tariff, which came into force on October 1st, fixes the maximum charge at 5.07 cents per unit, but with a gradual scale of discounts the price will be reduced to 2.53 cents a unit to consumers who take over $680 worth of electricity in three months.

Switches for Small Currents.

Two small specialties in the line of switching apparatus are manufactured by the General Electric Company, which are here illustrated. One of these specialties is known as the baby knife switch and the others are pendant switches.

The knife switch is a double-pole 15-ampere 125-volt device and, as shown in the illustration, it follows the design of the large punched-clip switches and is neat, durable and compact.

The pendant key-type switch is particularly designed for use where an inexpensive switch is desired to control one or two incandescent lamps which are inaccessible and which do not require



The Baby Knife Switch. Pendant Push-button Switch. Pendant Key-type Switch.

NEW SWITCHING DEVICES.

a five or 10-ampere switch. It is neat in design and matches the company's standard sockets and receptacles.

The pendant push-button switch is most useful in connection with temporary or permanent installations of incandescent or multiple arc lamps. It is also excellently adapted for use with fan motors, as it locates the control of motors at the most advantageous points, regardless of their accessibility.

In both types of switch the contact surfaces are of ample size and the mechanism is dependable. The circuit of the push-button switch is closed by pressing a button at the bottom of the switch, and opened by pressing the release button at the side. The key switch operates on the same principle as a standard key socket. The standard finish of all the pendant switches is polished brass.

New Ceiling Arc Burst.

The accompanying illustration shows the ceiling form of the new style arc bursts manufactured by the Benjamin Electric Manufacturing Company, Chicago. This type measures 18 inches in diameter and 11 inches deep and is essentially a low-ceiling cluster—particularly applicable to stores,

NEW CEILING ARC BURSTS.

restaurants, etc., in basements or places where it is not desirable to use a stem. The cluster body is finished in frosted aluminum to conform with the white appearance of the lamps and reflectors.

The fixture form, suspension form and weather-proof form for outdoor use are other types of the Benjamin company's arc cluster shown in its new folder, which will be sent on request.

New Atlantic Cable Laid.

A dispatch from Canso, N. S., says that the Commercial Cable Company completed its new Atlantic cable on October 6th, the final splicing having been delayed by bad weather. The signaling speed of the new cable is 15 per cent. greater, it is said, than that of Atlantic cables of similar length. Its cost varied from $1,000 to $6,000 a mile, according to the depth of water and the character of the ocean bed. The greatest depth in which it is laid is five miles.

N. E. Harvey has asked for a franchise for putting in an electric-light plant at Eldon, Mo.

Thermit Rail Welding.[1]

By G. E. Pellissier.

The thermit process of welding steel rails dates from the year 1899, and is the discovery of Dr. Hans Goldschmidt of Essen, Germany. Thermit, as described by the discoverer, consists of a mixture of powdered aluminum and iron oxide, and its application to welding depends upon the following fact: If the mixture is ignited at a single point by means of a special ignition powder, peroxide of barium and aluminum, combustion proceeds without further supply of external heat and without any combination with the oxygen of the air, at the same time developing a temperature estimated at 3,000° C.

The complete outfit for welding steel rails consists of the crucible, a pair of molds made to fit the section of rail to be welded, a pair of clamps to hold the molds in place, a wire brush to clean off the dirt from the ends of the rails, a small gasoline torch to dry off any moisture which may be present on the parts to be welded and to take the chill out of the metal, and a portion of thermit weighing from 15 to 25 pounds, depending on the section of rail to be welded. If an absolute butt weld of the ball of the rail is desired, a pair of heavy clamps for upsetting the rails while hot is also necessary. The whole outfit is easily transportable in an ordinary wheelbarrow.

The molds are easily made, being simply sheet-iron flasks filled with a mixture of clay and sand, or any other material suitable for steel casting. The only precaution necessary in making the molds is that they should be well vented and thoroughly dried. The flasks may be used repeatedly, of course, but have to be refilled each time after using. One man can fill from 15 to 20 pairs per day.

In making a weld the ends of the rails are first cleaned with the wire brush (this is simply to get the dirt off, as rust makes no difference), and heated to dispel the moisture. The rails are then brought into exact alignment and the molds put on and fastened with clamps. All contact lines between the mold parts and the rail are then luted with moist clay. The top of the rail is also painted with a thin paste of clay and water, which, when dry, prevents the slag and iron from adhering to the top of the rail. When a butt weld is desired, a pair of clamps is next adjusted to the ends of the rail, so that they may be upset while hot. These are not deemed necessary, however, and are not generally used, as it has been found sufficient to simply weld the base and web of the rail.) The molds are then backed up with sand. The crucible, which is set on a tripod, is next placed over the molds, with the tapping hole directly over the gate in the mold. A tapping rod is then placed in the hole, which is then stopped up by means of a couple of asbestos washers, a small iron disk, and finally a little refractory sand. The charge of thermit is then added and a little of the ignition powder placed on top, which is set off with an ordinary storm match. The reaction when once started proceeds rapidly, usually taking about 10 seconds, the molten mass boiling furiously. At the end of about 20 seconds more the boiling has ceased, and the iron is separated from the slag. The crucible is then tapped and the metal flows into the molds, followed by the slag, and in less than a minute the joint is made. The joint is then allowed to cool about 15 minutes before the molds are taken off. (This can be done three or four minutes after pouring, if necessary, as when welding while the cars are running.) Two or three taps of a hammer will separate the slag from the joint, and the work is completed, no chipping or grinding being necessary except when welding old rails, where the joints are battered, when, of course, the rails have to be ground down to an even surface. In case the two rails do not come together closely, a shim of steel may be inserted and welded in, completely filling the gap. (The writer has made many joints in this manner with perfect success.)

Four men constitute a welding gang, and 18 or 20 joints can be made in a day of 10 hours. No skilled labor is necessary.

The first place to experiment with this process was Essen, Germany, the home of the inventor. Owing to the importance of the rail-joint question, however, other Europen cities were not slow in investigating its merits. In 1900 about 1,200 joints were made in various cities on the Continent. The results obtained from these were considered so satisfactory that the use of this method of welding increased very rapidly, some cities introducing it on an extensive scale, notably Leeds, England; Dresden, Austria, and Singapore, India. Twenty-six hundred joints were made in 1902, and 20,000 in 1903. In 1904 a company was formed in the United States to introduce the process here, and at the suggestion of the writer, who had followed the development of the process with considerable interest, the Holyoke Street Railway Company decided to use it on a mile of track about to be reconstructed.

Discussion (in Abstract).

W. Boardman Reed, engineer of maintenance of way and buildings of the New York City Railway Company, said thermit welding has been recently introduced into this country and it seems to offer many advantages. He believed that, if properly done, it is positive as to results. The process is so simple that any track gang can do the work and, as stated in the paper, all the necessary tools and even the material for several joints can be carried in one wheelbarrow. The expense is rather high, but any road that can afford to use a solid road-bed and 107-pound rails can afford, he thought, to pay five or six dollars apiece for perfect joints. As stated above, the thermit weld has been recently introduced into this country, and Mr. Reed was, he believed, one of the first to weld joints commercially with thermit in this country, but, unfortunately, in neither of the places where thermit welding was done was the construction such as to give a fair trial.

Mr. Kirker spoke about thermit and an old rail. A large majority of failures in welded joints occur at the old bolt holes. On a new rail with only one hole in the end the chances of breakage are decreased. Thermit can be applied to either a new or an old rail, and its practical advantage is that the smallness of the equipment is of great advantage to the man in the field.

T. A. Cross, superintendent of line, United Railways and Electric Company, Baltimore, said that their rails are 8½, 6, and 9½, 6. In case they want to use these rails in their standard traveling they put plates on. They only have two holes drilled in the rail. He orders the steel company not to paint the ends of the rails for eight or 10 inches. For this work they have an old car with shelves along the side on which they carry the molds; also the thermit and the men. These men go from one job to the other, there being eight men in the gang. The gang has done as high as 46 in a day. Two men are at the yard making molds and can make 40 or 50 pairs of molds a day. The company has from 2,000 to 2,500 welds done so far this year. The first welding compound shipped them is what is called 15 pounds and three. That is 15 pounds of pure thermit and three pounds of punchings. He sifted out a pound of the punchings and put in two pounds of thermit. Since he did that they never had any trouble.

He requires his men as soon as they take the molds off to take a sledge hammer and hit the weld to see if it is loose, and try to knock it off with a chisel, so as to be sure it is all right before it is paved up. They have up to now 10 breaks that have had to be repaired. In about eight or 10 minutes the gang will make a joint in an old rail and let the cars run.

M. D. Pratt, engineer of the Central Pennsylvania Traction Company, asked what the conductivity of the joints were.

Mr. Cross answered that they had a test car run over the line, and found no loss at all.

Mr. Pellissier added that he had several joints tested at the polytechnical schools and electrical laboratories, and the average conductivity was 90 per cent. to 100 per cent. better than the rail. He took three feet of the rail and three feet of the joint, which showed the same thing. He also had Mr. Herrick's test car run over the line, and in many cases it showed a conductivity of the joint higher than that of the rail.

1. Abstract of a paper presented to the American Railway Mechanical and Electrical Association, Philadelphia, September 26, 1905. Mr. Pellissier is civil engineer of the Holyoke Street Railway Company.

Echoes of Street-railway Convention.

One of the important steps taken at the Philadelphia convention of the American Street and Interurban Railway Association was the provision for regular headquarters and the election of a man to the office of secretary-treasurer who could devote his whole time to the work of advancing the interests of the association. The one elected to fill the important position, as announced last week in the report, is Bernard V. Swenson, and he is well fitted for the office. He has an unlimited capacity for hard work, and to a man of his energetic nature the task of arranging the details under the new order of working will present only fascination. Mr. Swenson was born in Chicago, May 3, 1872, and received his early education in the public schools and in the Chicago Manual Training School. He then entered the University of Illinois and graduated from there in 1893, completing both the mechanical and electrical engineering courses. He engaged in instructional work from 1893 to 1898 at the University of Illinois, spending the summer of 1894 in travel in Europe. He was appointed to be assistant professor of electrical engineering at the University of Wisconsin in 1898, which position he held until he was given leave of absence to take up the work of the Railway Test Commission at the Louisiana Purchase Exposition, somewhat over a year ago. He received his master's degree in mechanical engineering from the University of Illinois in 1901 and in electrical engineering from Wisconsin in the same year.

BERNARD V. SWENSON.

Mr. Swenson is a full member of the American Institute of Electrical Engineers and of the American Society of Mechanical Engineers, and an associate member of the National Electric Light Association. He is a member of the Tau Beta Pi, an honorary engineering fraternity, and of the Phi Delta Theta fraternity.

Some interesting views of exhibits at the convention, which arrived too late for publication in last week's issue, are shown herewith. The exhibits are those of the Buckeye Engine Company, the Gould Storage Battery Company, the Continuous Rail Joint Company of America and the H. W. Johns-Manville Company. The exhibits here mentioned occupied booths in conspicuous places in the large convention hall and competent representatives of the companies were always on hand to "talk up" their respective products.

H. W. Johns-Manville Company. Buckeye Engine Company. Gould Storage Battery Company. Continous Rail Joint Company of America.

EXHIBITS AT THE PHILADELPHIA STREET-RAILWAY CONVENTION.

Overhead versus Underground Lines.[1]

By H. B. Gear.

The modern tendency toward municipal control of the policies of of public-service corporations is well exemplified in the agitation now current among cities of 10,000 population and upward, of the question of putting overhead lines underground.

The average "city father" more readily comprehends the desirability of removing from the main streets of his city the network of wires than the practical difficulties incident to such a change, and the central-station manager who has had no experience with the installation and operation of underground lines is placed at a disadvantage in being unable to present definite arguments with which to combat this aldermanic agitation.

It will therefore be the purpose of this paper to discuss some of the relative advantages and disadvantages of overhead and underground wires with especial reference to the conditions existing in medium-sized cities.

As implied by the title of this paper, arguments can be brought in favor of each of these methods of maintaining electrical distributing systems.

Overhead lines have been employed almost exclusively by central-station companies in all except the larger cities, principally because by this system a given amount of business can be transacted between generating station and consumer with a minimum investment. Indeed, were it not for the availability of this system there would be no central-station service in the majority of our smaller cities. In this connection it may be remarked that the possibility of maintaining overhead lines at small cost has no doubt led some central-station managers to make their construction so cheap that it has become a source of unreliable service and a menace to life and property. This state of affairs has no doubt been one of the factors in creating a public sentiment in favor of the underground work.

The maintenance of overhead lines is comparatively easy, owing to the ready accessibility of such lines for inspection at all times. The exposure of overhead lines, however, subjects them to a high rate of depreciation on account of the action of the elements.

Continuity of service cannot even be approximated with overhead lines in a distributing system of any considerable extent, no matter what precautions are taken or how good the construction. This becomes a serious matter in cases where considerable amounts of power are being distributed for manufacturing purposes over such lines, as interruption of service means loss not only to the central-station company but to the consumer, whose employes are standing idle while the service is off. The discharge of lightning arresters, the occurrence of grounds in the limbs of trees and elsewhere, swinging of wires in high winds during a storm are sure to interrupt service on every part of the system at one time or another.

It is usual in many cities for the telephone lines to be carried on the same streets with the electric-lighting wires. There are therefore many places where one set of wires pass under or above the other. In time, dangerous situations are apt to result from this condition, in case the upper set of wires breaks and falls across the lower.

The principal advantage of underground construction, aside from esthetic considerations, is that, where employed for reasonably large areas, it relieves the central-station manager of the troubles that beset his overhead lines in stormy weather, and continuity of service may therefore be more nearly approximated.

The maintenance of underground lines which have been installed in accordance with approved methods is comparatively simple, the necessity for repairs being less frequent than on overhead lines. However, when trouble does occur it is usually of such a character that a longer time and more expense is required to make repairs. The installation of underground services is also troublesome where sidewalks or basements are unexcavated.

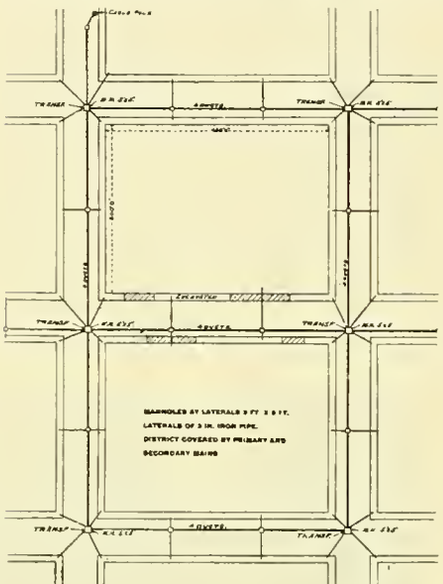
Laterals cannot be put into every building on account of the prohibitive expense, and it is therefore necessary for those consumers in whose buildings there are no laterals to extend their wires outside their own premises as much as 50 to 75 feet in some cases.

The failure of the insulation of cables near points where connections are made between overhead and underground lines is apt to be troublesome, especially where the length of the underground system is short (less than 400 feet) on account of the action of lightning. It is therefore necessary to provide lightning arresters near all cable poles. On such combination systems, where the underground work extends over a considerable area, this trouble is not so likely to be experienced, however.

The failure of joints between overhead and underground lines on cable poles, due to the action of the elements, is also a detail which has proved quite generally troublesome. It is difficult to protect the grounded sheaths of the lead cable so that it is safe for linemen to work on the pole without introducing other elements of construction which are equally dangerous to continuity of service.

In order that some idea may be had of the elements entering into the cost of underground construction, a typical underground system, such as might be required for a city of 15,000 to 25,000 in the business district, is illustrated by the accompanying drawing. The use of underground lines for general distribution in scattered residence territory is prohibitively expensive and will therefore not be considered.

In the case illustrated it will be noted that large manholes are provided at street intersections for the purpose of allowing ample room for the installation of transformers, jointing of cables, etc. Smaller manholes are provided at points where laterals are installed for services. Four ducts have been provided, although only two of them are occupied by the primary and secondary cables which have been included in the estimate. The average central-station has some series arc or 500-volt power service which would occupy the two remaining ducts, and though these were not occupied by such circuits it would be advisable to install them for future use. The additional expense of two ducts at the time



PLAN OF TYPICAL UNDERGROUND SYSTEM FOR CITY OF 15,000 TO 25,000.

the conduit line is being laid is small as compared with what it would be if it was desired to lay additional ducts later on, and conduit work is subject to a very low rate of depreciation.

Some idea may be obtained of the difficulty which customers would encounter in bringing their wiring to the nearest service where sidewalks are unexcavated by noting the points on the middle street where unexcavated portions of the sidewalks are indicated by shading. In such cases the laterals must be carried into the basement of the property which it happens to enter and no adjoining customer can reach this service without running his wiring into the premises of his neighbor.

The primary cables are of No. 6, as this is the smallest size which it is practical to use for mechanical reasons. The secondaries have been figured on the three-wire system, the copper being No. 2 B. & S. throughout. This perhaps would not be found in practice, as there are usually large blocks of load concentrated in the immediate vicinity of transformers which make larger cable necessary at these points and permit the use of smaller cable at other points. However, the net result would be about the same from the standpoint of investment as if No. 2 wire were used throughout.

Transformers of 15 to 25 kilowatts capacity are assumed to be required to carry the load, a total capacity of 125 being assumed. The value of transformers is not included in the figures given, as they would be the same for either overhead or underground construction.

The cost of installing the system above described, assuming that it were done as a job of undergrounding overhead lines, would be about $9,000, the items being as follows:

3,425 lineal feet of four-duct conduit line at $1.25	$4,300
Six 5 by 5 manholes, at $100	600
Thirteen 3 by 3 manholes, at $45	585
1,500 lineal feet of iron pipe laterals, at 40 cents	600
10,000 feet of No. 2 cable, at 14 cents	1,400
5,000 feet of No. 6 cable, at 11 cents	555
2,500 feet of service cable, average No. 4, at 11½ cents	400
Junction boxes and incidentals	300
Labor of installing cable and services	300
Total	$9,040

The cost of overhead lines of equivalent capacity to distribute the load provided for in the above-described underground system would not be over $2,000, using the best construction. The investment required for underground construction in a business district may therefore be taken as being from four to five times as great as for overhead construction.

Having before him estimates of the cost of undergrounding his overhead lines the central-station manager is confronted with the problem of determining whether or not the income from the consumers supplied in the territory under consideration will warrant an increase in the fixed charges resulting from the investment necessary to place his lines underground. There being no great saving in the maintenance charges, the question resolves itself into one of determining whether the greater degree of continuity of service will offset the increased expense in fixed charges; or, in case the line has been ordered placed underground by municipal authorities, it is a question of determining whether it would be better to lose the business than to incur the additional expense due to the underground investment.

For example, in the case illustrated above, assume that the maximum load at 125 kilowatts is used three hours per day during 300 working days per year. The current consumption of the district would then be 112,500 kilowatt-hours. The interest and depreciation on the investment of $9,000 figured at 15 per cent. amounts to $1,350. The cost of supplying customers in this district would therefore be 1.2 cents per kilowatt-hour more than it is with overhead lines. If the average daily use of current were two hours instead of three, the consumption would be correspondingly less, and the increased cost of current in this district would be 1.8 cents per kilowatt-hour.

If this were residence territory with a maximum load of 20 kilowatts, the investment in underground work would be only slightly less, say $7,500. If the maximum load of 20 kilowatts were used on an average of three hours per day, the annual current consumption would be 18,000 kilowatt-hours with fixed charges of $1,125. The cost of current delivered to this territory, due to the undergrounding of the wires, would then be about six cents per kilowatt-hour more than with overhead lines. This cost would of course vary with longer or shorter hours use of the current, but this figure would perhaps represent average conditions in first-class residence territory.

Having determined the increased cost per kilowatt-hour due to the undergrounding of these lines and knowing his other costs, the central-station manager can readily determine whether the proposed investment in underground work will be warranted.

In cities which are laid out with alleys the expense of going underground may often be avoided by moving the pole lines into the alleys where their presence is not objectionable and where the overhead services to buildings can still be maintained.

As suggested earlier in the paper, much can be done in the way of mollifying the public demand for underground work by keeping main pole lines out of the business district as far as possible and keeping all pole lines on business streets in first-class condition.

Discussion.

R. S. Wallace of Peoria wanted to know whether 10 per cent. depreciation were charged for underground work. Mr. Gear said the depreciation on conduits themselves was undetermined. Probably the cement work was as durable as the earth itself. Likewise depreciation on lead and paper-insulated cable was indeterminate. Such cable is likely to be good for more than 10 years. But 10 per cent. depreciation is taken to allow for changes in the art, changes due to increase of load and other causes. It is likely that as time goes on the 10 per cent. rate will decrease. Answering a question in relation to laterals, Mr. Gear said his company aimed to put in laterals at intervals of 100 or 150 feet, so that no customer will have to go farther than 75 feet to get service.

To another gentleman Mr. Gear said that in outlying portions of Chicago the only undergrounding of overhead wires had been with through feeders, the distribution being overhead. This combination makes the expense much less, and customers are not charged more for current, owing to increased cost of service. In any case the speaker doubted whether there should be two prices—one for overhead and the other for underground customers.

Transformers in subways should be avoided. It is better to put them on poles and run the secondaries down in the conduits.

George H. Lukes of Evanston wanted to know if in most small towns it would not be a good scheme to run primaries to say a distributing pole in an alley, with transformer thereon and overhead distribution therefrom. Mr. Gear said that scheme is all right where there are alleys. His proposed plan he thought best where there are no alleys.

Answering Mr. Hillman of Quincy, Mr. Gear said that in a town of 25,000 to 50,000 population where an overhead line had depreciated and had to be rebuilt, he would not propose an all-underground system for the business district. Perhaps the main lead might be underground. But the whole question depends on income, current consumption, fixed charges and the like.

1. A paper read before the Illinois State Electric Association on October 5, 1905. Mr. Gear is general inspector of the Chicago Edison Company.

Western Association of Electrical Inspectors.

A meeting of the Western Association of Electrical Inspectors was held in the assembly rooms of the Chicago Underwriters' Association, in the National Life Building, Chicago, at 10 a. m. on Thursday and Friday, October 5th and 6th. Twenty-nine members were present. The secretary's report indicates a membership of 114, 66 of whom are connected with municipal departments; 46 serve insurance interests, and two are in the employ of public-service corporations not engaged in the electrical business.

Since organization last June the association has issued eight bulletins and seven committee reports, consisting in all of 51 pages of printed matter. Notice was received of the death of one member, Martin C. Dee, late of the Inspection Department of Houghton, Mich., and suitable memorial resolutions were adopted.

Out of the large number of recommendations for changes in the National Electrical Code, the association only saw fit to indorse six.

Several interesting committee reports, covering various phases of electrical inspection work, were discussed. In view of the short time permitted for the consideration of subjects allotted to special committees, the general excellence of reports submitted to the association has been a source of great encouragement to its officers and members. Four additional special committees were appointed to undertake the investigation of the following subjects: Electric crane wiring; underground systems; induction motors; co-operation with national electrical associations.

The next meeting will be held at Indianapolis, Ind., in October, 1906.

Chicago Track Elevation.

The conditions and magnitude of the track-elevation situation in Chicago are so complicated and great that when the work is finally completed the methods employed in solving the special and general problems will offer, it is said, examples for meeting almost any conditions which may be encountered in similar work in any other city. Since 1892, when the first work in elevating the tracks of steam roads was begun, the various roads have accepted 26 ordinances passed by the city and calling for work approximating an outlay of $49,000,000; ordinances now contemplated, if work is carried out accordingly, will raise the figure to $75,000,000; this to be done by 1915, and the city to pay no part of the expense.

Chicago's track and terminal system is said to be more complicated than that of any other city in the world, and the city also has more busy streets crossed by tracks. The expenditure by the roads in this work up to date is estimated at probably $29,000,000, and all has been done without stopping traffic. In some cases entire yards have to be elevated, and again very narrow rights-of-way must go up, and to do this with the minimum of delay in traffic has involved peculiar problems. The roads, of course, will realize a saving from the elimination of delay in traffic from grade crossings and the reducing to a minimum of damages due to crossings. Many methods and original schemes have been applied by the roads as regards retaining walls, abutments, bridges, etc. Filling material used up to date has cost about 26 cents a yard. In 1902 there were 1,500 grade crossings in the city, and the loss of life was yearly about 300 persons.

Street-railway Employes Meet In Chicago.

The national convention of the Street and Electric Railway Employes of America was held in Chicago, beginning October 3d. It was the ninth annual convention, and 200 delegates were present. Mayor Dunne addressed the opening session, predicting higher wages, shorter hours and no strikes. He also expressed his views plainly on the subject of municipal ownership.

One of the features of note at the convention was the appropriation of $20,000 for the purchase of 10 automobiles to be used by the union to convey passengers wherever there is a street-car strike, the profits from these fares to go back into the defense fund, where the $20,000 came from. W. D. Mahon, president of the national organization, admitted that 10 motor cars would not be of much use in case of a street-car strike in Chicago or in any large city. "But they would be a start at least," he said, "and we could buy or lease more, and an auto is always good property. I'm not sure but that the traction question could be settled in Chicago if the city would buy enough automobiles. Omnibuses have been used in London for many years with considerable success, and autos are better than omnibuses."

The delegates made a tour of inspection of the Chicago, Aurora and Elgin third-rail line, and on the evening of October 3d were entertained by the Aurora Trades and Labor Council.

United States Independent Telephone Company Formed.

At a meeting held in Rochester, N. Y., October 7th, the organization of the United States Independent Telephone Company was completed by the election of the following-named directors: Thomas W. Finucane; Adolphus Busch, president the Anheuser-Busch Brewing Company; Walter B. Duffy, president the New York and Kentucky Company; George Eastman, president the Eastman Kodak Company; August Gehner, president the German-American Bank, St. Louis; Robert C. Hall, head of the syndicate which owns the Independent Telephone Company at Pittsburg; J. J. Heim, president the Kansas City Independent Telephone Company; James B. Hoge, president of the National-Interstate Telephone Association; Hendrick S. Holden, president the Commercial National Bank, Syracuse; Breckenridge Jones, vice-president the Mississippi Valley Trust Company, St. Louis; Morris Knapp, treasurer the Woodbury Whip Company, Rochester; William F. Nolker, president the Kinloch Telephone Company, St. Louis; William J. Naylor of the Lake Ontario Improvement Company; William H. Page, Jr., attorney, New York city; Eugene Satterlee, president the German-American Bank, Rochester, and president the Stromberg Telephone Company; John N. Rauber; Hiram W. Sibley, son of Hiram Sibley, one of the founders of the Western Union Telegraph Company, and its president for 18 years; O. C. Snider, manager of the Kansas City Independent Telephone Company; Henry A. Strong, vice-president the Eastman Kodak Companies; James S. Watson, vice-president the Security Trust Company, Rochester; John C. Woodbury, director the Alliance Bank, Rochester; F. W. Zoller, treasurer the Union Trust Company, Rochester, and Edward Bausch, principal owner of the Bausch & Lomb Optical Company, Rochester.

Thomas W. Finucane, who was chosen president of the company, gave out a statement in which he said among other things: "The formation of the United States Independent Telephone Company is the first step in the movement to furnish telephone companies with standard apparatus and with a guaranty that their supply cannot be cut off through the absorption of the manufacturing companies by the Bell interests; to knit together in connecting systems the Independent telephone lines of the country, which, unappreciated as the fact may be in the East, today considerably outnumber the lines owned or controlled by the Bell Telephone Company, and to aid Independent telephone companies in the installation of their plants and improvements in their service."

According to Mr. Finucane there are now over 5,000 Independent telephone companies in this country. It is to aid them in product and appliances and centralized unity of action that the new company has been formed. The Independent lines, represented directly or indirectly on the board of directors, extend from Kansas City to New York city.

The Independent people have acquired franchise rights in New York city which they have every reason to believe are similar in scope and character to the one owned by the Bell interests. Upon these it is proposed to build a plant with a capacity of 225,000 telephones, with an ultimate capacity of 750,000 in the city and the tributary districts. Mr. Finucane continued:

"Our company today authorized its collateral trust mortgage for $25,000 and the underlying securities will comprise the control of the Stromberg-Carlson Telephone Manufacturing Company, which manufactures a thousand telephones a day, and the New York Independent Company, which latter owns the franchise rights above referred to.

"The bonds will be five-per cent. collateral 30-year gold bonds. The trustee of the mortgage is the Security Trust Company of Rochester, N. Y. The coupons will be payable at its office and also at the Chemical National Bank of New York."

The directors of the New York company will be elected a little later on. It is stated that this is only the beginning of a greater development on the part of the Independent people.

Death of John I. Sabin.

News comes from San Francisco that John I. Sabin, the well-known Bell telephone manager, died in that city on October 10th, after a week's illness. Mr. Sabin made a great success of the telephone business on the Pacific Coast, particularly with the Pacific States Telephone and Telegraph Company. He came to Chicago in 1901 and accepted the presidency of both the Chicago Telephone Company and the Central Union Telephone Company, but his success in the Central West was not so marked as in his home territory, and about two years later he returned to California.

Mr. Sabin first went to California with the Collins expedition in 1866 to establish European telegraphic connection through land lines to Alaska and the Aleutian Islands. This project being abandoned he entered the Western Union service in San Francisco, and later he formed the Pacific States Telephone Company, of which he became president. A number of telephone patents were issued to Mr. Sabin, including those relating to the Sabin-Hampton express system.

Meeting of Indiana Independent Telephone Men.

A meeting of the members of the Indiana Independent Telephone Association of the first district, which includes the counties of Elkhart, Fulton, Kosciusko, Lake, Laporte, Marshall, Porter, Stark and St. Joseph, was held in South Bend on October 4th and 5th. There was much enthusiasm and interest shown in the meeting and the attendance exceeded expectation. Theodore Thorwood, president of the South Bend Telephone Company, and also vice-president of the first district, presided, the sessions being held in the Commercial Club rooms. The object and purposes of these district meetings, as set out by the state association, are to encourage development, foster and stimulate the growth, protect the mutual interests, promote and systemize uniformity of accounting, operation, maintenance, construction and standardization of Independent telephone interests, and to defend the same from unfair encroachment or competition by co-operation and other available means deemed advisable.

Many interesting and profitable topics relating to the progress of the telephone business in the first district were discussed. Plans were also perfected to further the extension of lines in all localities, and especially those leading into Chicago, which, it is thought, may be accomplished in a short time. Automatic service and apparatus were discussed and explained.

The various exchange managers present reported 16,109 telephones in use in the district. This is is regarded as a wonderful growth, since there were less than 12,000 telephones in use in the district a year ago. After making preparation for the state convention, to be held in Indianapolis, and also for another district meeting prior to the state convention, the business session closed. A banquet held at night, with the usual social features and responses to toasts, was a pleasing finale of the meeting. The following prominent telephone men were in attendance: John O. Harney, assistant secretary of the National Association; George W. Beers of Fort Wayne, president of the Indiana Association; Charles S. Norton of Indianapolis, secretary of the Indiana Association; Jesse W. Weike, president of the Greencastle Telephone Company. The following managers of Indiana telephone companies in the district were in attendance: G. W. Ritter, Syracuse; J. W. Rowabaugh, New Paris; G. H. Vanvuesen, Michigan City; M. C. Crow, Elkhart; W. L. Shoots, Goshen; W. D. Coffman, Dunlap; C. A. Lemmert, Teegarden; A. G. Schalliol, Klondyke; Daniel Agnew, Rochester; S. W. Groves, Calmar; W. F. Daniels, Knox; J. C. Wolf, Aetna Green; Frank W. Brown, Wakarussa; C. R. Stoop, Napanee; J. W. Scott, Warsaw, and O. L. Barger, Converse.

NEW COMPANIES.

The Southern Telephone Developing Company has been incorporated at Camden, N. J., with a capital of $100,000.

Among recently incorporated telephone companies are the Farmers' Mutual Telephone Company of Caldwell, Kan.; Stockmen's Telephone Company of Canadian, Texas; Ellis Telephone Company of Ellis, Kan., and the Newcastle Telephone Company of Newcastle, Ark.

MANUFACTURERS AND DEALERS.

The Appleton Electric Company of 224 Washington Street, Chicago, is now represented in the East by Mr. A. S. Merrill, who is showing all the goods in the Appleton catalogue at 227 Fulton Street, New York city. A large stock of telephone and electrical supplies will always be carried by the New York agency, and Mr. Merrill, who formerly represented the Chicago Fuse Wire and Manufacturing Company, will be glad to meet old friends at his new address.

"Intercommunicating Telephones" is the title of a new bulletin issued by the Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y. The bulletin is deserving of much praise for the artistic appearance which it presents, as well as for the reading matter which it contains. It is arranged on the loose-leaf principle. Generator-call, intercommunicating instruments are described and also a central-energy private-line telephone. Some diagrams of connections are a useful feature of the booklet.

Agents of the Kansas City Home Telephone Company have about concluded negotiations for the purchase of the exchanges in Humboldt, Thayer, Erie, St. Paul and Galesburg, all in Kansas. They will also ask for a franchise in Chanute.

Telephone News from the Northwest.

The Tristate Telephone Company has completed a toll line into New Ulm, Minn., from Mankato; also connection with Franklin, Minn. The company will improve and rebuild the local exchange at Mora, Minn., which it recently bought.

The Faith Telephone Company will install a local exchange at Twin Valley, Minn.

The system of the Minnesota Mutual Telephone Company, North Branch, Minn., was recently purchased by the Tristate Telephone Company interests.

The Red Wing (Minn.) Telephone Company will start a daily news service to rural subscribers. Between six and seven o'clock p. m. the company will furnish a synopsis of the more important news items of the day.

The Phœnix Telephone Company of New Richmond, Wis., is building a rural telephone line to Riverdale.

The Yankton Independent Telephone Company has been granted a toll-line-connection franchise at Hurley, S. D.

The Northern Telephone Company of Bottineau, N. D., seeks a franchise at Minot, N. D., for a competing telephone exchange.

The Mesaba Telephone Company is building a line from Hibbing, Minn., to Deer River.

The Bell Telephone Company is building two lines into Mt. Ayr, Iowa, one from Leon and the other from Blockton.

The Central Iowa Telephone Company is building a line from Iowa Falls to Clarion, Iowa.

The new exchange building for the Nevada (Iowa) Mutual Telephone Company has been completed.

The Corn Belt Telephone Company is building a full metallic line from Parkersburg, Iowa, to Allison. R.

Indiana Telephone Items.

Notwithstanding the City Council of Kokomo refused to amend the franchise granted to the Citizens' Telephone Company so as to permit it to enter into a long-distance service contract with the Bell Telephone Company, the company has nevertheless put on the prohibited service, and it remains to be seen what action, if any, the City Council will take to forfeit the property to the city. Section 2 of the company's franchise provides that the property of the Citizens' Telephone Company shall be forfeited to the city in case the company shall enter into any combination or agreement with any competing company for the establishment of uniform toll rates, or charges for telephone service. It is asserted that the connections now being made by the company over the Bell lines is such a departure or combination as will forfeit the property to the city. On the other hand, many persons favor the course pursued by the company because Chicago and other cities could not be reached over the lines of the Independent company and the prohibition was regarded as unfair.

The appeal of the Cumberland Telephone Company against the city of Evansville has been set for argument in the United States Circuit Court of Appeals for November 7th. The briefs of both the city and the company have been filed for some time. The suit grew out of an attempt to oust the company from the streets of Evansville, because, as alleged, the company's franchise had expired. The trial courts held favorably to the city's contention and the company appealed. The question has been in litigation for several years and the ultimate conclusion of the case is hoped for soon. S.

Michigan Telephone Matters.

The Citizens' Telephone Company of Grand Rapids, which has exchanges in several cities of the state, including Lansing and Muskegon, has filed articles of incorporation increasing its capital stock from $2,000,000 to $3,000,000.

The Co-operative Telephone Company of Detroit has had its franchise to use the city conduits for its wires repealed by the courts and also the restriction to hold its rates down to $48 for business and $24 for residence telephones. John Winter, president of the American Still-alarm Company, has acquired notes of the telephone company for $21,000, which are secured by a $40,000 bond issue, and is trying to get control of the company. The notes were given originally to the Stromberg-Carlson company for material used in the construction of the plant and have been allowed to go to protest. Mr. Winter has petitioned the courts to intervene and proposes to appeal the decision of the lower court and endeavor to have the franchise restored. The Co-operative company's exchange is the medium of entrance into Detroit of the Peninsula Telephone Company, which has several toll lines out in the state. W.

Consul Dunning of Milan, Italy, reports that new textile, chemical, cement, chocolate, silk and other factories are going up all over the northern part of the peninsula, or are being enlarged, and that the present prosperity is doubtless due in large measure to the utilization of the waters of the Alps and Apennines for generating electricity.

GENERAL TELEPHONE NEWS.

O. P. Kiker has purchased the business of the Tolar Telephone Company at Tolar, Texas.

A new switchboard will soon be installed at Ogden, Utah, by the Bell company, the improvement to cost $50,000.

R. D. Cannon, general superintendent of the Mississippi Valley Telephone Company, has moved to Burlington, Iowa, from Minneapolis.

President Frederick P. Fish of the American Telephone and Telegraph Company, who has been abroad on a six-week vacation trip, returned last week.

The Rocky Mountain Bell Telephone Company will this year make important improvements in its system at Helena, Mont., a new 800-line switchboard being already in process of installation.

Extensive improvements will shortly be made in the system of the Pacific States Telephone Company at Lewiston, Ida., where the service is at present unsatisfactory. The company will expend $21,000 in the work.

The Chicago Telephone Company for the month of September reports a gain of 2,024 telephones installed, 1,395 being placed in the city and 629 outside. The total number of instruments in service is given as 135,494.

The Missouri and Kansas Telephone Company has just installed a new switchboard in Independence, Mo., with a capacity of 10,000 instruments. The company has been granted a franchise for the construction of a new exchange in Parsons, Kan.

The Lewiston-Clarkson Telephone Company has been organized at Lewiston, Ida., with a capitalization of $50,000. The incorporators are: C. F. Osmers, E. R. Windus, E. L. Alford, J. B. Morris, J. E. McGillivray, J. Howard Howe and F. B. Bartlett.

The Wheatland (Cal.) Chamber of Commerce has appointed a committee, headed by W. F. Coffin, to meet the Chamber of Commerce of Marysville, Cal., to make efforts to obtain a franchise in Marysville for the Wheatland Independent Telephone Company's line.

Francis J. McCarthy, a young inventor of San Francisco, has made successful tests for a distance of a mile and a half from the Cliff House with wireless-telephone instruments which he designed and constructed. It is said he will soon go to New York to have apparatus manufactured.

The Eastern Utah Telephone Company of Price, Utah, incorporated by R. G. Miller and his associates with a capital stock of $50,000, has purchased the 52-mile telephone line from Price to Ferron of Levi N. Harmon and associates. Contracts are soon to be let for the building of lines connecting with the Rocky Mountain Bell Company at Colton for Salt Lake City and other connections and for building lines to Sunnyside, Clear Creek, Scofield, Winter Quarters, Castle Gate and Helper. About $20,000 will be expended.

The application of the Home Telephone Company of Alameda County, Cal., for a 50-year telephone franchise in the city of Oakland, Cal., has been granted by the City Council. Bids for the purchase of the franchise will be opened December 4th. The franchise ordinance provides that the company shall do at least $850,000 worth of work in the three years after the franchise is received and give a guarantee bond of $100,000. Fifty free telephones will be provided for the city. After five years two per cent. of the annual gross receipts are to be paid to the city.

The New York Telephone Company is rapidly perfecting the details for its exhibit at the Madison Square Electrical Show. The space chosen is the circle in the center of the promenade, directly in the middle of the garden. This circle is some 30 feet in diameter, and over it will be hung a large blue bell covered with incandescent lights. This bell will be of a bottom diameter equal to the space and will extend up almost to the roof. In the booth itself there will be, among other interesting exhibits, a model telephone central. This central station will, like almost all the other exhibits in the garden, be in use. Every exhibitor will have his telephone in his booth connected to this exchange, and during the show all the garden business will be carried on through it.

According to Export, the organ of the Central Union for Commercial Geography of Germany, Sweden is planning to use all the water now going to waste over its falls and in its rivers for electricity. Engineers are in the hills making surveys, and capital is being secured for the call that is sure to come just as soon as the surveys are completed. The same may be said of Norway, where the waters have shorter distances to run, but often of tremendous volume. In Sweden the power will be put to work in all manner of mills: in Norway in the mines—iron and copper. The movement in Norway is being backed by foreign capitalists, particularly Americans.

CORRESPONDENCE.

Great Britain.

London, September 26.—Something akin to excitement has been created in municipal telephone circles by the action of the Local Government Board in connection with the applications for loans by the corporations of Swansea and Brighton. It may be remembered that during the debate upon the report of the telephone committee appointed to consider the agreement between the National Telephone Company and the government it was agreed by the postmaster-general to give favorable consideration to any suggestion for negotiation for sale on the part of any local authority owning telephone systems. After having held inquiries in both instances the Local Government Board has now issued its reports. In both cases attention is drawn to the statement above mentioned, and the suggestion is made that the postmaster-general should be approached with a view to ultimate absorption. The difficulty the board is in is that a loan might be sanctioned, the repayment of which would extend beyond the date of the expiry of the licenses. Were some agreement to be made with the government for ultimate absorption this objection would disappear. In the case of Brighton the suggestion has been adopted, while in the case of Swansea no decision has yet been reached.

Apropos of the Swansea system, a difficulty has existed for some time between the National Telephone Company and the corporation on the question of intercommunication. The matter was taken to the law courts and the company ordered to give the necessary facilities within a specified period. The contention of the company was that under the existing conditions a most complete system of intercommunication was necessary, the expense of which should be shared. The corporation, on the other hand, asked for a modified form of intercommunication which the other side alleged would throw a vast amount of extra traffic upon its lines. Whether as a result of this difficulty or not, I am unable to say, but it is now reported that the company has offered either to buy up the corporation system or to sell its own Swansea system to the corporation.

Hitherto those electric power companies in operation have kept, tolerably free from interference with or from local authorities. Many of the power companies, however, have the right to give a supply in certain specified towns, with the consent of the corporation, if a demand is made for a supply of energy. The South Wales Power Company in this way is able to supply in Cardiff, but an application for the consent of the corporation has, as was inevitable, been refused. This point-blank refusal to consider the point has not engendered a "spirit of sweet toleration," and it is not surprising to find the company looking around, so to speak. It has now discovered that the corporation is supplying some premises partly situated without the borough of Cardiff and has called for a discontinuance of such supply, owing to it being within the company's area of supply. This conflict between a power company and a local authority is the first of its kind and further developments will be watched for.

There is still a marked tendency on the part of the London borough councils to reduce the price of electrical energy; it may be as the result of the flutter caused by the promotion of the big electric power bill last session. Many people, however, do not regard these reductions favorably, being of the opinion that they are merely made as an advertisement and that the present prices will be ultimately maintained by increased general rates either on account of public lighting or some other cause. The opinion is very generally held that electricity at two cents per unit cannot be profitable under the existing conditions in many instances; yet this is what is being proposed.

The Dublin corporation, which has been in considerable difficulty at various periods in connection with its large three-phase generating stations, owing to disputes with its consulting engineer, is still displaying characteristic indecision. It was agreed some time ago that certain works were necessary to carry the increased winter load, but discussions as to whether the work should be carried out by the resident engineer or the consulting engineer have had the effect of so shelving the matter as to leave no time for the full work to be carried out before the extra load comes on. Hence, only the absolutely necessary extensions can be carried out in time.

A complete electric service is now running upon the "Inner Circle."

Mr. C. T. Yerkes is one of the vice-presidents of the electrical exhibition now open at Olympia. G.

New York.

New York city, October 7.—The New York City Street Railway Company claims the property in some ancient and disused car tracks on Vesey Street, a relic of the old Eighth Avenue horse-car line. When the city authorities this week began to move them in order to repave the street with wood blocks the company obtained a restraining

order. At the other end of the town, namely, above One-hundred-and-forty-fifth Street, there is a good deal of activity in the matter of laying down car tracks in order to revivify franchises which, although granted years ago, have never been utilized.

In addition to cars recently received, the Long Island Railroad has placed an order for 75 steel coaches, which, when received, are to run in place of the old wooden day coaches, but are ultimately to be used for the electric tunnel service when the Pennsylvania Railroad improvements are completed.

The Staten Island Rapid Transit Company is busily engaged in re-laying its tracks with 85-pound rails and is planning a number of improvements.

Archbishop Seton of Rome made an inspection of the subway yesterday as the guest of Mr. John B. McDonald, the builder of the tunnel.

The Bridge Department has purchased for $3,666 the wires and fittings on the Williamsburg Bridge in preparation for lighting the bridge from the municipal plant, which is rapidly approaching completion. This plant, which is of 400 horsepower, will cost the city $100,000.

Kempster B. Miller of Chicago, an expert called in by the New York Board of Fire Underwriters, has reported to the fire commissioner on the unsatisfactory condition of the fire-alarm service of Manhattan. He says the system was originally faulty in design, and now, after continuous patching, it is nearly useless. He advocates the installation of an entirely new fire-alarm telegraph system without regard to the existing lines. Mr. Miller avers that the breaking of a single wire at certain points would throw a large number of boxes out of use.

The Western Union Telegraph Company has refused to allow certain special policemen to be authorized as agents of the company in order to facilitate the inspection of supposed poolrooms by the police.

Some New Orleans cotton men have been in New York to arrange for an improved telegraphic service between the New York and New Orleans cotton exchanges.

The United States cable ship Cyrus W. Field is ordered to proceed to New York Harbor for the purpose of repairing and relaying the cables connecting the various fortifications in the vicinity.

Sutherland M. Prevost, third vice-president of the Pennsylvania Railroad Company, died at Philadelphia on September 30th, within a few days of his fifty-first birthday.

The Switchboard Manufacturing Company of 661 West Fifty-eighth Street, has made an assignment for the benefit of its creditors, the liabilities being reported at $20,000.

A bankruptcy petition has been filed against the Hungerford Electric and Manufacturing Company of 156 Fifth Avenue, a company incorporated under the laws of West Virginia, with a capital of $1,500,000, of which $100,000 was paid up in cash. The company's factory is at Belleville, N. J., near which many of the creditors are located. The company is mainly engaged in the manufacture of insulated wire.

The Chicago Battery Company, with headquarters in Jersey City, N. J., has been incorporated by F. H. Howland and associates, with a capital of $125,000.

The Appleton Electric Company of Chicago, manufacturer of fuses and other fittings, has opened a showroom at 227 Fulton Street, with Mr. A. S. Merrill, formerly of the Chicago Fuse Wire and Manufacturing Company, as local representative.

D. W. W.

New England.

Boston, October 7.—At the annual meeting of the Edison Electric Illuminating Company of Boston, to be held on the 10th inst., one of the matters to be considered will be the sale of the Milton plant, acquired when the property of the old lighting company in that town was absorbed. The plant is no longer needed, electricity being furnished from the South Boston plant. The company's management will also ask for authority to finance some of its undertakings by the borrowing of money secured by a short-time mortgage on real estate held by the company. The company has just taken title, in accordance with prior agreement, to the property in Head Place, off Boylston Street, which it has occupied since starting in business. Upward of $300,000 is involved in the deal. Last July the company acquired adjacent property out to Bolyston Street, and changes are contemplated therein which will make of the several parcels a compact and commodious central structure for display headquarters and for offices of the company.

A surprisingly large number of cases are before the courts of Suffolk, Middlesex and Norfolk counties, wherein electric-railway companies are the defendants. In Suffolk Superior Court there are a large number of damage suits still pending against the Boston Elevated Street Railway Company on claims arising from noise, interference with light and general depreciation of values by reason of the construction of the road, as well as cases due to accidents. In Middlesex Superior Court the Elevated is the defendant in no less than 223 cases, while other electric-railway companies are defendants in 172 cases. The total on the docket is 1,478, so that the railways comprise more than one-fourth of the whole number. In Norfolk County Superior Court, railway companies are defendants in 77 suits.

The Western Massachusetts Street Railway Company opened its new line between Westfield and Huntington on October 5th. It is a 12-mile link in the project to connect with the Berkshire Street Railway Company's line at East Lee, a distance of about 21 miles.

A grade-crossing collision between a loaded freight car, which broke away from a train, and an electric passenger car of the Worcester Consolidated road, resulted in injury to 13 passengers in Worcester on October 1st.

Withdrawals of transfer privileges heretofore accorded patrons of the Boston and Northern Street Railway Company in a number of cities and towns near Boston have occasioned much discussion of late before the Massachusetts railroad commissioners. The plea was made by the railway management that the road cannot afford to continue these transfers, and is losing money on account of the burden which they entail. The commissioners finally decided in favor of the road, notwithstanding the arguments and petitions of patrons. Reading, Wakefield, Melrose, Stoneham and Saugus are the places affected by the change.

The Willimantic Traction Company of Willimantic, Conn., passed into the control, on October 4th, of the Consolidated Street Railway Company, which is the electric-railway holding company of the New York, New Haven and Hartford steam road. The line runs between Willimantic and Baltic, a distance of 10 miles, and connects at the latter place with the Norwich and New London road, which is also owned by the Consolidated.

B.

Dominion of Canada.

Ottawa, Ont., October 7.—The Dominion government has passed an order granting permission for the construction of a dam across the Rainy River at Fort Francis. This proposal has been before the government for a long time and electrical interests have been urging for the power to make the improvement.

The Montreal street railway is out with its financial showing for 11 months of its fiscal year. For that period the gross earnings have increased 9¾ per cent., operating expenses nine per cent., and the net earnings have increased 11¼ per cent. Fixed charges show a heavy gain of 15½ per cent., while the surplus increases 9½ per cent.

Matters are rapidly getting into shape for the experiments in electric smelting of ores and the making of steel rails at Sault Ste. Marie, which will be conducted by the Dominion government. The furnace is already constructed and the transformer ordered from the Westinghouse company for transforming the high-voltage current to one of low voltage is already on the way. The electrodes have been purchased in Sweden.

To facilitate the survey work of the Grand Trunk Pacific Railway, now in progress in Northern Ontario and Quebec, it has been decided to utilize space telegraphy for the purpose of communicating with the survey camps. At the present time it takes five or six weeks to send a communication to some of the engineering parties in the field and receive an answer from them. The first wireless station will probably be erected at New Liskeard and another in the vicinity of Lake Abitibi. From the latter point, east and west, there will be stations every 40 or 50 miles apart.

The Ottawa Electric Company, in order to prevent all possibility of impaired service, owing to the carrying out of works of improvement, shortage of water, anchor ice, etc., has decided to install a steam reserve plant of considerable capacity in addition to the steam plant already owned and operated as an emergency plant. The new installation will consist of a Westinghouse-Parsons steam turbine direct-connected to a two-phase alternating-current generator of 1,500 kilowatts. The exciter will be mounted on a bracket on the turbine frame and direct-connected to the turbine shaft, and there will be other sources of current for exciting the field, which will be available at any time in case of failure of the exciter. The boiler capacity will be sufficient to operate the turbine and generator to the highest limit allowable for overload when desired.

T. L. Wilson, prominent in Canadian electrical circles as the discoverer of calcium carbide, has fitted up in Ottawa one of the finest private chemical and electrical laboratories in the country. Mr. Wilson has acquired extensive power privileges on the Saguenay River, Quebec, where with a 152-foot head over 30,000 horsepower may be developed at tidewater, with a 30-foot draught for navigation, insuring cheap shipping direct to New York and elsewhere. He estimates at least 250,000 horsepower available at this point from the 230-foot head up to the discharge from Lake St. John. Mr. Wilson's property covers three miles of the river. He has built wharves and owns a square mile of the best limestone within a short distance. He contemplates the use of his electrical power in the production of carbide. Within 20 miles of the shore of the St. Lawrence and 100 miles below Tadousac Mr. Wilson says there could be developed a power to the extent of 1,000,000 horsepower, but it is not now possible to utilize it commercially without a railway on account of requiring to store manufactured product during six months of the year.

W.

Southeastern States.

Charlotte, N. C., October 7.—There is a fine waterpower (Gaston Shoals) on Broad River, near Gaffney, S. C., which, it is reported, will soon be developed. It was recently sold to John B. Cleveland of Spartanburg, S. C., and others by the Gaffney Manufacturing Company. Electrical power for several towns will be developed.

The Hampton Roads Railway and Electric Company of Hampton, Va., was sold on October 6th to Horace A. Doan, who was the representative from Philadelphia of the protective committee of bondholders of that city, the price being $250,000. The sale was at auction. The sum of $152,000 was paid by Mr. Doan in receivers' certificates and the balance will be paid in cash, while the new purchasers will be required to pay all liens not as yet determined by the court at Norfolk, Va., and the transaction of the 6th is to be confirmed by Judge Waddill.

The value of the big waterpower at Bull Sluice and the electric power plant will have to be arbitrated by a special committee in Georgia to fix the tax valuation. The comptroller has calculated the value of the franchise of the falls at $424,000, and the Atlanta Water and Electric Company, the owner, has returned the physical property's value at $100 to avoid danger of double taxation, as the company is not required to return aught but franchises, it being contended that it has no valuable franchises.

The incorporators of the Anderson-Easley (S. C.) electric interurban line have applied to the state for a charter and will have $100,000 capital, divided into shares of $100 each. The incorporators are: R. Frank Smith of Easley, J. J. Fretwell of Anderson, S. C., and others.

Work has been begun upon a handsome new telephone building for the Southern Bell Telephone and Telegraph Company in Atlanta. The structure will be steel and fireproof, four stories for the present, with basement and provision to add additional stories when desired. The Bell now has nearly 10,000 stations in Atlanta. Manager W. B. Roberts has applied himself diligently to his work and now has one of the finest and largest exchanges in the South. Additional improvements to the North End exchange, with 1,000 stations now connected, are rapidly being completed by the manager.

L.

Ohio.

Cleveland, October 7.—The Lake Shore Electric management is considering the feasibility of a new line from Clyde to Sandusky. In many ways a line between these two points would be of great advantage. It would reduce the distance from Toledo to Sandusky about 20 miles, and the line would pass through an excellent farming section, averaging 20 houses to the mile within patronizing distance of the line.

A mile of track and a bridge over the Great Central tracks at Lima will complete the connection between the Lima-Findlay line and the Western Ohio tracks, the connection through the city being made over the city tracks.

It is thought now that the new addition to the power plant of the Cleveland Electric Railway Company, located on the river at Superior Street, will be ready for operation about December 15th.

Stockholders of the Sandusky Southwestern passed a resolution a few days ago increasing the common stock from $1,000,000 to $2,000,000. A resolution passed some time ago making the same increase, but providing that $300,000 of it should be preferred, was rescinded.

A corps of engineers, said to be in the employment of the Elkins-Widener-Dolan syndicate, has completed a survey of the Appleyard properties and returned to the East. Edgar Stark of the Union Savings and Trust Company is quoted as saying his bank would be willing to advance money for the needed improvements on the roads.

The Traction Construction Company of Cleveland has been incorporated by A. J. Thompson, Albert E. Green and others. The capital stock is $10,000.

Three corps of engineers are at work running as many lines between Akron and Alliance. The Akron-Alliance Connecting Railroad Company is the one that planned the original line, and Chief Consulting Engineer Thomas Moore is now on the ground looking over matters. Engineers B. M. French and Spence are working on the route of the Alliance-Akron-Cleveland road. E. R. Merrill of Cleveland is also working on a line. He secured the right-of-way for the Stark Electric line Canton to Salem through Alliance.

Through the endeavor of the city of Cleveland to make permanent the temporary decision of Judge Taylor to the effect that the franchise of the Cleveland Electric on Cedar Avenue had expired, the company has filed an amended bill in which it

claims that the franchise is perpetual. Then the claim is also made that the franchise of the entire line, taken as a whole, does not expire until 1903. It is probable that the company will put up a vigorous fight against the city and the Forest City Railway Company in its endeavor to get possession of this long line of road.

The Toledo, Bowling Green and Southern has put on a limited service between Toledo and Findlay, three trains each way being operated. The time will be one hour and 50 minutes. Two new cars have been put on to accommodate this service.

Guy M. Walker of New York, who has been looking into plans for the reorganization of the Central Market Street Railway Company of Columbus, was in Cincinnati last week consulting with Claude Ashbrook and other brokers interested in the road.

The East Liverpool Traction and Light Company has taken over the property of the United Power Company and the East Liverpool and Wellsville Electric Railway Company, according to reports from East Liverpool, and Edward McDonnell of Buffalo has taken the place of L. W. Healy, principal owner and manager of the companies. The East Liverpool and Rock Springs railway line and the Rock Springs Park are to be taken over later.

It is possible that the Columbus Railway and Light Company will extend the Bullet Park line to East Columbus, where the Ralston car works and the Bell pottery factory are located. It is believed that a line to this point would be well patronized.

At the annual meeting of the Toledo and Indiana Railway Company a few days ago S. C. Schenck was elected president to succeed J. M. Longnecker of Delta, although the latter retains all his holdings and remains a member of the board of directors. The other officers are: Vice-president, J. H. Clauss; treasurer, M. C. Briggs; secretary, C. H. Masters. It is now thought that the road will be extended from Bryan to Fort Wayne as soon as possible. This will be done under another corporate name, but by the same men. The Hirsch Construction Company will have charge of the work.

From Dayton it is reported that the construction of the Cincinnati, Dayton and Fort Wayne road is assured, and that S. F. George has arranged for financing the company. The total length of the road is 194 miles.

The Indiana Central Traction Company has filed a mortgage for $800,000 in favor of the Dayton Savings and Trust Company, to secure an issue of bonds. The road is to connect at the state line with the Dayton and Southwestern, and it is said to be owned by the same people. The officers are: President, V. J. Drayer; secretary, W. C. Teeter; treasurer, M. L. Mower.

The Cleveland Electric Railway Company is arranging to equip its cars with automatic blowouts, if it is found that they are practical. Two different kinds are now being tested. Electrical Engineer E. C. Cook of the company has one which he believes will be successful.

As soon as the additional power of the Columbus, Delaware and Marion is ready for use, through cars will be put on between Delaware and Marion and several other improvements in the service will be made.

At an address at a banquet at Chillicothe a few days ago Attorney H. M. Daugherty said that out of 88 county seats 57 are reached by electric railways and 34 other towns of over 2,000 population have the service, making 91 in all over that size, besides the innumerable villages and small places.

The Nelsonville, Athens and Glouster Traction Company has been incorporated with a capital stock of $10,000 by L. F. Carpenter, W. J. Stuart and others.

Notice has been given of the increase of capital stock of the Lima Electric Railway and Light Company from $850,000 to $1,250,000.

Mayor Tom Johnson of Cleveland sent a message by wireless telegraphy to Mayor McClellan of New York, congratulating him upon his renomination, this being the first commercial message sent between the two cities. All arrangements have now been completed at the Nottingham station, near Cleveland, to do a commercial business. Messages have been received there from Connecticut.

The Cleveland Electric Railway Company is planning to build a car barn 500 feet long and 250 feet wide next summer. The structure will be located on Woodland Hills Avenue, on land that has been purchased for the purpose. It will be of brick and concrete, with fire walls separating the tracks into pairs. In addition, it will be equipped with overhead and side sprinkler lines, so that it will be as nearly fireproof as could be made. This will be one of the largest and best-built car barns in the country.

M. A. Bradley, president of the Bradley Electric Light, Heat and Power Company, has filed with the city clerk here an application for a franchise for the use of the streets and other public property for the use of lines and conduits for the purpose of conducting a general lighting, power and heating business. Mr. Bradley asks that this be referred to the City Council and that the question of extending such franchise be brought before the people.

A telegram from Newcastle, Pa., states that the merger of the Pennsylvania and Mahoning Valley Railway Company, owning the local systems there and at Youngstown, with the Sharon-Newcastle and the Youngstown-Sharon roads has been consummated. The actual negotiations were closed some time ago. The new company, it is stated, will be known as the Valley Heat and Power Company and will control 180 miles of tracks. O. M. C.

Indiana.

Indianapolis, October 7.—The City Council of Scottsburg has granted a franchise to James Smith for an electric-light plant and a franchise to Joseph Shea for a waterworks plant. Messrs. Shea and Smith will join their franchises and put up one plant that will furnish electric light and water instead of having two separate plants, and work will begin on the building as soon as plans can be perfected and the contract let.

The LaRuche Glass Company of Matthews, Ind., is installing in its factory an electric-light plant of 500-light capacity. The work is being done by the Reynolds Electric Company of Marion, Ind. The company is also installing steam pumps and a steam-heating plant. The company is now manufacturing its own gas from coal and says it is producing it for less than 12 cents, the price formerly paid for natural gas.

S. B. Nickum, the inventor of the "Perpetual Light," who gave Logansport considerable notoriety a few years ago, has appeared in Indianapolis and proposes to give an exhibition of his perpetual light next week. Mr. Nickum received thousands of dollars from people all over the world for territory for the sale of his light when it should have been perfected. It was never perfected, and when the purchasers of the worthless contract began to demand the return of their money and the government took the matter up, Mr. Nickum left for parts unknown and has remained in seclusion until recently.

The Windsor Motor Car Company has been incorporated for the purpose of manufacturing automobiles and other motor vehicles. Some of the stockholders in the company formerly operated a factory in Chicago. The company's headquarters and factory will be in Evansville. J. C. Zutt is president and general manager, and J. A. Windsor of Chicago is secretary.

It is announced from Philadelphia that the long-talked-of merger of interurban electric lines in Indiana and Ohio is about to be consummated and that Hugh J. McGowan of Indianapolis is managing the negotiations and assisting with the details of the merging company. The plan is to form two holding companies, one for Indiana and one for Ohio. About 400 miles of electric road in each state will be taken into the merger and a corporation in each state will be formed with a capital stock of about $25,000,000 each. The merger scheme has been under consideration for six months or more, during which time experts have quietly examined all the property to be included. Behind the scheme is said to be the Elkins-Widener-Morgan syndicate. The Indiana lines included are the Indianapolis and Northwestern, the Fort Wayne and Wabash Valley, the Fort Wayne, Van Wert and Lima, the Indianapolis and Plainfield, the Indianapolis and Martinsville, the Indianapolis and Eastern, the Richmond Street and Interurban, the Indianapolis and Western, the Fort Wayne, Bluffton and Marion, and the Muncie and Portland line. Indianapolis has been selected as the initial point of operation because of the superior system of terminals now in vogue and because of the ultimate purpose of the syndicate to construct lines to Chicago and St. Louis.

The Fort Wayne and Wabash Valley Traction Company reports a gratifying increase in gross earnings during the month of August. The gross earnings for the month were $94,835, and the net earnings $37,808. This increase is due to the acquiring of the extension of the line from Peru to Logansport and of traffic connections from Indianapolis to Peru and Wabash.

The Lebanon and Thorntown Traction Company has sold its line between Lebanon and Thorntown to Robert P. Wood and Howard Atkinson of Indianapolis.

John Ratliff of Marion is promoting a traction line proposed to be built from Marion to Noblesville. The commissioners of Grant and Hamilton counties have granted franchises for the new line.

Articles of incorporation has been filed with the secretary of state by the Wabash and Northern Traction Company, capitalized at $500,000. The road will be a part of the Indiana Northern Traction Company, but will be distinct for the purpose of issuing bonds. The company's headquarters will be in Wabash, and in addition to building an interurban line to connect Wabash and Warsaw and a number of intervening towns the company will furnish light, heat and power to the citizens of these towns.

Subsidy elections to vote aid to interurban lines have been ordered by the commissioners of Green County for Beech Creek, Jefferson and Smith townships, and the commissioners of Dubois County in Bainbridge township. The beneficiary companies are the Wabash and Southeastern Railroad Company and the Vincennes, Jasper and French Lick Traction Company. The former company will build its machine shop and power house at Worthington, and the road is to be completed in twelve months.

The commissioners of Henry County have granted a new franchise to the Indianapolis, Newcastle and Toledo Electric Railway Company, which will enable the company to build a line from Newcastle to the Wayne County line and from Newcastle to the Delaware County line. The work of grading is to commence at once.

The "Electric Cycle Line" is the name of an electric line which is being promoted by J. N. Crabb of Indianapolis. The plan is to encircle Indianapolis at a radius of 25 miles. The promoter asserts that such a line will connect a score of excellent county towns and prove a popular undertaking. A company to build the line is said to be in state of formation.

Otto Hoffman of New Albany, who made the first sheet of plate glass turned out in America some 35 years ago, has obtained a patent for the construction of railroads on a plan which does away with wooden ties and which is attracting considerable attention from railroad constructors. The entire roadbed is built of macadam and limestone blocks in such a manner as to preclude the use of ties.

The Pan-American Bridge Company of New Castle, Ind., has been awarded a contract to construct a large viaduct for the Indiana Union Traction Company's line near New Castle. The viaduct will be 800 feet long and will require over 300 tons of steel.

The contract for the construction of the Marion, Bluffton and Eastern electric line has been let to the Moore-Mansfield Company of Indianapolis. The line is 31 miles long and 10 miles of it is to be completed by January 1st.

The Indianapolis Union Railway Company has approved plans for the erection of a heating and lighting plant for the Indianapolis Union Station. The improvements and equipment will cost upward of $75,000. S. S.

Michigan.

Detroit, October 7.—The promoters of the new Detroit and Bay City Traction Company expect to complete their Caro division before winter. This company has issued bonds amounting to $3,500,000, secured by a trust mortgage, which will run for 30 years and draw five per cent. A statement is made in connection with the filing of the mortgage that the line will be operated exclusively as a freight line. This company is the successor of the Detroit, Pontiac, Lapeer and Northern Company, which was formed last year and later sold to C. T. Gregory of New York. The officers of the new company are as follows: President, E. H. Whitcomb, Davenport, Iowa; vice-president, W. Perkins, Detroit; secretary, L. A. Rockwell, Chicago; treasurer, J. H. Christian, Chicago.

Frederick D. Mines, formerly of Muskegon, has been appointed chief engineer of the Mexican Light and Power Company. Mr. Mines has resigned his position as assistant engineer of the Utah Light and Railway Company at Salt Lake City, where he has been employed for the last four years, and will make his headquarters in Mexico City, where he will have charge of nine power stations generating 80,000 horsepower.

The voters of Monroe at a special election held recently decided not to sell or do away with the city's electric-lighting plant. The board of public works is trying to devise some means for putting the plant on a paying basis. The city engineer, J. W. White, has been empowered to investigate the waterpower possible by damming the River Raisin. If the plant can be operated by waterpower instead of steam it will result in a reduction of $2,000 for operating expenses.

At the annual meeting of the stockholders of the Grand River Valley Railway Company the following officers were elected: President, E. W. Barber, Jackson; vice-president, John George, Jr., Jackson; secretary and treasurer, F. H. H., Jackson.

The contracts for the Murphy power building at Detroit have partially been let. Albert Albrecht has secured the mason work and is at work. The steel contract has been given to the Russel Wheel and Foundry Company. It is expected that the plant will be in operation in about a year. The laying of conduits is being pushed as fast as possible. Considerable difficulty is being experienced in underground work, owing to the fact that there is no accurate map of the underground pipe system of the city.

The Muskegon Traction and Lighting Company has developed quite a summer resort at Lake Michigan Park. It has recently purchased a row of small cottages which it will lease or replace by more modern houses. The demand for ground for summer homes has increased until desirable sites are becoming scarce.

The Detroit, Ypsilanti, Ann Arbor and Jackson electric line, which has for some time maintained an office in Detroit and in Dearborn, has recently abandoned the Detroit office, claiming that it was subject to taxation in both towns, and has prepared

to make Dearborn its headquarters, thus saving an annual tax of $120,000.

The Hylo Lamp Company has been incorporated to export and sell under foreign patents the Hylo lamp made by the Phelps company. The capital stock of $180,000 is held by William J. Phelps, J. H. Wilson and J. V. Oxtoby. C. G. W.

Northwestern States.

Minneapolis, October 7.—The Twin City Rapid Transit Company has completed its new suburban trolley line from Minneapolis to Excelsior, on Lake Minnetonka, and has started a regular car service. The new power station at Excelsior has not been completed as yet, but sufficient power is available from Minneapolis and Hopkins to take care of light traffic.

The Warfield Electric Company has installed a 24-hour service at Bemidji, Minn., and is furnishing an electric service for power to its patrons.

Matters relating to the adoption of electrical power for the operation of the ore roads of St. Louis County, Minn., are being worked out. Experts from a number of eastern electrical equipment companies are in Duluth and vicinity getting data on the subject. The power in prospect will be obtained from the Great Northern Power Company, and a thorough and exhaustive test will be made. The officials of the ore roads are much interested in the question, as well as that of the working of the mines by electrical power.

The proposition to sell the municipal electric-light plant at Spirit Lake, Iowa, was defeated at a special election.

Several thousand dollars' worth of new machinery is being installed in the electric-light plant at Fort Madison, Iowa.

The survey has been completed from Brookings to Flandreau for the proposed trolley line from Brookings, S. D., to Sioux Falls.

The project of building an electric railway from Kilbourn, Wis., via Barbaoo, to Devils Lake, is being revived by N. Wetzel and others.

The survey for the proposed electric line from Fairfield to Keosauqua, Iowa, has been completed.

E. S. Bosworth's electric-light plant at LeRoy, Minn., has been destroyed by fire, the loss being $5,000, with $2,000 insurance.

The county poorhouse and asylum at Oshkosh, Wis., is to be fitted with an electric-light plant.

The Newton and Northwestern Railway Company has let the contract for the construction of a line from Goddard to Colfax, Iowa. R.

Rocky Mountain States.

Salt Lake City, October 6.—A certificate of its articles of incorporation has been filed with the county clerk at Helena, Mont., by the Helena Light and Railway Company, which has taken over the system of the Helena Light and Traction Company. The incorporators of the company, which is capitalized at $1,500,000, are Louis Sperry of South Windsor, Conn., and Warren B. Johnson and Harry W. Reynolds of the same state.

The Boise Valley Railway Company has filed its articles of incorporation with the secretary of state at Boise, Ida. The company plans the early construction of an extensive electric road from Boise to Caldwell, as well as branch lines, the entire system to cover a distance of 36 miles. The capital stock amounts to $1,000,000, and the directors of the company are John McMillan, B. F. Olden, H. E. Neal, D. R. Hubbard, Robert Noble, A. Ross, O. V. Allen, H. P. Ustick and W. N. Donaldson.

An auxiliary power plant will soon be established by the Telluride Power Company, near Provo, Utah, and from this source power will be distributed to various mining camps in that vicinity and to a point as far north as Salt Lake City. The plant will be located on the Duchesne River, where the company controls important water rights.

The Inter-mountain Electric Company, which has a capitalization of $1,500,000, contemplates the early construction of a power plant near Coalville, Utah, for the distribution of power to the various towns in Summit County. The plant will have a capacity of 2,000 horsepower, this to be increased to 10,000 at some future day.

The Clark Electric Power Company, with headquarters at Tooele City, Utah, has secured a franchise from the City Council to erect poles for the installation of the electric lights. Work has been commenced on the construction of this 12-mile pole line.

The Boise Valley Railway Company has been incorporated at Boise, Ida., for the purpose of building an electric railway down the valley to Caldwell or some other point on the main line of railroad. The capital stock is $1,000,000. The directors include John McMillan, Robert Noble, W. N. Donaldson and H. P. Ustick, all of Boise.

Electrical Engineer Leon M. Hall of the Comstock Pumping Association has arrived in Virginia City, Nev., in connection with the final installation of pumping machinery for the unwatering of the mines on the Comstock lode. Considerable preliminary work must be done. New drain boxes will be laid in the Sutro tunnel at once. The Truckee River General Electric Company commences this month to supply the Comstock mines with power for all purposes under a new 10-year contract on more favorable terms to the mines than the one that has expired. An additional electric power plant has been installed at Marmol on the Truckee River for this service. G.

Pacific Slope.

San Francisco, October 6.—The Board of Supervisors of San Francisco has passed the ordinance granting the Ocean Shore Railway Company a 50-year franchise to operate an electric road from a point on the county line along certain streets to the intersection of Army and Illinois streets. Also for a 25-year franchise for a branch line crossing Golden Gate Park into the Richmond district.

The Yosemite Railroad Company, which will operate an electric line from Merced, Cal., to a point near the boundary of the Yosemite National Park, recently awarded the construction contract for 80 miles of road to James H. O'Brien of San Francisco. Grading has already been commenced at Merced. Frank G. Drum of San Francisco and Thomas Prather of Oakland are among the backers of the project. There is ample water power available.

The Robert Dalziel, Jr., Company has closed a contract to supply two electric generating sets for lighting the French Hospital in San Francisco.

The representatives of D. O. Mills in San Francisco have sold to Stone & Webster of Boston the power plant at Nooksack Falls on which the Bellingham Bay Improvement Company has spent $150,000 in preliminary work. The new owners will install the plant with a capacity of 2,000 horsepower at first. Power will be transmitted 50 miles to Bellingham, Wash.

H. A. Butters of the Northern Electric Company has had favorable action taken by the Board of Trustees of Chico, Cal., on his application for an electric-railroad franchise on Main Street between the head of Park Avenue and Fifth Street. Bids for the franchise will be received November 1st. Portions of the present belt line of the local system will be double-tracked and turn-outs will be put in where they are needed. Machine shops will be erected at Chico for the company's repair and construction work.

The Northern Water Power Company has been incorporated by H. L. Atkinson, Charles P. Pritchard and others of Oakland, Cal., with a capital stock of $5,000,000.

The Spokane and Inland Electric railway has purchased property for terminals in Colfax, Wash. A passenger depot, freight depot, five grain warehouses and 1,500 feet of side tracks will be built. The cost of the site was $40,000.

The question of installing an additional generating unit at the municipal electric-light plant supplying Seattle, Wash., is being investigated by City Engineer Thomson and L. B. Youngs, superintendent of the lighting and water department. They accompanied the health board on a trip to the headworks on Cedar River to examine the conditions surrounding the watershed. The cost of the additional equipment is estimated at $15,000.

H. T. Latham, who operates a flour mill at Bricklelton, Wash., has secured an option on electric machinery in Portland, Ore., with a view to installing it to furnish commercial lights in his town.

Two members of the firm of Clark & Co. of Philadelphia and two from the firm of J. & W. Seligman & Co. of New York are expected in Portland, Ore., about October 10th for the purpose of reorganizing the Portland Consolidated Railway Company, which is controlled by these firms. A.

PERSONAL

W. S. Belt has succeeded F. A. Ross as superintendent of the Blue Earth (Minn.) electric-light plant.

Otto E. Osthoff, who was chief engineer for H. M. Byllesby & Co. of Chicago, has been appointed vice-president of the company.

Edwin R. Whitney, head of the Whitney Electrical Instrument Company, died at the Margaret Pillsbury Hospital in Concord, N. H., on September 1st. He was an inventor of note in the line of electrical measuring instruments, and it was he who suggested the development of the Shawinigan Falls.

H. M. Brinckerhoff, general manager of the Metropolitan West Side Elevated Railroad Company of Chicago, has resigned his position, but as yet has made no statement concerning his future connections. He will leave for Europe soon upon an extended trip.

John McDougall, a graduate of Stanford University, and until now with the California Gas and Electric Works of San Francisco, has been selected for the vacancy caused by the resignation of Prof. E. C. Hayward in the electrical department of the Oregon Agricultural College.

Announcement has been made at New Haven, Conn., of the appointment of John K. Punderford of that city as general manager of the Consolidated Street Railway Company. He has been manager of the New Haven system, and will be succeeded in that division of the company's properties by his former assistant, F. P. Hallan.

E. C. Folsom, who recently resigned as transportation manager and superintendent of construction of the Fort Wayne (Ind.) and Wabash Valley Traction Company, has accepted the position of general manager and purchasing agent of the Atlantic City and Suburban Traction Company. His residence will be at Pleasantville, N. J. Mr. Folsom has had wide experience in electric-railway development. His work in the development of the Fort Wayne and Wabash Valley lines was hampered by many difficulties, but the present excellent condition of the various interests is largely due to his untiring energy and ability as an engineer, which have won for him the commendation of his employers.

A. T. Tomlinson has been transferred from the New York office of J. G. White & Co. to the Montreal offices of the Canadian White Company. Mr. Tomlinson is a graduate of the Royal Military College of Canada. For six years he was engaged on railway work such as location, construction and betterment of way for various steam roads. Mr. Tomlinson was with the Brooklyn Elevated railway for about three years and during that time had charge of the construction of about 1½ miles of elevated railway. In 1894 he went to Chicago to take charge of the extension of the Lake Street Elevated railway, now the Oak Park line. He afterward became principal assistant and then assistant chief engineer of the Union Loop and Northwestern Elevated Railway Company in Chicago. In 1898 he was called to Boston to assist in the building of the Boston Elevated railway as consulting engineer. He had charge of a large part of the construction and resigned before the completion of the work, entering the employment of the White company in 1902.

ELECTRIC LIGHTING.

The Chapman Milling, Elevator and Electric Light Company has been incorporated at Chapman, Kan., with a capital of $30,000.

The Fremont Gas and Electric Light Company of Fremont, Neb., has been bought by L. P. Funkhouser and other Lincoln men.

The proposition to issue $75,000 in bonds for waterworks and electric-light plant has been carried in Port Washington, Wis.

The Edina Light Company of Edina, Mo., has been incorporated with a capital stock of $10,000 by Fred J. Wilson and others.

The Mena (Kan.) Light, Heat and Power Company has been incorporated with a capital of $250,000 by Francis R. Hoyt and others.

The Charles De Watteville combined ice and electric-light plant at Holdenville, I. T., was totally destroyed by fire. It will probably be rebuilt.

Frank A. Higley of Cummings, Kan., has asked the Osborne (Kan.) City Council for an electric-light franchise, and proposes to put in a lighting plant if given a free site for his power house.

The Copen Light and Power Company has been organized at Eastport, Me., with a capital stock of $10,000, for the purpose of generating and supplying gas and electricity for lighting, heating and mechanical purposes in the towns of Perry, Pembroke and Dennysville. Charles E. Copen of Eastport is president.

ELECTRIC RAILWAYS

The citizens of Beaver City, Neb., are agitating an electric railway to Almena, Kan.

The Rome (N. Y.) and Oneida Electric Railway Company was incorporated at Albany on October 2d with a capital of $350,000. The company will construct a 13-mile street railway between the places named. The directorate includes Dr. T. L. Hill and C. C. Goodwin of New York city, and E. F. and G. V. Lally of Detroit, Mich.

Chicago is to have a new electric trolley road affording transportation in a northwesterly direction as far as McHenry within a year, according to the promise of George W. Bryson, one of the incorporators and principal promoters. To do this a company was recently incorporated called the Chicago, Des Plaines and Fox River Railroad Company, with a capital stock of $1,000,000. The incorporators and first board of directors are: George W. Bryson, William S. Reed, E. T. Ross, W. C. Gunn and William K. Kenly, all of Chicago. The road is to run in a northerly and northwesterly direction through the counties of Cook, Lake and McHenry.

The Chicago, Desplaines and Fox River Electric Railway Company, incorporated a few days ago, is said to have for its object the furnishing of freight transportation for the truck gardening and dairy region in the Desplaines River territory. The Lake Street Elevated, it is said, will bring

the cars to the Market Street terminal in Chicago. The capital of the company is $1,000,000 and the incorporators are George W. Bryson, William S. Reed, Ernest T. Ross, Walter C. Gunn and William K. Kenly, all of Chicago. The Illinois and Wisconsin Railway Company, which has done some work on a similar project, is taken over by the new company, it is said.

Traffic records of the elevated railways of Chicago for the month of September show good gains over the corresponding month last year. The number of passengers carried daily by the several roads during the month and the percentage of gain over September, 1904, is as follows: South Side Elevated, 90,578, 20.57 per cent.; Metropolitan, 124,427, 15.31 per cent.; Northwestern, 74,307, 11.89 per cent. For the Northwestern and Metropolitan each month this year shows a good gain over the corresponding month last year, while the South Side company shows gains for every month since March. The Chicago and Oak Park Elevated for September made the largest percentage of gain in the current year. The daily average of passengers was 45,851, as against 41,915 for September last year, a gain of 9.40 per cent.

The Fairfield and Olney Traction Company was organized under the laws of Delaware in September, 1904, and domesticated under the Illinois laws September 27, 1905. The capital stock is $300,000 and private right-of-way has been secured from Olney to Fairfield, Ill., a distance of about 35 miles. The right-of-way is 60 feet in width. The company has secured good terminal grounds at each of these points. The line runs through a fine section of country, well populated and well improved, that is at the present time without transportation facilities; it will be both a passenger and freight line. Surveys have been finished and the maximum grade is one per cent. Arrangements have been made for the financing of the line, and the company expects to let the contract inside of 30 days and get to work. It will also have about five miles of street line in Olney.

TELEGRAPH.

Clarence H. Mackay, president of the Commercial Cable Company, is reported to have said that the new cables to China and Japan will be in operation on or before April 1st next.

An inspection of the Alaskan telegraph system has been completed by Gen. A. W. Greely, chief signal officer of the army. In the last two months telegraph tolls on commercial business have amounted to more than $32,000, while the cost of government business on the lines during this time exceeded $20,000. Many thousand code words were transmitted during the 15 months the wireless system in Alaska has been in operation without a single error. The competition between governmental, commercial and press business on the Alaskan lines has developed to the point where a new system to expedite business has been developed.

SPACE TELEGRAPHY.

What is said to be a new record in receiving wireless messages has been made by the government plant at the torpedo station. Using a German system, 18 words a minute were received clearly and accurately from Cape Henry, 350 miles; Washington, 325 miles; Philadelphia, 250 miles; Portsmouth, N. H., 150 miles, and several other points where the government has wireless stations.

The West India and Panama Telegraph Company is supposed to keep the island of Trinidad in telegraphic communication with the outside world. But the cable is often broken, sometimes for weeks at a time. The business community is, therefore, greatly dissatisfied and the feeling is strongly in favor of a space-telegraph system, and it is said to be the intention of the government to offer a subsidy for such service.

PUBLICATIONS.

The Crocker-Wheeler Company of Ampere, N. J., has issued a convenient calendar for the months of October, November and December.

An introduction to the general line of machinery manufactured by the C. W. Hunt Company of West New Brighton, N. Y., has been issued in pamphlet form by the company. A portion of the apparatus made by the concern is illustrated and described in a pleasing manner in the pamphlet.

The Commercial Automobile Company of 1336 Michigan Avenue, Chicago, distributers of Synnesvedt electric vehicles, has issued a small bulletin descriptive of a light and a heavy type of electric delivery wagon. These machines are clean, almost noiseless, simple to operate and maintain and ready for work at a moment's notice, making them ideal for commercial service.

A comprehensive catalogue issued by the Foos Gas Engine Company of Springfield, Ohio, gives not only full descriptions of the various types of Foos gas engines, but also a number of fine illustrations of the interior of the works at Springfield. The engines are designed on the four-cycle principle. They have now been on the market 18 years. Some simple mechanical rules, which, however, occur most frequently in practice, are also contained in the catalogue and will be found convenient.

Fort Wayne Electric Works of Fort Wayne, Ind., in three new bulletins, Nos. 1067, 1068 and 1070, describes, respectively, type A transformers, type M induction motors and a series alternating-current arc-light system. In the latter all the parts of the system are described, including the lamp, transformer, regulator, switchboard and lightning arrester. Points of excellence in the type A transformer are low operating temperature, high insulation strength and vacuum-treated coils, together with general high grade of materials used. The induction motor is of a new line, combining the latest changes made necessary by the rapid development in this class of machinery.

SOCIETIES AND SCHOOLS.

The Boston branch of the American Institute of Electrical Engineers held its annual meeting October 4th in the Lowell Building, Institute of Technology, and elected officers as follows: Chairman, C. A. Adams; secretary, H. D. Jackson; executive committee, Charles L. Edgar, James I. Ayer, C. B. Burleigh, Dr. A. E. Kennelly, R. Fleming.

An exposition of motive power will be opened in Santiago, Chile, some time toward the end of the current year, under the auspices of the Society for the Encouragement of Industry, and, with the approval and support of the government of Chile. The exposition will comprise the following sections: (1) Motive power; (2) industrial uses of alcohol; (3) pumps and presses; (4) machinery for various small industries. The society especially desires the participation of American firms, and has named as its agent in the United States, with that object in view, Don Wenceslao Sierra, whose address is in care of the Chilean legation, Washington, D. C.

The National Civic Federation, at its recent meeting in New York, determined upon a thorough investigation of the problem of municipal ownership, both in this country and abroad. For this purpose a committee of investigation was appointed to look into the subject of municipal plants now operating in this country, and next year members of this committee will be sent abroad to investigate conditions there. At the meeting Melville E. Ingalls was chosen president of the federation in place of August Belmont. "A tremendous pressure for municipal ownership is abroad," said President Ingalls, "and it is our duty to the public to give them all the facts we can get together. You read both sides in the public press, one showing that it is a success, while the other records a failure. What is good for one country is not good for another." The federation also adopted resolutions asking that steps be taken to prevent the destruction of the scenic beauty of Niagara Falls.

MISCELLANEOUS.

A German patent has been taken out by F. R. Steigelmann for an electrolytic process of preparing lead peroxide from natural or artificial lead sulphide. The sulphide is employed as anode in an electrolyte consisting of simple water to which sufficient acid, alkali, or saline matter has been added to render it a conductor. During the operation the sulphur of the sulphide is converted into sulphuric acid and the lead into peroxide.

The Louisiana Fire Prevention Bureau is now engaged in a house-to-house inspection of electrical installations in New Orleans, and says that its inspectors are finding almost without exception defects requiring immediate attention. After an inspection is made a communication is invariably addressed to the property owner, in which attention is called to the defects and notice given that 30 days is allowed under the rules in which to bring about corrections. The bureau is a local as well as state institution, conducted for the benefit of the insured as well as the insurance companies.

TRADE NEWS.

E. J. Conklin of Wichita, Kan., has sold out his electrical supply business to the Wichita Electrical Construction Company.

John W. Mead and others of Amsterdam, N. Y., have incorporated the Electrical Development Company with a capital of $4,000.

H. G. Pope and associates have incorporated the H. G. Pope Electric and Manufacturing Company of Buffalo with a capital of $200,000.

The Babcock Elevator Safety Manufacturing Company has been incorporated at Pittsburg, Pa., with a capital of $300,000. The new concern will specialize in controlling and safety devices for all kinds of elevators.

The Electric Storage Battery Company of Philadelphia is now represented in Mexico by Mr. Charles L. Seeger, whose office is located at Primera de Humboldt No. 10, City of Mexico. W. G. Davis, who has for some time been connected with the Electric Storage Battery Company in its Pennsylvania sales office, is now associated with Mr. Seeger in the Mexican office, and his thorough familiarity with storage-battery practice enables him to take up all engineering matters in this special field of electrical work.

The business which has been conducted since 1897 by William Roche at Nos. 52 and 54 Park Place, New York, is now owned by the William Roche Dry Battery Company, with a capital stock of $25,000. William Roche is president of the new corporation, and he has associated with him C. Laton Ford (formerly vice-president of the Celadon Roofing Tile Company), Ernest A. Lowe (president of the Lowe Electric Company) and William C. Hubbard, for a number of years associated with the Westinghouse Electric and Manufacturing Company.

BUSINESS.

The Ideal Stoker Company of 114 Liberty Street, New York, has secured a contract for the installation of Ideal stokers at the Bayonne (N. J.) works of the Para Recovery Company.

The Belden Manufacturing Company of Chicago during the last year has installed a complete and modern braiding plant, and is manufacturing flexible telephone and electrical cords, sleeving and braided wire.

As incandescent lighting becomes more common the buyer of incandescent lamps becomes more particular as to quality, life, etc., which is the reason the Electric Appliance Company of Chicago gives for the unprecedented growth of its business in the sale of the Packard incandescent lamps.

A building to cost $70,000, to be occupied under a 10-year lease by the Woods Motor Vehicle Company, is to be erected on Wabash Avenue, Chicago. The building will have a frontage of 115 feet and a depth of 120 feet, extending through to Calumet Avenue, and will be four stories high.

Pass & Seymour's line of brass shell sockets and receptacles, the ones with the double pole, they state, is meeting with a sale far beyond their expectations, and they have had to increase the capacity of this department. They make future delivery contracts, thereby enabling customers to order in small quantities. This is an appreciable advantage to the contractor and those who do not desire to carry excessive stocks.

The Chicago House Wrecking Company announces that, through its purchase of the electrical material at the St. Louis World's Fair, it came into possession of thousands of incandescent lamps which were used only a short time and are still in good condition for further service. These lamps have been tested and are of 104 voltage, Edison base, eight candlepower. The company also offers 150,000 brand-new incandescent lamps in original cases of 200, 250 and 400 lamps, ranging from 100 to 110 volts, eight and 16 candlepower. It also offers 20,000 colored lamps which have never been used.

The manager of the Eastern Carbon Works of Jersey City, N. J., Mr. E. J. Wilson, reports that he is preparing for the Madison Square Garden electric show, to be held in New York from December 11th to 23d, a complete line of the company's standard and general forms of carbon work. A special feature of the exhibit will be the Eastern dry batteries. These batteries are made in various forms for telephones, electric bells, annunciators, gas lighting, automobiles, launches, gas engines and all similar work. The various other carbon products of the company are to be made the medium of a unique display.

The Whitney Electrical Instrument Company, for whose product Machado & Roller of New York are general sales agents, guarantees that the materials entering into the construction of the Whitney instruments are of the best of their respective grades, flawless so far as careful inspection can determine, and that the workmanship is also of the best. It further guarantees that the instruments have been tested and found to be in proper adjustment and calibration. Any recalibration, readjustment or repair that may be required within a period of one year will be effected by the company gratis; provided that the instrument is returned with seals intact, charges prepaid for that purpose. If the seals are broken, a charge will be made, and no charges for repairs made by other parties without our written consent will be recognized.

The manufacturers who plan the application of motor drive to machines and machine tools are often unable to make satisfactory progress with the work because of the lack of information necessary to enable the electrical manufacturer to bid on suitable machines. The Northern Electrical Manufacturing Company of Madison, Wis., is able to send the purchaser quotations on Northern machines for application to machines and machine-tool

drive upon learning of the class of work to be accomplished and the voltage of the power circuit from which the current is to be taken. The company has had extensive experience in all kinds of manufacturing plants applying motor drive for increased output, and is usually able to determine upon the proper sort of motor equipment to be applied upon learning of the conditions.

A. D. Curtis has recently purchased the controlling interest in the National X-ray Reflector Company of Chicago. The company has moved into new and enlarged quarters at 126 Franklin Street, where it will have better facilities for handling its increased business. In addition to its regular line it will be in a position to supply the trade, after October 25th, with some new specialties in the way of ceiling rosettes, both in convex and concave shapes, new seven and 10-inch corrugated cones, ornamental half shades, and in particular a 14-inch sectional and adjustable corrugated sterling silver-plated glass trough reflector for store-window and picture lighting. This reflector is expected by the company to revolutionize window lighting, as it is easily adjusted to any size of window and can be operated at a saving, it is said, of one-third the current and with an increase of 100 per cent. in richness of effect. It is a device that jobbers may carry in stock, which is of decided advantage. Being sterling silver-plated, it is in no way affected by heat or cold. The silver-plate is backed with enamel that expands and contracts evenly with the glass of the reflector.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) October 3, 1905.

800,619. Reversible Galvanic Battery. Charles B. Askew, Chicago, Ill. Application filed August 24, 1903.

A reversible galvanic battery embodies an anode, a cathode and non-conducting walls extending transversely of and between the electrodes to form with the electrodes vertically non-communicating compartments. (See cut.)

800,625. Induction Coil for Igniting Explosion Motors. Jules Carpentier, Paris, France. Application filed February 8, 1905.

In an induction coil are the armature of the interrupter and a coil of thin wire surrounding the core of the induction coil and connected in shunt to the primary current, operating so as to keep the armature attracted during the continuance of the distributer's contact.

800,638. Storage Battery. William Gardiner, Chicago, Ill., assignor of one hundred and fifty-one two-hundredths to the Universal Electric Storage Battery Company, Chicago, Ill. Application filed June 11, 1904.

The lead grid of the battery has horizontal portions each formed with top and bottom offsets facing in opposite directions, the offset surfaces being vertical and at right angles to the top and bottom surfaces of the horizontal portions. The horizontal portions of the grid have comparatively thin and straight unbroken outer edges, whereby the opposite surfaces of the plate, when in use, present a maximum of active surface and a minimum of inactive surface.

800,653. Method of and Apparatus for Communicating Between Stationary Points and Moving Objects. Isidor Kitsee, Philadelphia, Pa. Application filed February 8, 1902.

A conducting line placed along the road of the moving object has one or more stations connected electrically and provided each with a transmitting device. A receiving device is located on the moving object, the receiving device embracing a free-moving magnet, such as a magnetic needle and an electric circuit, the resistance of which is dependent on the position of the magnet, the electric circuit embracing means to annunciate the change in position of the free-moving magnet.

800,654. Automatically Steering Moving Objects. Isidor Kitsee, Philadelphia, Pa. Application filed February 28, 1903.

An automatic steering device for moving objects, embodies a compass and means in the compass to vary the resistance of an electric circuit containing an electromagnetic device operatively connected to the steering device.

800,656. Telegraphic Transmitting Tape. Isidor Kitsee, Philadelphia, Pa., assignor of one-half to William J. Latta, Philadelphia, Pa. Application filed January 19, 1905.

A perforation on one side of the tape always alternates with a perforation on the other side. A perforation on one side is adapted to allow connection with the line to a source of current of one polarity and a perforation on the opposite side is adapted to allow connection with the line to a source of current of opposite polarity.

800,657. Telephonic Transmission. Isidor Kitsee, Philadelphia, Pa. Application filed June 14, 1905.

Two stations are connected together with an all-metallic line, a secondary of an inductorium being provided for each station. The secondary is adapted to act as an impedance if inserted in series in the line and consists of two parts, each part connected with one terminal in shunt to one leg of the circuit and connected with the other terminal with the second leg of the circuit.

800,658. Space Telegraphy. Isidor Kitsee, Philadelphia, Pa. Application filed June 17, 1905.

In a system of space telegraphy are a moving vehicle an aerial conductor reaching over the top of the vehicle, means to keep the aerial conductor in place and means to lower the conductor, the means dependent on the closing of an electric circuit. The electric circuit is in operative relation to the actuating means.

800,675. Telephone Receiver. Hermann G. Pape, New York, N. Y. Application filed June 16, 1904.

A telephone receiver includes a casing having an apertured wall, a diaphragm within the casing, a magnet opposed to the diaphragm and including a shell, a core, and an interposed coil, the shell being screwed into the apertured wall of the casing and the core being extended to the exterior of the casing.

800,676. Combined Telephone Receiver and Aural Massage Instrument. Hermann G. Pape, New York, N. Y. Application filed June 16, 1904.

Combined with a casing is an armature and a diaphragm therein, an electromagnet arranged to operate both of the elements, an interruptor located in the magnet-circuit and arranged to be operated by the armature and an automatic circuit-closing device for closing the circuit through the magnet and interrupter.

800,747. Key for Telephone Switchboards. Frederick H. Loveridge, Chicago, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed December 12, 1902.

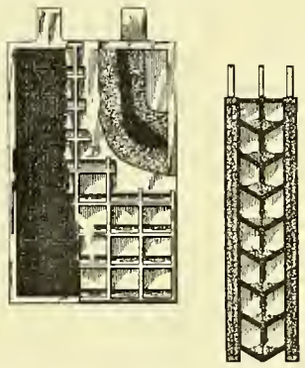
The mechanical details of a telephone switchboard key are described in the patent.

800,755. Connection Switch Member. Frank R. McBerty, Evanston, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed December 7, 1904.

In a connection switch member are a hood, a cross-piece within the hood, a chamber in the hood above the cross-piece, a contact device supported by the cross-piece and a device having contact parts below the cross-piece. Connection terminals for the parts in the chamber above the cross-piece, the chamber having an opening to admit conducting wires to the terminals and a support for the hood are the remaining features.

800,756. Protective Apparatus for Electrical Instruments. Frank R. McBerty, Evanston, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed December 7, 1904.

An instrument is described which has a movable terminal connector and a pair of main conductors connected to it. The movable connector has contacts connecting with the main conductors. An extra contact is connected with a protection conductor and switch members are adapted in closing to join the extra contacts before uniting the line contacts. A lightning arrester has a plate connected with each line conductor of the instrument and a third plate connected with the protecting conductor. Thus the user of the instrument is protected from strong currents with which the line conductors may be accidentally charged.



NO. 800,619.—REVERSIBLE GALVANIC BATTERY.

800,762. Trolley Pole. Andrew L. Prentiss, Buffalo, N. Y. Application filed October 18, 1904.

A pressure cylinder containing a piston is connected to the trolley pole. A valve case is mounted on the pole and has an inlet port, a conduit connecting the pressure cylinder with the valve case. Valve mechanism controlling the admission of the pressure fluid to the cylinder and its escape therefrom is operated by the movements of the pole.

800,767. Telephone Transmitter. Philip J. Spies and Rudolph C. Deuben, Chicago, Ill., assignors to said Spies and John M. Klein, Chicago, Ill. Application filed November 1, 1902.

Mechanical features are described.

800,765. Pneumatic Compressor. Lebbeus H. Rogers, New York, N. Y. Application filed December 29, 1904.

In an air-compressor pump are a revoluble piston-carrying drum, oil-receiving spaces in the drum, electric heating means carried by the drum and means for connecting the heating means with a source of electric current.

800,792. Thermometric Rheostat. William H. Bristol, New York, N. Y. Application filed April 18, 1905.

A thermometric rheostat comprises a mercury thermometer containing within its shank a platinum leading-in wire, the active portion of which is of reduced cross-section forming a resistance adapted to be short circuited or vice versa by the mercury.

800,816. Motor Controller. Samuel S. Neu, New York, N. Y. Application filed October 10, 1904.

In an electric motor having a shunt field-magnet coil is a rheostat having a contact point which when engaged by the arm of the rheostat throws the armature onto a short circuit. An electromagnet is in the short circuit and an armature controlls the circuit of the shunt field-magnet coil.

800,820. Thermal Cut-out Device. Charles A. Rolfe, Adrian, Mich., assignor to the Rolfe Electric Company, Rochester, N. Y. Application filed January 11, 1897. Renewed July 27, 1904.

Line springs of the device are adapted to make contact with the plug when it is inserted into the socket. Spring means tend to withdraw the plug from its socket, an an excess-current-operated device holds the plug normally in the socket.

800,821. Thermal Cut-out Device. Charles A. Rolfe, Adrian, Mich., assignor to the Rolfe Electric Company, Rochester, N. Y. Application filed January 11, 1897. Renewed July 27, 1904.

A circuit-breaking device adapted to open or break the circuit is provided with means normally tending to actuate the device so as to cause it to break or open the circuit. An excess-current-operated device holds the actuating means normally in engagement with the circuit-breaking device, and releases it when operated.

800,822. Fuse Device. Charles A. Rolfe, Adrian, Mich., assignor to the Rolfe Electric Company, Rochester, N. Y. Application filed January 20, 1902.

In an inclosing casing is a sleeve fitted into it and projecting therefrom. A screw locks the sleeve in position and a clamping device consisting of a pair of clamping members is fitted loosely upon the sleeve.

800,823. Electrical Protective Apparatus. Charles A. Rolfe, Adrian, Mich., assignor to the Rolfe Electric Company, Rochester, N. Y. Application filed February 13, 1903.

An electrical circuit protector comprises a pair of solder-joint protective devices arranged side by side, each of which devices has provisions whereby after operation it is automatically resoldered preparatory for another operation. Means are provided for short circuiting the circuit upon operation of either of the devices.

800,824. Electrical Circuit Protective Apparatus. Charles A. Rolfe, Adrian, Mich., assignor to the Rolfe Electric Company, Rochester, N. Y. Application filed February 13, 1903.

Oppositely disposed protective devices are each adapted to operate upon the passage in the circuit of an unduly strong current. Means for short circuiting the circuit upon the operation of one of the devices are further provided.

800,825. Fuse Device. Charles A. Rolfe, Adrian, Mich., assignor to the Rolfe Electric Company, Rochester, N. Y. Application filed February 13, 1903.

An insulating tube, a threaded sleeve having a portion of its length inserted into the end of the tube, a band or ring about the end of the tube, pins exteoding through the band and through the walls of the tube into the sleeve and connecting devices arranged upon the sleeve are the essential parts of the device.

800,827. Electrical Protective Apparatus. Charles A. Rolfe, Adrian, Mich., assignor to the Rolfe Electric Company, Rochester, N. Y. Application filed May 18, 1903.

An electrical circuit protector comprising a single thermally operable circuit protective device has provisions for short circuiting the circuit on the passage of an unduly strong current and provisions whereby it is automatically restored to operative condition.

800,828. Electrical Protective Apparatus. Charles A. Rolfe, Adrian, Mich., assignor to the Rolfe Electric Company, Rochester, N. Y. Application filed May 18, 1903.

A pair of terminals are each provided with springs tending to separate from one another. A heat cartridge holds the spring normally under restraint and is adapted to permit its release when operated. A metallic bar or rod is attached to one of the springs and has a bent end located in the rear of the other spring, whereby upon operation of the heat cartridge the springs are released and one comes into contact with the bent end of the bar or rod attached to the other.

800,829. Electrical Circuit Protector. Charles A. Rolfe, Adrian, Mich., assignor to the Rolfe Electric Company, Rochester, N. Y. Application filed September 25, 1903.

In an electrical-circuit protector are a spring means for controlling the circuit, a heat cartridge, and an intermediate member holding the cartridge spring device together.

800,830. Electrical Circuit Protector. Charles A. Rolfe, Adrian, Mich., assignor to the Rolfe Electric Company, Rochester, N. Y. Application filed September 25, 1903. Renewed July 30, 1904.

In an electrical circuit protector are a heat-concentrating device and means for controlling the circuit having provisions for automatically restoring itself to operative condition.

800,831. Electrical Protective Device. Charles A. Rolfe, Adrian, Mich., assignor to the Rolfe Electric Company, Rochester, N. Y. Application filed December 29, 1903.

Details are described.

800,832. Electrical Protective Device. Charles A. Rolfe, Adrian, Mich., assignor to the Rolfe Electric Company, Rochester, N. Y. Application filed December 29, 1903.

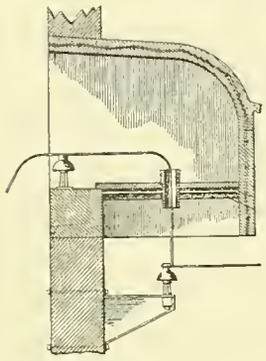
Spring means open the circuit and a heat cartridge comprises the mechanism for holding the spring means together.

800,833. Electrical Circuit Protector. Charles A. Rolfe, Adrian, Mich., assignor to the Rolfe Electric Company, Rochester, N. Y. Application filed July 28, 1904.

A heat cartridge for electrical-circuit protectors has a bodily removable core carrying a fine-wire heating coil, and provided with a double trigger pivoted between its ends and having a solder connection with the cartridge.

800,834. Weather Trap for Electric Wires. William H. Roney, Chicago, Ill. Application filed November 3, 1904.

A weather trap for electric wires is adapted to be inserted into the wall of a building and to receive an electric wire. The trap has an outer end opening downwardly, and an insulated support inside for supporting the wire out of contact with the walls of the trap. (See cut.)



NO. 800,834.—WEATHER TRAP FOR ELECTRIC WIRES.

800,843. Controlling Device for Motor Vehicles. Victor E. Chamberlin, Indianapolis, Ind., assignor to the Pope Manufacturing Company, Jersey City, N. J. Application filed March 17, 1905.

The controller for the motor vehicle comprises groups of contacts and connections to determine the speed and direction of movement of the motor. A controller handle for the motor, a housing slotted to guide the controller handle, a bodily removable switch plug included in the motor circuit, and a seat provided for the switch-plug in the housing adjacent to the handle are the other electrical features.

800,844. Quadruplex Telegraphy. Stephen D. Field, Stockbridge, Mass. Application filed August 20, 1904.

In a receiving apparatus are an armature lever, means for affecting the armature lever through the medium of the line current and local means controlled by the armature lever for continuing the excursion of the lever.

800,854. Wireless Telegraphy. Isidor Kitsee, Philadelphia, Pa. Application filed February 8, 1902.

A system of telegraphic communication without continuous line wire consists of a sending and receiving station, the sending station being provided with a source of alternating or interrupted current. A spark device is provided, one part of which is wound or connected in a manner so that the impulses induced in the secondaries will normally neutralize each other. A sending key and means operatively connected to the key to destroy the neutralizing action complete the apparatus. (See cut.)

800,855. Telephony. Isidor Kitsee, Philadelphia, Pa. Application filed June 30, 1904.

A transmitting line connects two stations to each other, and means are provided to transmit over the line high-tension impulses. The means are connected in multiple are as to the line, the line also being provided with an artificial line at each terminal. Receiving devices are connected in series with the line.

800,856. Receiving Device for Electric Transmission. Isidor Kitsee, Philadelphia, Pa. Application filed June 14, 1905.

An electric relay or receiver embraces an inclosure provided with a vacuum. A volatile liquid in the inclosure contains heating means immersed therein and connected to the line. Terminals of a local circuit are adapted to be conductively connected through the rise of the liquid, the local circuit containing a source of current and translating means.

800,873. Electrical Measuring Instrument. Edwin F. Northrup, Philadelphia, Pa., assignor to the Leeds and Northrup Company, Philadelphia, Pa. Application filed November 19, 1904.

In an electrical measuring instrument are combined with a single field magnet having a number of pole faces of north polarity only, on one side of the air gap separating the poles of the magnet, a number of pole faces of south polarity, only opposite the north poles, and a flat coil system supported to move in the air gap in a plane substantially at right angles to the direction of the magnetic lines of force between the poles of the magnet.

800,885. Electric Cooking Apparatus. Gustav Teuber, Laasphe, Germany. Application filed April 27, 1905.

The side and bottom walls of a vessel are grooved and an electrical resistance conductor is wound in the groove.

800,902. System of Electrical Distribution. Rufus N. Chamberlain, Depew, N. Y., assignor to the Gould Storage Battey Company, New York, N. Y. Application filed January 12, 1904.

A system of electrical distribution comprises a main generator, a storage battery, a booster provided with differentially acting energizing coils and a counter-electromotive-force generator operating to resist the current passing through one of the coils.

800,907. Antiseptic Telephone Mouthpiece. William B. Curtis, San Francisco, Cal. Application filed April 18, 1905.

An annular disinfectant holder surrounds the telephone mouthpiece.

800,909. Controller Regulator. Cyrus P. Ebersole, Keokuk, Iowa, assignor to the Electrical Devices Company, Keokuk, Iowa. Application filed July 23, 1902. Renewed May 5, 1904.

Operating means for the controller embody a series of stops, a movable dog, and a series of cams to move the dog into engagement with the stops, the dog being laterally movable, whereby when the controller is moved in one direction the dog will ride over the stops and not engage them.

800,916. High-potential Switch. Edward M. Hewlett and William L. R. Emmet, Schenectady, N. Y., assignors to the General Electric Company, Schenectady, N. Y. Application filed January 15, 1900.

In an electric switch, combined with a horizontal supporting plate, are side plates depending therefrom, insulating bars connecting the side plates and a series of spring contacts mounted on the bars.

800,935. Electric Wire Tower. La Verne W. Noyes, Chicago, Ill. Application filed February 11, 1904.

Details of the steel work of a tower surmounted by insulators for carrying electric transmission lines are described.

800,940. Telephone Transmitter. Jerome Prince, Milford, Mass., assignor to the Prince Telephone Company. Application filed August 18, 1902.

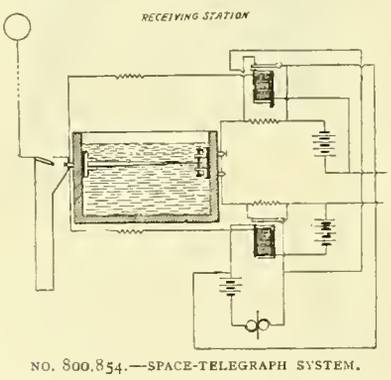
In a telephone-transmitter are the casing and a suitable mouthpiece and diaphragm. In addition there is a vitreous reinforcing chamber open to the air on all sides for free vibration, made distinct from the diaphragm, and suitably secured within the casing.

800,946. Polarized Electric Bell. Samuel C. Shaffner, Mobile, Ala. Application filed July 15, 1903.

In a polarized electric bell is a cast-metal base formed integral with which are the pole pieces. A permanent magnet is removably secured thereto, in engagement with the pole pieces.

800,993. Turn-down Incandescent Lamp. Samuel E. Doane, Cleveland, Ohio, assignor to the National Electric Lamp Company, Cleveland, Ohio. Application filed November 16, 1904.

The metal base of the lamp is composed of a threaded portion adapted to engage in a socket, and a plain portion above the threaded portion. A switch is mounted on the outside of the plain portion and a protecting cap embraces the plain portion of the base and extends over the switch.



NO. 800,854.—SPACE-TELEGRAPH SYSTEM.

800,994. Magnetic Rivet Holder. Henderson B. Douglas, Butler, Pa., assignor of one-half to John S. Douglas, Butler, Pa. Application filed December 2, 1904.

A die shaped to receive the head of a rivet forms the pole of an electromagnet which is provided with a handle so that it can be conveniently held. (See cut.)

801,034. Telephone Receiver. William J. Murdock, Boston, Mass. Application filed January 5, 1905.

A telephone receiver case has a diaphragm retaining cap of insulating material provided with an internally screw-threaded flange and having a substantially unyielding reinforcing ring of greater tensile strength than the material of the cap, the ring is embedded in the material of the cap and surrounds the threaded flange.

801,035. Electric Bell. William J. Murdock, Boston, Mass. Application filed July 21, 1904.

A base of insulating material is molded around a magnet and contains a recess into which the poles of the magnet project. An armature is located in the recess and free to oscillate therein.

801,049. Railway Signaling System. Karl Scholz, Liebauthal, Austria-Hungary. Application filed April 27, 1905.

Two senders adapted to emit horizontal slightly diverging pencils of ultra-violet rays of light forward and rearward from the train, are associated with two receivers adapted to receive ultra-violet rays of light from the front and the rear. Each receiver comprises a quartz plate as a window, a rock-crystal lens adapted to collect the rays of light and a spark-gap adapted to receive the collected ultra-violet rays of light. Circuits on the train contain the spark-gap of the two receivers, and means controlled by the circuits give the signals.

801,089. Lamp. Gottlieb Keller, New York, N. Y. Application filed April 13, 1905.

The lamp comprises a glass globe having a neck open at its outer end and formed with an integral liquid chamber surrounding the sides and bottom of the globe. An electric lamp is secured to the upper end of the neck of the globe and extends through the neck into the globe.

801,118. Wireless-telegraph Receiver. Gustaf T. Swenson, near San Pedro, Cal., assignor to the Pacific Wireless Telegraph Company. Application filed December 1, 1902.

The coherer is composed of a stationary carbon filament and a moving contact. Means to hold the filament against mechanical vibration comprise a pad affixed to a spring adapted to cause the pad to press the filament against the contact.

801,130. Telegraph and Telephone Line and the Like. John C. Barclay, New York, N. Y. Application filed June 3, 1905.

Several signaling circuits comprise conductors of a multi-conductor cable, the return connections for the conductors comprising high resistance. Anti-induction circuits of low resistance comprise conductors in the cable located substantially equidistant from the other conductors.

NO. 800,994.—MAGNETIC RIVET HOLDER.

801,132. Electrical Means for Detecting and Announcing Contact Between Two Conducting Bodies. Mark Barr, Kensington, England, assignor to the Linotype Company, Limited, London, England. Application filed May 31, 1901.

A telephone and circuit are used in connection with a machine and tool to ascertain when the tool comes in contact with the work.

801,165. Railway Signaling System. Herbert B. Taylor, East Orange, N. J., assignor to the Advance Signal Company, Newark, N. J. Application filed May 15, 1905.

Details are described.

801,173. Printing Telegraph. John C. Barclay, New York, N. Y. Application filed March 18, 1905.

Associated with a number of operating magnets are selecting relays having contacts connected in tandem adapted to complete circuit through such contacts to any one of the operating magnets. Means comprising a sunflower control the operation of the selecting relays and means break circuit through the contacts of the selecting relays to the magnet selected prior to the breaking of such contacts by the selecting relays.

801,186. Main Distributer for Telephone Exchanges. Georg Deisenhofer, Munich, Germany, assignor to the firm of Deutsche Telephonwerke R. Stock & Co., G. M. B. H., Berlin, Germany. Application filed May 31, 1905.

A distributing frame having a number of terminal members is arranged in spaced parallel pairs having broad inner and outer faces. The interstice between the members of a pair is comparatively less than the spaces between pairs. Terminal posts extend transversely of each of the members and have ends projecting beyond the outer and inner broad faces.

801,190. Electric Semaphore. Clayton E. Frederickson, Denver, Colo., assignor of one-half to Jean F. Webb, Denver, Colo. Application filed January 23, 1905.

A semaphore signal consists of a supporting standard, a casing rotably mounted thereon, the casing having windows, a lamp mounted on the standard within the casing and means for normally locking the casing from rotation with its windows out of register with the signal lamp. Electromechanical mechanism is mounted within the casing for releasing the locking means, and means for rotating the casing to bring its windows in register with the lamp are provided.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on October 9, 1905:

390,642. Mechanical Telegraph. J. B. Bennett, Indianapolis, Ind.

390,674, 390,675, 390,676, 390,677. Galvanic Battery. D. Humphreys, Cincinnati, Ohio.

390,721. Dynamo-electric Machine. N. Tesla, New York, N. Y.

390,741. Insulator or Bracket Support for Electric Wires. T. E. Adams, Cleveland, Ohio.

390,748. Battery Electrode. H. J. Brewer, New York, N. Y.

390,778. Electric Bell Pull. P. A. Harris, Paterson, N. J.

390,795. Electrically Operative Lock. G. S. Neu, New York, N. Y.

390,802. Telegraphy. F. Jarvis Patten, Fort Sidney, Neb.

390,820. Regulator for Alternate-current Motors. N. Tesla, New York, N. Y.

390,833. Hotel Signaling System. A. Barrett and J. Zenther, Kansas City, Mo.

390,846. Globe for Electric Arc Lamps. W. W. Downing, Peoria, Ill.

390,891. Electrical Stop Mechanism for Knitting Machines. A. M. Newlands, Preston, Ontario, Canada.

390,903. Incandescent Electric Lamp. A. L. Reinmann, Pittsburg, Pa.

390,904, 390,905. Electrodynamic Machine. E. E. Ries, Baltimore, Md.

390,906. Multiple-current Electric Generator. E. E. Ries, Baltimore, Md.

390,910. Coupling Dynamo-electric Machines for Electric Distribution. O. B. Shallenberger, Rochester, Pa.

390,911. Regulator for Electric Translating Devices. O. B. Shallenberger, Rochester, Pa.

390,912. Apparatus for Synchronizing Alternate-current Dynamo-electric Machines. O. B. Shallenberger, Rochester, Pa.

390,930. Synchronizing Electric Generators. G. Westinghouse, Jr., Pittsburg, Pa.

390,955. Dynamo-electric Machine. J. Emmner, Jr., Washington, D. C.

390,990. System of Electrical Distribution. O. B. Shallenberger, Rochester, Pa.

390,993. Track Instrument for Railroad Signals. I. B. Sutherland, Syracuse, N. Y.

DEPT OF ELECTRICAL ENG'G

WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XXXVII. CHICAGO, OCTOBER 21, 1905 No. 17

Hydro-electric Power Development at York Haven, Pa.

At York Haven, Pa., on the Susquehanna River, there is now in operation an important hydro-electric installation. The plant, as it now stands, is capable of developing about 5,000 kilowatts, but the power available is estimated at 16,000 kilowatts. The energy here generated is used for power and lighting purposes in York Haven, York and surrounding towns, and already the York Haven Water and Power Company, which is the owner of the plant, is supplying a large number of factories with current.

The power-plant buildings are constructed of brick and Portland-cement mortar, resting upon a solid granite foundation. The walls for 10 feet up from the floor line are three feet thick, and from this point to the roof line are two feet in thickness. Ample windows are provided to give good light and ventilation. As the business in sight calls for additional extensions, the present structure will be continued and will cover all the wheel-pits provided in the original foundations. Fig. 3 shows the main structure as it now stands.

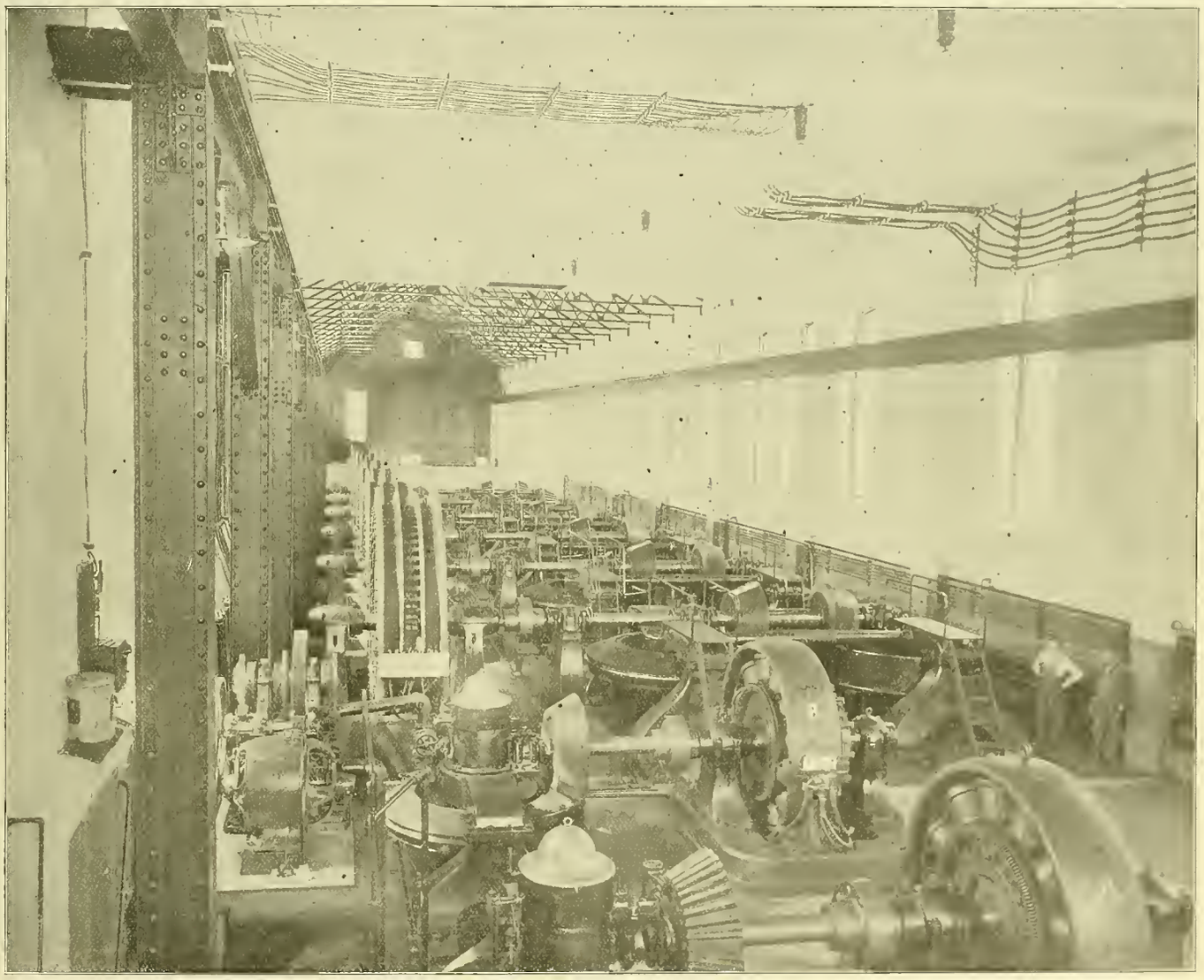


FIG. 1. MAIN OPERATING ROOM IN YORK HAVEN POWER HOUSE, SHOWING GENERATORS AND EXCITERS.

Generators and Exciters.

Generators to the number of six are now installed and in operation. Four new units of equal capacity are being placed in position and will probably be ready for service in 60 to 90 days. These generators are Stanley three-phase 60-cycle delta-connected machines, made for 2,400 volts terminal pressure. They are rated at 875 kilowatts on unity power factor and 750 kilowatts on 85 per cent. power factor. They are of the inductor type, running at 200 revolutions a minute. These generators show an efficiency of 94 per cent., and under full load have never shown a temperature of over 30° C. above the surrounding air.

The present six machines have all been operated in parallel without manifestation of cross-currents or a tendency to work out of phase. The ease with which these generators can be thrown in parallel is worthy of mention, and even when the operator at the board throws in the switch some seconds early or late of true synchronism, they will pull in step at once without trouble and remain so until thrown out again by the operator.

Current from the machines is led to the switchboard through 40 stranded cables, supported by cable insulators on the walls.

Two exciter units are provided, of 2,000 amperes capacity each, at 120 volts. They are compound-wound, each unit being of sufficient capacity to excite the full station of 20 generating units, besides supplying current for what small motor equipments are in use around the station.

Fig. 1 is a view in the main generator room, showing in the foreground the exciter sets and farther back the alternators mounted on shafts, which are driven by the hydraulic turbines through the agency of bevel gears.

Switching Devices.

The arrangement of the 2,400-volt switching devices and operating tables is complete in every detail and shows the skill put forth by the designers and manufacturers in making the apparatus up to date, as well as substantial and convenient. All switches and controlling devices are in duplicate. The present generator switches are 12 in number, each switch controlling the three phases of one generator. They are shown in Fig. 2, which is a view of the main switchboard.

Each generator has two complete switches corresponding to the duplicate busses. By this arrangement part of the load can be operated on one set of busses and part on the other, or the full generated load can be thrown on one set of busses. This arrangement insures continuous operation, and gives as well opportunity for cleaning or repairs.

Generator switches are enclosed within slate cabinets, which make them fireproof and safe. Mounted on and directly in front of each generator switch cabinet is a solenoid, controlled by the operator at the operating table through a small knife switch. It is very quick-acting for both opening and closing, and insures ease in paralleling the generators onto the busses.

Each solenoid has mounted in conjunction with its trip coil a time-limit-relay device, which, in case of an overload or short-circuit, regulates the time in which the switch shall be opened. This time element is necessary, inasmuch as, should a momentary short-circuit or overload take place, the automatic switches will not work, consequently saving the generators from being thrown off the busses and out of parallel.

As shown in Fig. 4, the operating tables and instrument panels form a hexagon and are located in the center of the switchboard gallery. This

form of construction makes the manipulation of the switches very simple and convenient, as the operator at all times can see all the instruments, and does not move from his position. Each generator has its own polyphase, indicating kilowatt wattmeter, generator ammeter, field ammeter and field rheostat. Each generator has also its own synchronizing plugs, signal lamps and push-buttons. All instruments, switches, plugs, etc., for each generator are mounted on marble, and, being in vertical line, the operator cannot make a mistake by handling the wrong switch.

Two totalizing panels, corresponding to the duplicate busses, have mounted upon them polyphase recording wattmeters, a frequency indicator, a power-factor indicator, together with ammeters and voltmeters in the leg of each phase.

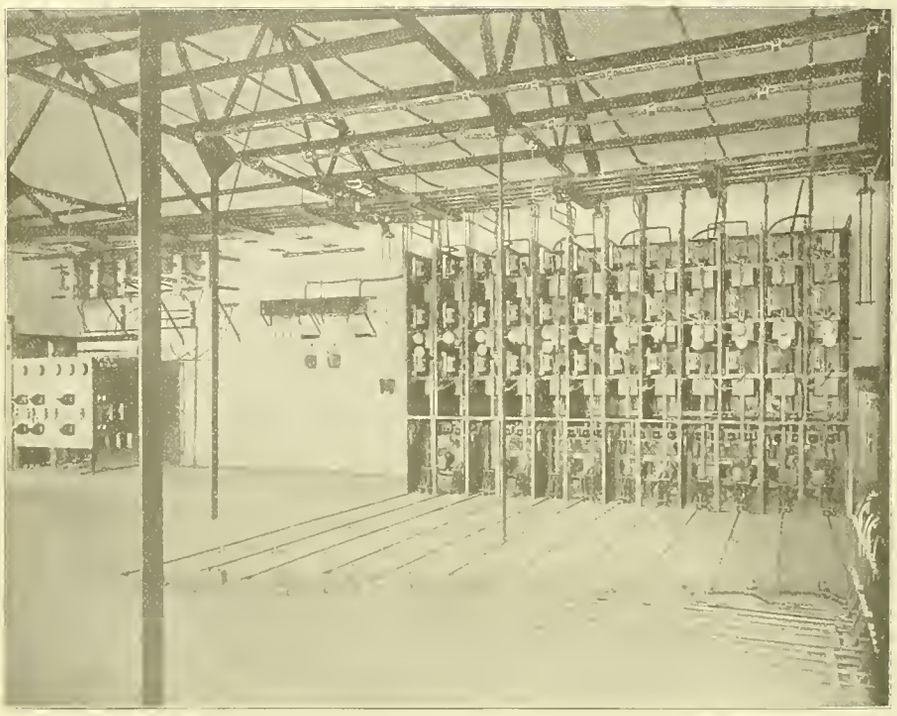


FIG. 2. MAIN SWITCHBOARD IN YORK HAVEN POWER HOUSE.

Of all the instruments in operation a half-hour reading is taken and recorded upon the station log sheet. For the purpose of paralleling the several generators, two Lincoln synchronoscopes are provided, together with plugs, etc., for each generating unit. Mounted upon the same panel with these synchronoscopes are the Bristol recording voltmeters and the operating voltmeters.

The operation of the generator field rheostats is accomplished in quite unique manner. Extending from the brush plates of the rheostats to the front of the operating table is a shaft having upon its end a worm gear. This gear engages another gear upon a transverse shaft, which shaft is in turn operated by a small motor of one horsepower, series-connected and reversible. This apparatus is to be seen in Fig. 4.

After paralleling a generator onto the busses, the operator sets the field and throws the worm gear in mesh with the gear on the transverse shaft. Then, by using a small double-pole double-throw switch he operates the motor, which moves all the generator rheostats simultaneously. By this arrangement all generator fields in operation can be strengthened or weakened together, which gives admirable regulation, as well as facilitates quickness in case of a sudden change in generator voltage.

Exciter panels are provided with all the necessary switches for single, parallel and series operation, together with automatic circuit-breakers on the negative side, of 2,500 amperes capacity. Weston standard switchboard direct-current voltmeters and S. K. C. hot-wire ammeters, with shunts, are mounted upon these panels. The lighting of the station is done from another panel adjoining the exciter panels, and current can be had from two sources, either direct current or alternating current.

Both direct-current enclosed arc lamps and 16-candlepower incandescent lamps in clusters are used to light the generator room. The arc lamps are suspended from the roof trusses, while the incandescent lamps are hung below the crane girders upon each side. The lighting of the plant is brilliant and free from shadows.

At the southern end of the switchboard gallery and directly under the generator busses are three marble panels which take current from these busses and feed it into the lines running to the transformers and distributing panels in the paper mills of the York Haven Paper Company of York Haven, Pa., the Chase Felt and Paper Company of Cly, Pa., the Susquehanna Roofing Company of Cly, Pa., the American Phosphorous Company of Falls, Pa., and the Pennsylvania Railroad Company for pumping water.

These panels have mounted upon them polyphase indicating wattmeters and ammeters in each phase, together with two three-pole single-throw automatic oil switches for each circuit.

This switch arrangement makes it possible to change from one set of busses to the other, as the case may be, without interruption to service of the several circuits. Immediately back of these panels and upon the wall are mounted the lightning arresters and choke coils which protect the circuits.

Hydraulic Equipment.

The hydraulic equipment for driving the six present electrical units consists of 12 78.5-inch turbines, and there are being erected eight more turbines of the same size, making a total of 10 units for present needs, or 10,000 horsepower. These turbines are operated in pairs under a present head of 20 feet, which head makes the turbines capable of developing 1,000 horsepower for each pair. This head, however, will be increased to 25 feet minimum upon completion of the dam across the river. The turbines have several good features which were brought out by the Poole Engineering and Machine Company of Baltimore, Md.

The turbines proper are of special design. The buckets are of pressed steel and have cast gunmetal hubs and guide rims. They show a high efficiency at all stages of the gates with a minimum usage of water. The turbine gates are of special design also and are of the balanced type, register pattern.

The shafts extend from the turbines vertically to the miter gears above the floor (shown in Fig. 1), and each is encased in a cast-iron tube, with inspection doors, which protects it from the action of the water and insures longevity both to the shafts and the bearings which sustain them in line.

Another special feature in connection with these turbines and their equipment is the thrust bearings. These are immediately below the miter gears, above the floor line, and rest upon a small bridge tree between the floor girders. They sustain the weight of the turbines, shaft and miter gear, and run cool at all times and are noiseless.

The exciter units, two in number, consist each of a single turbine of 68 inches in diameter, with a design identical to the large units, and they have shown their worth by doing continuous service month after month without intermission.

The layout of governors for controlling the speed of the turbines consists of a nine by 16-inch Lombard governor for every other unit. These governors are operated in multiple and give a speed regulation of two per cent. from no load to full load, or vice versa. Oil under pressure is supplied to these governors by a central-energy system, consisting of an accumulator, a triplex pump and suction tank into which the spent oil from the governors is discharged after doing its work.

Distribution of Current and Present Transmission Line.

The current as generated and fed into the 2,400-volt busses is conducted by them in conjunction with 1,000,000-circular-mil lead-covered cables through a spacious covered wire alley (Fig. 6) to the transformer house, situated about 250 feet from the main building and shown in Fig. 3. Within this transformer house are located the step-up transformers, necessary switches and lightning arresters.

The wire alley contains at present sufficient cables to transmit over 10,000 horsepower and are in duplicate in accordance with the duplicate busses. These cables lead to the transformers through heavy oil switches by which either set of cables and their connecting busses can feed into the transformers the 2,400-volt current which they carry. This arrangement of switches precludes the possibility of interruption to service from any trouble caused by a punctured cable or otherwise.

The step-up transformers, of which there are two banks of three transformers each, are of sufficient capacity to take care of over 10,000 horsepower. Each transformer is rated at 1,400 kilowatts, which makes the present installation capable of handling 8,400 kilowatts with ease. These transformers are of the oil-insulated and water-cooled type and represent the latest development in transformer construction.

The transformers take in 2,400-volt current on one side and deliver it to the high-tension busses from the other side at 24,000 volts. From these high-tension busses, which are also in duplicate, the current is fed to the transmission line through high-tension circuit-breakers. These breakers are of the unit type, with each leg of a phase, together with its switch, confined in a fireproof brick and slate cell. In case of a heavy short-circuit on the transmission line, which might cause material damage to the transformers or generating apparatus, these breakers will open automatically and give the necessary protection.

Each transmission line leaving the transformer house has its own set of choke coils and lightning arresters, as shown in Fig. 5, and while the plant has experienced some very severe lightning storms, yet these arresters have taken every discharge coming over the lines and have thoroughly protected the station.

At present high-voltage transmission is used only to the sub-station at York and is conducted over a pole line of 12 miles in length. This pole line has many excellent points which will bear mention.

FIG. 3. EXTERIOR OF YORK HAVEN POWER HOUSE AND TRANSFORMER HOUSE.

After leaving the plant the two circuits—for there are two sets of wires used to carry out the duplicate scheme used in the station—pass through York Haven on a double-pole overhead construction until they reach the city limits, where the single-pole construction commences.

The copper wire used is No. 2 hard-drawn and is supported on the yellow pine cross-arms by locust pins and triple-petticoat porcelain insulators tested to 60,000 volts. All cross-arms are braced with a special form of angle iron, giving great stability and permanency to the cross-arms. The poles are all first-grade and were selected with great care and properly set. All corners or turns are thoroughly guyed with one-half-inch stranded galvanized guys in conjunction with special mica molded guy-strain insulators. The poles also sus-

tain two independent telephone circuits to the sub-station.

The performance of this transmission line during the bad winter months has been exceptionally good. During some heavy sleet storms, accompanied by heavy winds, these lines stood intact, and the copper was free from sleet, and circuits showed no grounds. The fact that this was so is probably due to the low temperature coefficient which caused a slight heating of the lines and kept the sleet from adhering.

SUB-STATION.

The sub-station at York, which is owned by this company, contains high-tension equipment identical with the transformer house at York Haven, with the exception that the transformers are of 875 kilowatts each, with two banks consisting of three transformers each. The low-tension or 2,400-volt side of these transformers feeds into the low-tension busses mounted near the switchboard. From this switchboard the current is passed through suitable automatic switches to the several circuits, of which there are five. The switchboard also has all switches in duplicate, which bears out the scheme used at York Haven.

There is also a totalizing panel with polyphase recording wattmeters which give the total load delivered over the busses and provide a means whereby the load delivered can be checked with that delivered at York Haven. The several circuits leaving the sub-station supply 15 manufacturing concerns with power and light together with several suburban roads, while 1,000 horsepower contracted for has not yet been connected.

Located at the sub-station is the meter-testing department, where all recording wattmeters are cleaned, overhauled and calibrated.

OTHER FEATURES OF INTEREST.

Located across and some six miles up-river from the York Haven plant is the thriving city of Middletown, Pa., while six miles farther on is Harrisburg, the state capital. Between these two places are several extensive manufacturing plants where the consumption of power is considerable. With these points in view and the fact that contracts amounting to many hundred horsepower have been secured at these places this company has now under construction a heavy transmission line to carry current to these several centers of industry. The river crossing was quite a problem to meet, as the insulation for 24,000 volts had to be secured.

After considering many propositions the management and engineers of the company decided upon laying two three-wire submarine cables, to be imbedded in the river and convey the high-tension current across to a terminal house on the other side. From here the circuits leading to Harrisburg, Middletown, Columbia, Marietta, Spring Grove and Hanover, Pa., will radiate, supplying these cities with power.

On account of the weight of the machinery in the plant and to facilitate repairs when necessary an electrically operated traveling crane with a span the full width of the building and of 15-ton capacity has been provided.

On account of the usual backsets encountered in building a dam in a cold climate this part of the present undertaking has been delayed somewhat. However, with a large force of several hundred men this work is now being pushed to completion rapidly, and by the time winter sets in the uncompleted portion extending across the rapids at the head of the falls to Duffy's Island will be finished, which will then maintain a minimum effective head at the turbines of 25 feet.

The officers and directors of the York Haven Water and Power Company are: President, Henry L. Carter; vice-president, W. F. Bay Stewart; secretary and treasurer, Henry W. Stokes; general manager, Edward F. Baker; directors, Thomas H. Savey, Wilmington, Del.; George Poole, Baltimore, Md.; Julian Christensen, Philadelphia.

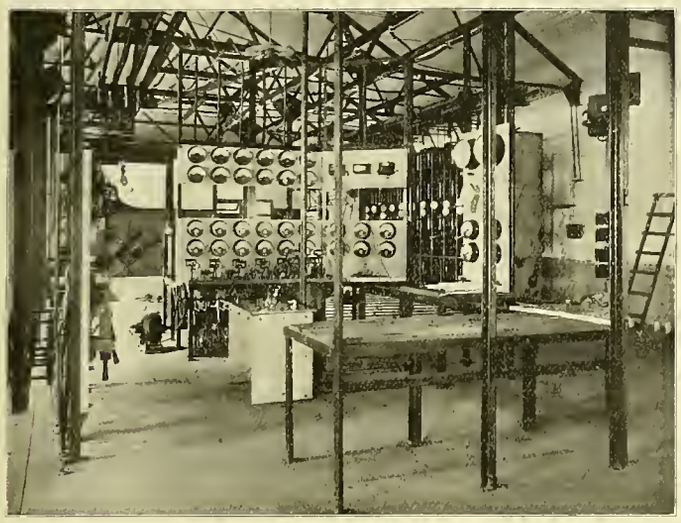


Fig. 4. Low-tension Operating Table

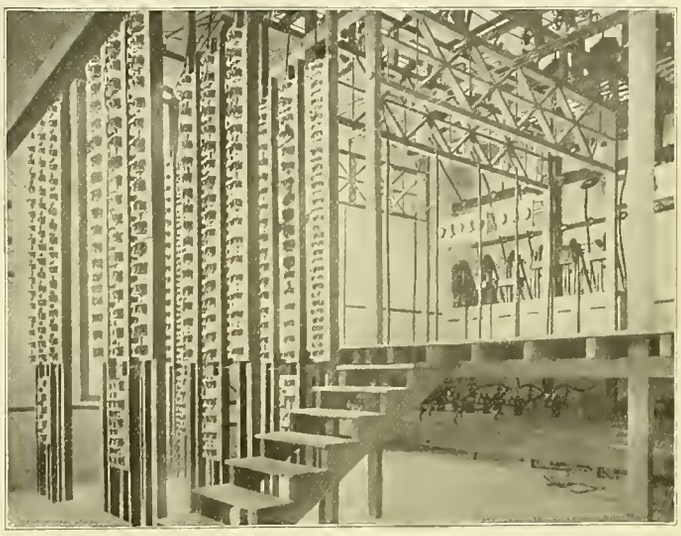


Fig. 5. Lightning Arresters in Transformer House.

HYDRO-ELECTRIC POWER DEVELOPMENT AT YORK HAVEN, PA.

Development of the Dry Battery.

Group jury No. 68 at the Louisiana Purchase Exposition compiled a great many notes relative to its study of electrochemical and electrometallurgical exhibits. Complying with a suggestion made by W. E. Goldsborough, chief of the Department of Electricity, the committee, which consisted of Carl Hering (chairman), Dr. Kahle (vice-chairman), Professor C. F Burgess (secretary), Dr. Samuel Sheldon and K. Sosnowski, presented a paper representing the results of its investigations to the American Electrochemical Society. This paper was read at the recent meeting of the society in Bethlehem, Pa., and contains, among other things, remarks upon the development of the dry battery which are interesting.

According to this paper, the greatest development in primary-battery manufacture was shown in the "dry cell," which in the last decade has been so greatly improved that it is apparently replacing the liquid cell. Proof of this lies in the enormous number now being annually produced by the various companies which made exhibits, an estimate of the value of their total product showing that this phase of manufacture has become an electrical industry ranking with those industries which measure the value of their product by millions of dollars annually.

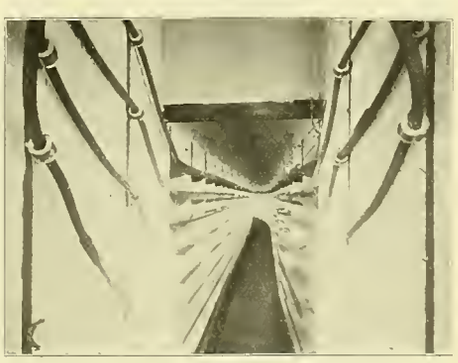


FIG. 6. CABLE ALLEY FROM POWER HOUSE TO TRANSFORMER HOUSE AT YORK HAVEN, PA.

The cell most extensively manufactured is six inches long and 2½ inches in diameter, cylindrical in shape. The earlier dry cells, as is well known, were most unsatisfactory, because of their small capacity and their rapid deterioration when not in use. A great deal of study has been put upon the matter by the various manufacturers, and their attempts to overcome the defects of the earlier cells have met with much success. The improvements which have been effected have resulted in a lower internal resistance, a longer life on open circuits, or, as the trade designates it, a better "shelf wear," a greater number of ampere-hours per unit of weight, and immunity from explosion and similar accidents. The tendency formerly prevalent among manufacturers of attempting to make the public believe that each had a mysterious and secret formula for making his particular battery superior to all others is gradually disappearing. The claims which are now made are for an approximate perfection approached, not so much through the use of new materials or by reason of novel features of construction, as by the employment of materials having the highest degree of purity, put together in such manner and in such proportions as to give the best possible satisfaction. It is asserted that the purest grade of zinc which it is possible to obtain is used in the manufacture of these cells, and it is undoubtedly due to this fact that the low depreciation on open circuit is secured. The capacity of such cells is determined by the length of time which they will operate and the number of ampere-hours which they will deliver, and this, in turn, depends largely upon whether the cell is used continuously or intermittently. The end of the dry cell's life is determined when the electrolyte is completely changed from ammonium chloride to zinc chloride, or when the zinc becomes consumed, or the depolarizing material is exhausted, or when the internal resistance increases to a high value, which may be due to the consumption of the electrolyte or to the evaporation or leaking of the liquid This last may be caused by the seal being broken, or the zinc, constituting at once the outer electrode and the containing vessel, becoming perforated. It appears to be a common practice among manufacturers to choose the least factor in determining the life of the cell. In other words, the materials are so proportioned that the zinc gives out first by becoming perforated.

Although the six-inch cell is the most common size manufactured, various other sizes are made, these being adapted to different kinds of service. While it is recognized that the manufacture of a dry cell larger than the standard size and having all of its properties is an easy matter, it has not been demonstrated until recently that a very small cell can be made, comparable in capacity per unit weight and durability to the larger sizes. During the last few years much attention has been given to the manufacture of a small dry cell, and marked progress has been made, as shown by the exhibits. Cells having dimensions of approximately three inches in length by seven-eighths inch in diameter are used for lighting the miniature lamps which are most extensively employed as novelties, although devices of a more practical nature have thus been made possible. The pocket flash lamp furnishes a market for the greater number of these small cells, and the output of the various factories along this line has reached a really amazing figure. These cells have an electromotive force of about 1.4 volts, and the normal amount of current which they deliver on intermittent service is about 0.2 of an ampere. The makers of these cells state that their construction has been made possible by the use of materials of the highest degree of purity obtainable.

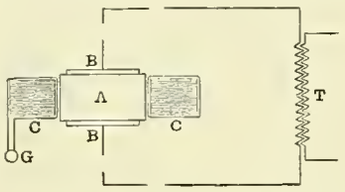
German Electrical Strike Settled.

A Berlin dispatch of October 14th says that the strike of the electrical workers is ended. At a conference on that day the delegates of the workingmen voted to accept the associated companies' original offer of five per cent. increase in wages. The result is a decided victory for the employers, as the men asked for a 15 per cent. advance. The number of men who struck is said to have been 40,000.

Magnetic Effect of Electric Displacement.

That a moving electric charge has the power to exert magnetic effect has been proved by the work of Pender and Crémien. Following up this line, J. B. Whitehead has shown the existence of a magnetic effect due to displacement currents in a dielectric. The method by which this principle is shown, as described in the London Electrician, is as follows:

If a portion of the dielectric be subjected to an alternating electric intensity, alternating displacement currents will be set up in the dielectric. If, now, the dielectric be properly surrounded by a magnetic circuit, alternating magnetic induction will be set up therein, and if this circuit be wound with a number of turns of wire an alternating electromotive force will be induced therein, and this electromotive force may set up a current. The value of the current may be calculated and measured. As constructed, the dielectric was a cylinder of paraffin. The electromotive force was applied to electrodes consisting of circular brass



MAGNETIC EFFECT OF ELECTRIC DISPLACEMENT.

plates on the end faces of a cylinder. Concentric with the cylinder and surrounding it was a laminated magnetic circuit consisting of soft-iron disks; the iron ring thus formed was wound with what may be called the secondary winding, in circuit with which the measuring instrument was connected. The magnetic circuit was composed of rings of annealed sheet armature iron weighing altogether 500 pounds. The apparatus is shown in the diagram, where (A) is the cylinder of dielectric, (BB) are the electrodes, (CC) the surrounding magnetic circuit and (T) the transformer. A Rubens vibration galvanometer reading to a fraction of a microampere was used as a measuring instrument. The calculated result was 3.16 microamperes; the observed value was 5.2 microamperes, this being well within the limits of experimental error.

Chicago City Council Not Opposed to Private Ownership.

By a test vote of 37 to 27 the Chicago City Council on October 16th decided against Mayor Dunne in his effort to force the local transportation committee of that body to "cease all negotiations contemplating the granting of a franchise to any of the present existing street-railway companies and all negotiations with said companies excepting those looking to the purchase of the properties of said companies."

The mayor submitted a brief message, in which he once more recited "the fact that the people of Chicago, by a majority vote of 2½ to 1 last April, declared that no private company should obtain a street-railway franchise from the city of Chicago and that this vote was a logical sequence to two previous votes declaring that the city of Chicago should undertake municipal ownership of the street railways." He therefore wanted the local transportation committee directed to act in accordance with the "expressed will of the people." An order to that effect was put to vote in the council, but was defeated by 37 to 27, as mentioned. The mayor is reported to have said, as naturally he might, that he did not consider any alderman who voted "no" on this division was a friend of municipal ownership. But it is to be noted that, although the mayor was defeated, it was only by a vote of 37 in a body whose full membership is 70. This is merely a slight majority, although it might be increased two or three by aldermen absent when the vote was taken. It is shown that the mayor has a sufficient number of followers in the council to sustain him in vetoing any street-railway ordinance, for it requires a two-thirds vote to pass an ordinance over the mayor's veto. Thus, in the present situation, if the mayor is not strong enought to cause his own municipal-ownership ideas to be accepted by the City Council, he is strong enough to prevent any plan but his from being adopted.

The council voted to refer any street-railway franchise ordinance securing its approval to the vote of the people and pledged itself not to pass any ordinance or ordinances that shall not receive a majority of the votes cast by the people upon the proposition.

The local transportation committee has now before it the ordinances submitted by both the Chicago City Railway Company and the Union Traction Company. Many changes and amendments will no doubt be made before they are reported to the council, and after that, with the mayor's veto power, it is problematical whether they will become laws. Half the aldermen go out of office next spring, and it is doubtful, in view of the present "deadlock" between mayor and council, whether anything decisive is done until after the election of next April. The mayor will hope that the people will return aldermen favorable to his ideas, while the majority in the council will look for an indorsement of their views.

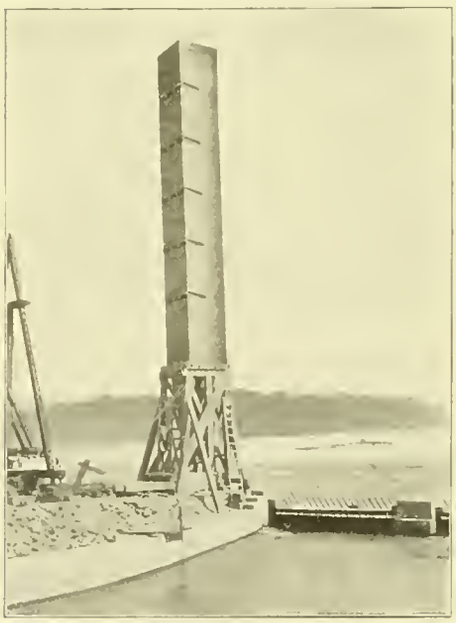
In the meantime the United States Supreme Court is expediting the pending suit of the city of Chicago against the traction companies to test the validity of the 99-year franchises. This case has been advanced on the docket to January 2, 1906, for which date a hearing is set.

Concrete Column to Be Tipped Over to Form a Dam at a Niagara Intake.

By Orrin E. Dunlap.

The commissioners of Victoria Park, on the Canadian side at Niagara, have adopted a strange method to assist the Niagara Falls Park and River Railway Company as well as the city of Niagara Falls, Ont., in securing a sufficient depth of water in their joint intake in Victoria Park. The Niagara Falls Park and River railway is the electric line that forms a part of the Niagara Gorge belt line, as it skirts the top of the cliff on the Canadian side at Niagara. Frequently in the past it has been troubled by a lack of water supply to operate the turbines in its power station, as it controls power rights in Victoria Park. The city of Niagara Falls, Ont., takes its water supply from this intake and there have been times when it has been forced to call upon the officials of Niagara Falls, N. Y., to supply it with water by means of a line of hose laid across the lower steel arch bridge. All these conditions have been quite annoying both to the railway company and the city, and complaint was made to the commissioners of Victoria Park that the water at the joint intake had been lowered by works of construction for power development.

It was under these circumstances that the park commissioners consulted Mr. Isham Randolph, consulting engineer of the Chicago Drainage Canal, who has on several occasions acted as consulting engineer for the commissioners. Following the advice of Mr. Randolph the park commissioners



CONCRETE COLUMN TO BE TIPPED OVER TO FORM A DAM AT A NIAGARA INTAKE.

have erected a concrete column 50 feet high and seven feet four inches square on top of a trestle that stands 20 feet above the ground level at the waterworks intake. This giant column it is proposed to tip over into the river to act as a dam, designed to raise the water level at the intake considerably.

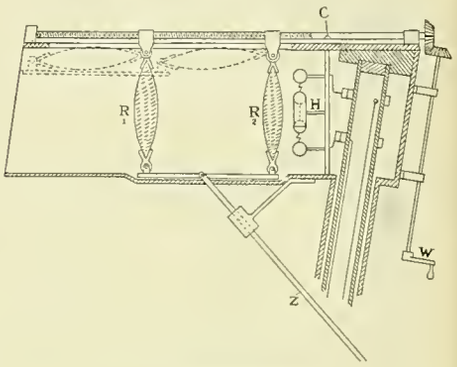
The concrete of which the column was made was mixed of one part cement, three parts sand and five parts stone. Its approximate weight is 200 tons, and every eight feet or so there is inserted a wooden wedge that has a width of a foot at the outside and which tapers to about six inches near the center. The object of these wedges is to break the column into six parts as it falls. Running through the center of the column there is a big chain that weighs about 800 pounds, and this will hold the six pieces in which the column is expected to break together. When prostrate the column will be about 20 inches above the ground level, and for this reason an opening will be left between the end of the dam and the edge of the river in order that any ice which may be floated down stream in front of the intake may be carried away.

The column will be left standing, as shown in the illustration, for about a month to dry out, and when thoroughly dry it will be tipped by means of jacks. The scene of the work is hardly 600 feet back from the brink of the Horseshoe Fall.

The Telemobilescope.

A recent German invention for locating ships at sea during a fog or in the night is reported by Mr. Bardel, United States consul at Bamburg. The apparatus merits the attention of seafarers and is said to have gained the special attention of German maritime circles.

The device, which is shown in the accompanying illustration, is called the telemobilescope. It embodies a peculiar adaptation of space telegraphy, and is used to enable the pilot of a ship to discover the proximity of another vessel, even if the pilot



THE TELEMOBILESCOPE.

of the latter vessel neglects to give signals by which his presence may be known. The apparatus works automatically, and after it is once adjusted nothing has to be done until a ship is discovered, when, after a simple mechanical action, the nearness of the other ship may be determined. The principle upon which it is based is that electric waves sent through the ether are reflected by a metallic body in a manner similar to sound waves.

In the diagram the axle of the apparatus is shown in its normal vertical position, and in that position it remains regardless of the position of the ship. Around this axle, moved by mechanical means, swings a hollow cylindrical body slanting slightly toward the water, and thus continually searching the surface of the ocean.

Within the cylinder is a wave inductor (H) which is in operation continuously. In order to make the waves travel continuously and in a certain direction the lenses (R_1) and (R_2) are used. Unfortunately, a description of the manner of operation of these lenses and their construction is lacking.

The "ray" of waves, something analogous to that of a searchlight, is therefore constantly playing upon the surface of the water. If the waves strike a ship (all ships have metal parts of some description) a reflex action will bring them back to the point from which they started, at which point is located a receiver not shown in the diagram. A metal plate between the receiver and transmitter in the tube prevents the transmitter from affecting the receiver directly. To discover the exact distance of the ship the lenses are turned at varying angles by the handles (W) and (Z) so as to get the strongest reflection, which the indicator will then show in terms of distance.

Municipal Ownership in New York City Campaign.

William Randolph Hearst was nominated as a candidate for the mayoralty of New York city by the Municipal Ownership convention on October 12th. Mr. Hearst appears to have a considerable following and is of course pledged to the municipal ownership and operation of public utilities. William M. Ivins, the Republican candidate, has also made an unequivocal declaration in favor of the principle of municipal ownership, saying that every franchise that has lapsed should be at once acquired by the city. With regard to the Democratic candidate, Col. G. B. McClellan, who has been renominated by the Tammany organization, it is clear from statements emanating from Tammany Hall that he also stands in some degree for municipal ownership if not also for municipal operation. As a kind of ante-election bid the present Tammany administration asked last week for an appropriation of $50,000 for the purpose of fighting the pending suits brought by the local lighting companies against the city to recover a sum exceeding $8,000,000 for bills outstanding since 1903.

Electric Power Development at Medina, N. Y.

Through the village of Medina, N. Y., flows a stream called Oak Orchard Creek, which proceeds northward until it reaches Lake Ontario. Along the course of this stream are a number of manufacturing establishments and mills which require a considerable amount of power for their operation. Oak Orchard Creek has sufficient fall and a volume to furnish a large portion of this power, and for its utilization the A. L. Swett Electric Light and Power Company has built a series of storage dams and power houses.

In the early days of Medina a large flouring mill was built at Medina Falls, which was finally abandoned and eventually burned down. Albert L. Swett, who is now the president of the power development company, at that time had a contract to furnish the city with electricity and determined to build a waterpower plant at the falls. This was done and the plant, which is now known as station No. 1, supplies light and power for the citizens of Medina. But his plans did not end here. He bought up the property contiguous to the stream below the falls and upon the formation of the present company built a large dam about one mile north of the town to utilize the fall in the rapids below the falls. Here is located station No. 2.

The dam is built at a point where the banks of the stream are 75 feet high and only 600 feet apart. The main dam is built across this span and a dike extends about 1,600 feet farther to the westward, making the total length 2,200 feet. The dam across the main channel of the stream is built of earth and concrete. It is over 600 feet long, 300 feet wide at the bottom, 60 feet high and 30 feet wide at the top. A concrete core passes through the center of the dam at right angles to the river course. This core is built on hard foundations 10 feet below the river bed. It is six feet thick at the bottom and two feet thick at the top. Its object is to prevent any seepage of water through the dirt of the dam. No water flows over the dam or dike. At the westward is a spillway constructed of cut stone and concrete, over which the waste water flows. Below this spillway a channel with a rapid fall carries the water back to the main stream many hundred feet below.

To control the water during the construction of the dam and for the purpose of emptying the reservoir whenever it shall be necessary from the up-stream side of the dam a concrete culvert 10 feet wide and six feet high was built. This culvert enters a gate-well six feet by 12 feet in the middle of the west end of the dam. This gate-well extends upward for a distance of 60 feet. From the end of the culvert two 48-inch cast-iron pipes carry the water to the raceway below. Connected to these pipes in the gate-well are two heavy iron sluice gates, operated from the top of the gate-well. From the west end of the dam on the up-stream side a semi-circular canal 30 feet deep conducts the water to a concrete bulkhead. In this bulkhead are imbedded three iron penstocks 60 inches in diameter. The water which enters these penstocks is controlled by three 66-inch iron sluice gates. From the bulkhead the water is conveyed by the penstocks to the turbines in the power house, a distance of 100 feet. By means of this dam and dike a great reservoir of water is created, the upper part of which extends to the Medina Falls.

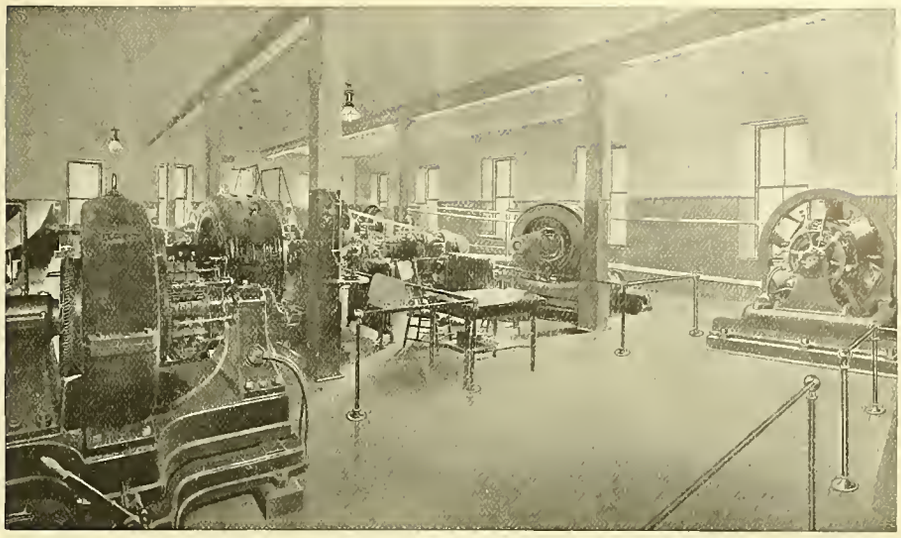


FIG. 1. INTERIOR OF STATION NO. 1, LOCATED AT MEDINA FALLS, N. Y.

The upper power house, or station No. 1, is a two-story stone building, 45 by 100 feet. It contains two 300-horsepower turbines, which are operated under a head of 33 feet. These turbines are connected to a drive shaft by rope transmission. From this drive shaft the generators are operated. These generators were constructed by the General Electric Company. Connected to the drive shaft, for use in case of emergency, it a 250-horsepower Corliss engine. Above the generator room is a machine shop for general repair work, the office and storeroom. Fig. 1 is an interior view of station No. 1, showing the generators but not the steam auxiliary apparatus.

FIG. 2. VIEW OF STATION NO. 2 AND PORTION OF RESERVOIR.

The lower power house, or station No. 2, receives its water from the new reservoir described above. This station is a stone structure, 40 by 86 feet, and is shown in Fig. 2. It has concrete foundations, concrete floor and iron roof. In this power house there are three General Electric units of 800 horsepower each. Each unit is directly connected by shaft drive to a McCormick turbine waterwheel. These turbines operate under a head of 55 feet. The units are shown in the interior view, Fig. 3. In this power house is a 10-ton traveling crane, to be used for handling heavy machinery.

In addition to these two buildings a sub-station located in the business section of the town is so equipped that factories can be supplied with direct or alternating current. In it is a motor-generator set of 300-horsepower capacity.

The whole system of power plants, including water area and manufacturing sites, covers a total of 200 acres. The combined output of the power houses is 3,000 horsepower, and the total head of water used is 88 feet. In the construction of the new plant just completed W. A. Brackenridge of Niagara Falls was consulting engineer. All the machinery in the various plants was installed under the supervision of A. J. Howard, who has been connected with the company since its organization as electrical engineer and general manager.

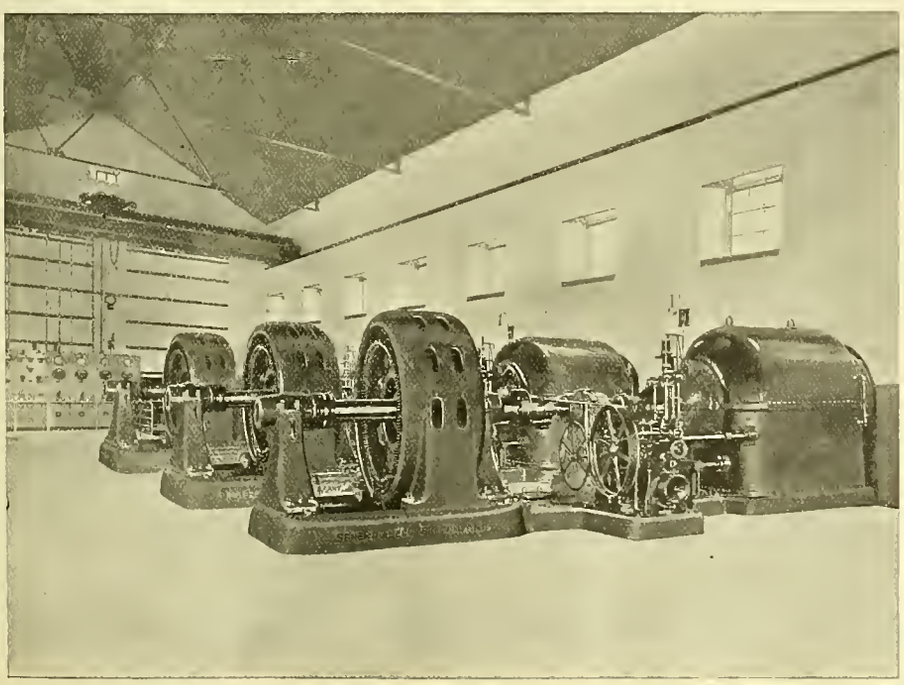


FIG. 3. INTERIOR OF STATION NO. 2, SHOWING HYDRAULIC TURBINES AND GENERATORS.

Proposed Merger of Electric Roads in Indiana and Ohio.

Hugh J. McGowan, general manager of the Indianapolis Street Railway Company, has returned from the East and announces that the long-talked-of deal in which the leading electric lines of Indiana and Ohio are to be merged and operated as two big co-operating concerns is now an assured fact. Just when the change in the management of these lines will take place Mr. McGowan declines to say, except that the time is not far distant. It is estimated that $25,000,000 will be involved in the Indiana deal. Mr. McGowan, with Randall Morgan, Thomas Dolan and Irvin & Co. will be at the head of the Indiana syndicate. In Ohio Mr. Dolan, Mr. Morgan, Irvin & Co. and W. Kesley Schoepf of Cincinnati will have charge of the merger. No definite announcement is made as to what roads in the state will be taken in. It is known, however, that the Martinsville line, the Indianapolis and Northwestern, the Indianapolis and Eastern, the Indianapolis and Western, the Richmond Street and Interurban, and the Plainfield line will be among the roads included in the big merger. The Indiana company will have its headquarters in the Indianapolis Traction Terminal Building. Each merger will be managed separately.

The Breese (Ill.) Water and Light Company has decided not to attempt to get its new lighting plant in operation before Christmas. All of the bids received on October 9th have therefore been rejected, and new proposals are invited for 10 a. m. Monday, October 30th. Victor J. Klutho is architect, and William H. Bryan is consulting engineer. Both are of St. Louis.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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DATES AHEAD.

Ohio Society of Mechanical, Electrical and Steam Engineers (annual meeting), Canton, Ohio, November 17th and 18th.

Automobile Club of America (annual exhibition), Sixty-ninth Regiment Armory, New York City, January 13th to 20th.

Chicago electrical exhibition (first annual exhibition of Electrical Trades Exposition Company), Coliseum, Chicago, January 15th to 27th.

ELECTRICAL expositions are quite the fashion. One is now in progress at Olympia in London. Another is scheduled for December at the Madison Square Garden, New York, and a third is to be held at the Coliseum in Chicago during next January. These three shows are quite distinct in management, but, coming so close together, in three widely separated centers, they are significant of great popular interest in electrical machinery and electrical appliances and novelties. A wider diffusion of knowledge relating to electricity and electrical apparatus can only result in good alike to electrical manufacturers and dealers, central-station operators and the general public. Therefore, these expositions, properly managed, deserve encouragement. We hope that the New York and Chicago attractions will be at least as successful as that in London appears to be.

FISHERMEN—that is, professional fishermen—are urged by one of the marine journals not only to use steam or otherwise mechanically propelled boats, but also to provide themselves with space-telegraph outfits. We are told that "The fisherman (excepting offshore fishermen) who has not a power-propelled boat is literally out of the race in his important calling. This class of hardy toilers no longer wait for a favorable breeze to market the catch, but when a fair catch is under the hatches, away they go to the nearest city, town or resort, and dispose of it to the best advantage. Fishermen only need wireless telegraphy now to make their equipment perfect. With that apparatus on board any enterprising gatherer of deep-sea food might ascertain which market to head for that would be the most profitable as to price, in consequence of a scarcity of the special kind of fish he had to dispose of." Of course the wireless apparatus would be of no use without someone to operate it, but possibly this practical objection might be met on the larger boats. The wireless telephone now, if it were only to be had with a practicable radius of 200 miles, would just fit the fisherman's case!

BUILDING PERMITS should be carefully watched by the central-station companies. Nearly all cities of considerable size have building departments, where information about projected new buildings of all kinds can be obtained before their erection. It should be the business of representatives of the electric-light company to wait on the owners and architects of these new buildings and convince them, if they need convincing, of the very great advantage of wiring the structures for electric current during the process of construction. Even if electricity is not to be used at first (although probably it should be), the building should be wired just the same, for it is altogether likely, in an edifice of any importance—house, apartment building, office building, warehouse, factory, church, or what not—that the "juice" will be required sooner or later. When the time comes the wiring will be already in and at a cost very much less than would be the case if it were necessary to put it in after the building was erected. It will also be easier to get the current-supply business if the wiring is in. If the central station does the wiring in the new building it should be done on very reasonable terms, for the main idea should be to get that particular building on the mains of the company as soon as possible after its erection.

GOVERNMENT ownership of railroads, like municipal ownership of public utilities, is held up as a panacea by many who profess to know that it is the only way in which the general public can hope to obtain its rights in the matter of transportation. Advocates of government ownership, however, cannot derive much satisfaction in pointing out the success of this scheme abroad, for it has long ago, with a very few exceptions, proved its inefficiency in all departments on the foreign roads. Switzerland presents a striking example of this fact. During 1903 and 1904 the Swiss roads were under the complete control of the state, and the most confirmed advocate of public ownership cannot contend that the result was successful; in fact the outcome was in no way comparable with the golden age that was predicted. One of the most serious phases of the government ownership was the reflex action which it exerted on the national credit, and the Swiss three and 3½-per cent. bonds, which had long been above par, immediately fell in value. Where patrons had been promised lower rates the same tariffs prevailed as before; there was no improvement over old conditions, and delays and car blockades were more frequent than before. In fact, the Swiss government was itself forced to admit, during the progress of the experiment, that the "irregularities of the train service have constantly increased and during the past summer the conditions were such as to be intolerable."

So much for the experience of Switzerland. Corporation ownership of railroads is open to serious abuses, certainly, but for the government to assume such a tremendous responsibility would mean, if the experience of other nations goes for anything, a condition of affairs on the whole no better and in many respects much worse than those which now obtain.

IS IT TRUE, as an "eminent physician"—one of those unnamed authorities so constantly and confidently cited in the daily newspapers—is reported to have said, that "electricity, beyond its use to heat a bit of platinum wire for cautery, is of no definite therapeutic value, except for the psychic or suggestive effect on the hysteric and neurasthenic"? We are disposed to believe that it is not true; that the arraignment is too sweeping, inclining to one extreme as the electro-medical quacks do to the other. Indeed, the "eminent physician"—he is quoted in the New York Times—becomes himself more conservative as he expands his views. He says that there is little definite knowledge on the subject. "High-tension currents do seem to exercise paralyzed muscles and to prevent wasting while waiting for interrupted nerve connections to be restored. There is also some evidence that such currents may help to restore the functional activity of nerves affected by neuritis, but this is very uncertain ground. The vast literature on the medical use of electricity is empiricism, almost pure." The doctor—always presuming that there is a real doctor back of these lucubrations—might have gone further and with much truth admitted that there is a great deal of empiricism in all—or nearly all—medical literature. Compared with, say, electrical engineering, medicine can hardly be called an exact science.

It is true that plain, every-day electrical men rather look askance at the electrotherapists, persuaded, no doubt, that these gentlemen know little about electricity and somewhat skeptical also of their ability in the healing art. But this attitude is one of indifference rather than hostility. The electrical men have "other fish to fry." The doctors who make a specialty of the use of electricity have a right to their theories, their experiments and their patients. The other doctors are experimenting too, perhaps with more powerful agents than electricity as the latter is used by physicians. Medical men lay great stress on fresh air and sunlight as therapeutic agents. Why not see if another manifestation of Nature—electricity—may not be helpful when applied to the human economy? Indeed, how do the doctors know that sunlight is not electricity? Are they sure that they can draw the line between light and electricity? And if it prove true that all matter and force can be resolved into electric charges, it would appear that the electrotherapists will have rather the better of the argument. It is evident that it is not wise to be too cock-sure about the futility of the use of electricity as a therapeutic agent.

About a month ago the American Electrotherapeutic Association held its fifteenth annual meeting in the Academy of Medicine, New York city. This is a respectable medical society and embraces within its membership able men of undoubted sincerity, such, for instance, as Dr. W. J. Herdman of the University of Michigan. The Western Electrician was sufficiently interested in this meeting to report it to the extent of two columns of space in its issue of September 30th. A perusal of this report will be likely to convince anyone that the members of that society, at any rate, are entitled to recognition for honesty of purpose, and should also be allowed a fair show to demonstrate their theories.

Michigan Electric Association.

The Michigan Electric Association, which held its initial meeting in Detroit a year ago, came back to its birthplace for its second annual meeting, which convened in the Griswold House on Tuesday, October 10th. The attendance was all that could be expected, and the assembly room was comfortably full most of the time. A feature of this year's gathering was the new members who have become interested since a year ago. The social features were attractive, and altogether the meeting was one of the most successful of its kind ever held in Detroit.

While the members of the association were busy at the sessions of the convention the ladies were entertained by the Detroit Edison Company. On one afternoon there was a trolley party and on the other an automobile ride around the city. On Tuesday evening the members and ladies enjoyed a banquet, while on Wednesday evening they were entertained by the Detroit Edison Company at a theater party. This was the last day of the convention proper. On Thursday the visitors were the guests of the Peninsular Electric Company, which took them by special car to Ann Arbor, where they were entertained by the faculty of the engineering department of the University of Michigan. The new engineering building, which is a credit to the state, was inspected, and short talks were given by Professors Cooley, Allen and Williams. The party was entertained en route at Ypsilanti, where the ladies and gentlemen were the guests of the Washtenaw Light and Power Company at dinner.

In opening the convention the usual annual address by the president was dispensed with by E. F. Phillips of Detroit, who asked Alex Dow of the Detroit Edison Company to say a few words of welcome, which he did in a very happy manner. Mr. Dow rallied Mr. Phillips for evading his duties as president so early in the history of the association as the second year and hoped it would not be taken as a precedent for future meetings. Mr. Dow said that while it was with pleasure that he welcomed the association again to Detroit, he felt it undesirable that electrical men from the other towns and cities should think that the association was a Detroit institution. Not that they were not infinitely welcome, for he would like to have them every year, but that it will be advantageous to meet in some of the other cities, where in some cases methods preferable to those of Detroit are used. The speaker brought out the fact that methods of getting and keeping business in a large city were not always applicable to smaller places, as he had himself learned by observation of an eastern plant in one of the large cities. The men who are growing up from small plants are the ones who make the most successful managers of today. The system of large concerns are not adapted to educating good all-round men, and they don't do it.

"I have been trying to find a man who would go as a superintendent of a plant in an eastern city. The conditions require that he shall be an all-round man for $3,000, which is what they expect to pay. These men are scarce, and it is to the moderately small cities we have to look for them, and we shall expect you in many things to teach us."

Papers were read and discussed as follows:

"Rates," by W. F. Kingan, Detroit.

"High Efficiency, High Candlepower Incandescent Lighting Units," by Francis W. Willcox of Harrison, N. J.

"Constant-speed Motors and Centrifugal Pumps—Their Advantage to Waterworks Plants," by P. D. Denman, Detroit.

"Uniform Accounting and Its Relation to Cost Determination," by S. G. Carleton, Sault Ste. Marie, Mich.

"Electric Heating Devices," by H. W. Hillman, Schenectady, N. Y.

"Lightning Arresters," by Robert S. Stewart, Detroit.

Mr. Hillman's paper on "Electric Heating Devices" was of much interest. The author presented to the association a list of heating devices, but laid special stress upon the six-pound residence flatiron as offering the easiest field for introduction with the best returns. Electric heating creates a demand for a day load that is bound to grow and be of good earning capacity. The operating expense of the electric flatiron varies from 60 cents to $1.25 a month, depending on the size of the family. On the central-station side of the subject the sale of the iron involves no expense, but the annual income is from $7 to $15. If the smallest station in Michigan has 300 residence customers it can increase its earnings $4,000 by the successful introduction of this iron. This is mostly profit, because the current would be used mostly on Tuesday morning. A large station, with 6,000 residence customers, could increase its annual income by $80,000.

Mr. Hillman advocated the peddling out of these irons from house to house, putting them in on trial. Station managers have testified that the plan is very effective. The limit is suggested only by the wired houses. That the flatiron is assuming importance as an electric device is proved by the fact that the General Electric Company for a period of three months requires 16,000 six-pound irons to fill its orders.

Attention was also called to electric cooking or heating with liquids, with dishes such as pint and quart water heaters, chafing dishes, baby milk warmers, etc. The ability of these heaters to warm milk with a spoonful of water in two or three minutes or to generate steam from this amount of water is interesting. Eggs may be boiled this way, requiring but four minutes from the start. These appliances make more competition for gas and will not be injured if used without water. Figures were introduced to show that with coal at $6.50 a ton and gas at $1.30 a thousand, electric cooking was about the same in cost with much greater convenience.

Mr. Hillman spoke in the way of illustration of his own house in Schenectady, built by and for himself, into which he put $250 for wiring—$150 on the heating service, $100 on the lighting. The kitchen chimney is done away with, saving about $125 on that item. For two years no other form of cooking or baking has been used in this house, and the average monthly bill for a family of five is $6.

The paper was discussed by Messrs. Chandler, Dow, Padfield, Jacobi and Marshall. The question of running small plants, now operated for night load only, for this business was brought up and discussed by Mr. Jacobi of the Mt. Clemens plant, who gave some interesting facts on running a day load. He thought every station should have one. He has introduced the irons.

Mr. Kingan's paper on "Rates" gave a simple and comprehensive method of arriving at meter rates. He advocated simplicity, equity and publicity as cardinal factors in this much-argued question. He said that a manufacturer using power 10 hours a day is to be preferred to an office building using light for two hours a day and that the demand charge for all customers using energy outside the peak should be at least one-half that asked during the peak period. He advocated the keeping of exact accounts of cost in detail as vital to the question of rates.

The meeting of the association concluded by the election of officers for the ensuing year, nominations having been made by a committee appointed for that purpose. The new officers are:

President—William Chandler, Sault Ste. Marie.

Vice-president—F. S. Hubbell, Milford.

Secretary and treasurer—A. C. Marshall, Port Huron.

The members were very hearty in their praise of Messrs. Dow and Phillips of the Detroit Edison and Peninsular lighting companies for their entertainment in the city. A unanimous vote of thanks was given.

Both the General Electric and the Westinghouse Electric and Manufacturing companies had exhibits of lamps and appliances in the Griswold House.

Kansas Gas, Water and Electric Association.

The eighth annual meeting of the Kansas Gas, Water, Electric Light and Street Railway Association was held at the Mercantile Club rooms in Kansas City, Kansas, on October 13th and 14th, and was probably the most interesting session the association has had. The additions to the membership are a good indication of the interest taken in the work by the Kansas people, there having been 24 new members elected in the different classes.

President R. C. Johnston gave a review of the work of the association in his opening address covering the last year, and was followed by Prof. B. F. Eyer of the Kansas State Agricultural College on "The Tantalum Lamp."

Other addresses were: "Producer Gas," by R. M. Sutton of Wichita, Kan.; "The High Efficiency of High Candlepower Lamps," by J. F. Schaefer of Kansas City, Mo.; "The Need of Sewage-disposal Plants in Kansas," by R. E. McDonnell of Kansas City, Mo.. "Co-operation in the Management of Gas, Water, Electric-light and Street-railway Companies," by C. R. Maunsell of Topeka, Kan.; "Public Utilities and Municipalities," by Prof. E. H. S. Bailey of the University of Kansas; "Purification," by E. S. Springer of Leavenworth, Kan.; "Relative Heat-producing Values of Natural Gas, Oil and Coal," by Prof. Erasmus Haworth of the University of Kansas.

In the last-mentioned address the professor gave some interesting figures as to heat units produced by the different fuels; but owing to the loss of heat units in the power plant his figures were about double those which the practical men present were able to get out of the fuel they used.

Following the last paper on Saturday the business of the association was rapidly closed up and the balance of the day was devoted to visiting the various plants of Kansas City, Kan., and Kansas City, Mo.

At this meeting the name of the association was changed to the Kansas Gas, Water and Electric Association. This covers all the branches and is a shorter name. There were also a number of new amendments made to the constitution and by-laws and they were ordered printed.

Lawrence, Kan., was the city selected for the next annual meeting, and while the time was not definitely set, it was understood that it would be between the 1st and 15th of October, according as the most favorable railroad rates could be secured.

The election of officers for the 1905-6 period resulted as follows:

President, W. E. Sweezy of Junction City, Kan.; first vice-president, S. W. Sterrett of Kansas City, Kan.; second vice-president, F. D. Aley of Wichita, Kan.; third vice-president, C. L. Brown of Abilene, Kan.; secretary and treasurer, James D. Nicholson, Newton, Kan. The new executive committee consists of E. S. Springer, W. R. Morrison and J. C. Nicholson.

The following-named new members were elected at this meeting: W. R. Clifford, Wyandotte Gas Company, Kansas City, Kan.; Matt Harington, Marysville Light and Power Company, Marysville, Kan.; C. C. Barnard, Lexington Gas and Electric Company, Lexington, Mo.; A. L. Newman, Arkansas City Gas and Electric Light Company, Arkansas City, Kan.; E. M. Stevens, Allis-Chalmers Company, Milwaukee, Wis.; William Goodwin, city waterworks, Kansas City, Kan.; Thomas F. Clohesy, Stanley-G. I. Company, St. Louis; Harvey V. Forest, Lyons Electric and Manufacturing Company, Lyons, Kan.; Kansas City Electric and Telephone Supply Company, Kansas City, Mo.; F. L. Williamson, Clay Center, Kan.; J. E. Taylor, Western Electric Company, Kansas City, Mo.; H. M. Reed, St. Louis, Mo.; J. S. Tretle, Westinghouse Electric and Manufacturing Company, Kansas City, Mo.; F. C. Banington, Columbia Electrical Company, St. Joseph, Mo.; Frederick W. Best, Utica, N. Y.; Louis Benast, Olds Gas Engine Works, Kansas City, Mo.; R. M. Sutton, United Electric Company, Wichita, Kan.; Bert L. Spendler, Lindsborg Water and Light Plant, Lindsborg, Kan.; A. C. Jackman & Co., Minneapolis, Kan.; Clyde Wilson, Manhattan Electric Light Company, Manhattan, Kan.; C. L. Brown, Abilene Electric Light Works, Abilene, Kan.

Electrical Section of the Western Society of Engineers.

The first fall meeting of the Electrical Section of the Western Society of Engineers was held in Chicago on October 13th, and Samuel G. McMeen acted as chairman. He announced that Peter Junkersfeld has been appointed to fill the vacancy in the executive committee made by the removal of W. G. Carlton to New York.

Mr. McMeen in a few words explained for the benefit of new members how it was that the present Electrical Section of the Western Society grew out of the old Chicago Electrical Association. He said that there had been no printed records made of the proceedings of that association. The only facts recorded concerning its proceedings were in the minutes of the meetings and the more or less complete accounts given in the technical press during the years of its existence. The Chicago Electrical Association has a warm place in the hearts of all its old members, and it is their desire as well as that of the majority of the members of the Electrical Section that an effort be made to collect all the records possible concerning it, which might upon the discretion of the society be eventually put in printed form. To perform this task he appointed a committee consisting of James R. Cravath (chairman), Albert Scheible and Kempster B. Miller.

The paper of the evening was entitled "Do We Need Better Illuminating Engineering?" by James R. Cravath. The paper was illustrated by lantern slides, and further reference is made to it elsewhere in this issue.

Indiana Electric Railway Association.

The first regular monthly meeting of the Indiana Electric Railway Association following the summer vacation was held in the Palm Room of the Claypool Hotel, Indianapolis, on October 12th. President C. L. Henry presided. "Claims and Their Adjustments" was the principal topic on the programme. The discussion was opened by the presentation of a paper by E. C. Carpenter of Anderson, Ind., claim adjuster for the Indiana Union Traction Company. Mr. Carpenter's paper was well received, and in the discussion that followed, Mr. Spillman of the Indianapolis and Northwestern Traction Company said that he thought it a good policy to pay damages actually sustained, even where there is no liability.

It was decided to establish a question box, and Mr. Kelsey of the Indiana Union Traction Company was appointed as its custodian. Questions sent to Mr. Kelsey will be assigned to certain members to answer. Questions, however, will be received up to the time of opening the box. The supply men present asked for the privilege of making an exhibit once a year, and the meeting in May was designated for the making of the desired exhibit.

The next meeting will be held at Rushville, Ind., the members being the guests of Mr. Henry, who desires an opportunity to show the members the power house and sub-station of the single-phase system of the Indianapolis and Cincinnati Traction Company.

The first stake for the preliminary survey of the extension of the Indianapolis, Columbus (Ind.) and Southern Traction Company's line from Columbus to Seymour was driven October 9th. This means traction connection between Indianapolis and Louisville, the road being but a connecting link. The company chiefly interested is the Louisville and Southern Indiana Traction Company, which already owns the street-car lines in Jeffersonville and New Albany, Ind., and has a terminal in Louisville.

Circuits for Automatic Block Signaling.

Circuits for automatic block signaling on steam and electric railways was one of the most important of the subjects discussed at the ninth annual meeting of the Railway Signal Association, which was held in the Cataract House at Niagara Falls, on October 10th-12th. This was one of the best conventions ever held by the association, as 215 members were registered, while the visitors numbered 50. The convention opened on the afternoon of Tuesday, October 10th, at which time Mayor Cutler delivered an address of welcome in which he made reference to the importance of a proper signal service in railroading. A resolution was adopted favoring the placing of the signal department of railroads on a level with the operating department, in which case the signal department would report to the general manager.

As new officers of the association the following-named gentlemen were elected: President, C. H. Morrison, signal engineer, Erie railroad, Jersy City, N. J.; vice-president, J. A. Peabody, signal engineer, Chicago and Northwestern railroad, Chicago, Ill.; secretary-treasurer, H. S. Balliet, engineer maintenance of way, Grand Central Depot, New York; new member of executive committee, J. C. Mock, electrical engineer, Detroit River Tunnel Company, Detroit, Mich.

On Wednesday afternoon the delegates paid a visit to the Ramapo Iron Works, Niagara Falls, and on Thursday afternoon they went to Rochester to inspect the plant of the General Railway Signal Company.

In relation to block signaling, the committee on "Circuits for Automatic Block Signals for Steam and Electric Roads," consisting of L. R. Clausen (chairman), E. A. Everett, C. H. Dryden, H. J. Hovey and C. A. Parker, recommended a number of rules as good practice, under average conditions, relative to the installation, arrangement, proportion and maintenance of track circuits. The rules which follow are taken from this report.

Relays.

The working parts of relays should be enclosed in transparent, dustproof casing.

A 3,000-volt alternating insulation test should be required between separate insulating parts, and between insulated parts and frame or magnet cover.

Four ohms is a good resistance to use for average conditions, and special conditions may require higher resistance, but it is not advisable to use lower resistance than four ohms.

The following specifications are acceptable:

6-100 ampere for raising armature.

4-100 ampere at release of armature.

11-100 ampere average current through relay in service.

Platinum to carbon front contacts.

Platinum to platinum back contacts.

Points should open one-sixteenth inch and armature one-sixteenth inch from poles open; one thirty-second inch from poles closed.

Armature pins, bone, one thirty-second inch long.

Armature stop not adjustable.

Cut sections represent good practice if the relay breaks the circuit and shunts rails of adjacent track circuit.

Relays should be sealed and maintainer not allowed to adjust.

Relay Shelter.

Wood or metal boxes on wood or iron posts are satisfactory.

Where convenient to do so, relay boxes may be supported on signal masts or signal bridges.

If wood boxes are used, one thickness of match pine, with double-hinged door, arranged for padlock is acceptable.

If iron boxes are used, single-hinged door, one-fourth inch thick, and arranged with dust gasket and for fastening the padlock, is satisfactory.

Iron boxes should be lined with wood, and wood board used for relays.

Iron boxes need not be connected to the ground.

All relays should be arranged in relay boxes, so that all binding posts are accessible without moving the relay.

Relays may be placed in mechanism cases, if mounted on wood or other insulation.

Batteries.

Two gravity cells in parallel are satisfactory for average conditions, but special conditions may require more cells to be used on a track section.

Four-pound round mercury-alloy zincs represent the best practice.

An ordinary flat-leaf copper is acceptable, but it is advisable to use a shape of copper that will allow bending of same to prevent pulling upward through the copper sulphate.

Six by eight-inch glass jar for track cells represents the standard practice.

Track batteries should receive attention every two weeks.

Zincs.

Zincs should have life of one month in track-battery service.

Storage cells in glass jars may be used, placed above ground, either in box or enlargement of signal post.

One storage cell on track circuit with one ohm in each leg of the circuit between cell and rail is recommended.

Bonding and Insulation.

The following specifications represent standard practice:

Two No. 8 Washburn & Mohn gauge E. B. B. galvanized-iron wires for bonding purposes, placed outside of splices and inside of rail.

Two No. 6 B. & S. soft copper wires in tunnels, located outside of splices and inside of rails.

Two No. 6 B. & S. soft copper wires inside of splices and outside of rails used through platforms, crossings, etc.

Wire should be 16 to 18 inches longer than splice, with expansion loops provided on one end.

Wire should be inside of all spikes and should not be stapled to tie, and bends should be made by hand.

Wires not to be twisted together.

Life of wires should be five to eight years under average conditions.

Frogs should be bonded in circuit in series with two wires, not twisted, which may be stapled to ties if required.

Ten-inch to 15-inch slack should be allowed.

Hand switches should be included in circuit and insulated rods used.

Switch points should be bonded into circuit, in shunt, two wires being used.

Sidings should be bonded to fouling point in shunt, two No. 8 B. & S. or No. 9 B. & S. copper wires being used for the shunt connection.

Sidings and main-line crossovers should be bonded into circuits, whether operated by pipe line from one end or not.

Block signs are not used on sidings.

Switch instruments should be used on all siding derails and at both ends of all crossovers.

Both ends of main-line crossovers should shunt both main-track circuits.

All switch instruments should be arranged to shunt track circuits, two wires being used for connection to each rail and four contacts of the switch instrument, if possible.

Interlocking switches and derails should be included in circuit, if expense and complications introduced are not too great, insulated rods being used for the purpose.

The channel-pin type of bond plug should be used.

Copper plating of bond plugs is satisfactory, but tin plating may prove better.

Track Insulation.

Type of joints to be used on main line and in yards of terminals to have mechanical and insulating qualities equal to the best standard makes now on the market.

The 24-inch and 26-inch joint with four bolts is found to be long enough for satisfactory service.

One common fiber end post is sufficient with some types; others require two.

On light-traffic sidings six-bolt wood joints are satisfactory.

Joints need not be oiled and will give two to three years' life under average conditions.

Fiber plates have life of one year under average conditions.

End posts six to nine months.

Electric crossings should be cut out of circuit, one joint in series being used for this purpose.

The effect of the high-potential circuit on electric-line rails may be reduced or nullified by one of the following methods or combinations of the same:

A. Bonding the rails of the electric line together.

B. Introducing more insulated joints in the steam line.

C. The locating of track battery at crossing.

D. Using 16-ohm relay at crossing and breaking block wire through same.

E. Grounding sections of track of electric line.

F. Grounding sections of track of steam line.

G. Shunting street-railway rails.

H. Introducing extra battery on track.

I. Removing ballast from rails of steam line.

J. Inspecting bond wires on steam line and keeping same in good condition.

K. Providing better path for high-potential current on electric line.

No special devices are used to insulate track circuits through platforms or crossings.

For insulating rails from steel bridges, wood blocks or fiber insulated bolts, with wood or fiber shims below the rails are used.

Nearly all lines report trouble with foreign current, and the various methods for taking care of the trouble are enumerated immediately above in connection with electric crossings.

Battery Shelter.

Both chutes and wells may be used for housing track battery.

Chutes should be round in shape, and made of cast-iron.

Nine inches by seven feet for two cells and nine inches by eight feet for three cells is satisfactory under ordinary conditions, with a maximum depth of frost of five feet.

Where four and six cells are used, two chutes placed side by side should be used.

Walls of chutes should be three-eighths inch to one-half inch thick.

Chutes should be placed nine inches above ground and frost covers used.

It is not practicable to use air-tight chutes with a view of reducing the evaporation.

The connections in chutes should be fastened in connectors to keep them from grounding on chutes.

Wood elevators provided with rope for raising are satisfactory.

Lamps in chutes, manure, mineral wool, or similar material placed in and around chutes are recommended for protection against extremely cold intervals.

It is recommended, however, that the chutes be placed below the frost line.

Insulated Wire Connections.

No. 8 B. & S. or No. 9 B. & S. rubber-covered copper wire should be used for track circuit; the same size being used for all purposes, except battery chutes.

Two wires in parallel should be used around switches or crossings and other siding connections for each side of circuit.

Thickness of wall of rubber insulation recommended as three thirty-seconds inch for No. 8 B. & S.; five sixty-fourths inch for Nos. 9, 10, 12 and 14 B. & S.

One layer of braid should be provided.

No. 12 B. & S. stranded wire should be used in chutes of approximately 18 strands.

Smaller wire for relay connection need not be used.

Wires may be placed either above or below surface of ground. Both are considered good practice.

Track Connections.

Twelve-inch slack is allowed for track connections.

Soldered joints at track connections should be poured.

Iron wire should be used for track connection to the rail, and connections should be made three feet from rail joint.

Trunking.

Forty per cent. extra space should be provided in trunking containing track wires.

Stakes for supporting trunking should be seven feet apart and trunking two to three inches clear, if placed above the ground.

Bevel joints should be used, placed directly over supports and carried on a supporting piece.

Three by three inches is a good-size trunking for track wiring.

Trunking should not be painted inside.

Trunking should be painted outside.

Trunking should not be nailed in slots, but through sides.

When crossing track, trunking should be placed one inch below rail, or 16 inches below rail, depending upon whether trunking is run above or below the ground.

White or yellow pine and redwood are satisfactory for this purpose.

Patent Litigation.

Two court decisions of importance were handed down during the month of September relative to the litigation on certain electrical patents. One of these is that of the Thomson-Houston Electric Company, complainant, against the Salem Electric Company, defendant. Judge W. M. Lanning of the United States Circuit Court for the District of New Jersey filed his decision in this case on September 19th. The complainant's patent (No. 413,293) was for a system of electrical distribution and was applied for by Elihu Thomson and Edwin Rice, Jr., on July 30, 1888, and granted to them October 22, 1889, being subsequently assigned to the complainant. The complainant alleged infringement of this patent.

The defense was that, at the time the patent was applied for, its essentials were old, and that the combination of the elements in the manner described in the patent involved no invention but was a mere non-patentable aggregation.

Judge Lanning decided that the defendant infringed in the first, third, fourth and sixth claims and entered a decree for the complainant, asking an accounting for profits.

The second decision was that of Judge Lowell of the United States Circuit Court for the District of Massachusetts, the case being a suit in equity brought by the Westinghouse Electric and Manufacturing Company, complainant, against the Stanley Instrument Company, defendant, for alleged infringement of the Tesla split-phase patents Nos. 511,559 and 511,560. The hearing was upon a motion for a preliminary injunction. In former proceedings the Circuit Court of Appeals held that the claims which the complainant said were infringed were valid. This decision Judge Lowell held to be binding, with the exception that there was some doubt arising concerning several phrases found therein.

The motion for preliminary injunction was granted.

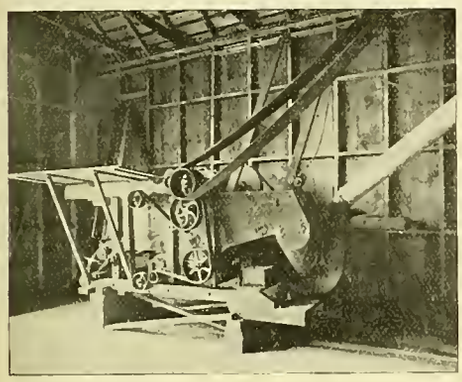
Illuminating Engineering.

"Illuminating Engineering," a term now generally used to designate that branch engineering, which has for its aim the efficient use of artificial light, formed the topic of discussion at the meeting of the Electrical Section of the Western Society of Engineers held in Chicago October 13th. The subject was introduced by James R. Cravath, who read a paper entitled "Do We Need Better Illuminating Engineering?"

Illuminated engineering, as pointed out in the paper, does not concern itself with production and distribution of light-producing energy but with the utilization of light after it is produced in order to secure the best illuminating effects both from an economical and hygienic viewpoint. Its work consists mainly of the selection of the proper illuminant, the proper location of the lighting units and their proper equipment as regards reflectors, shades and globes.

As in most other branches of engineering, the fundamental principles of this branch are simple and easily mastered; but the knowledge of ways and means of accomplishing practical results and the technical data on these ways and means can only be obtained and kept in shape for ready use, as in other engineering branches, by long-continued work and study and by some concentration of effort along special lines.

The speaker went on to give a number of examples of good and poor lighting of interiors, illustrated by the use of lantern slides. He also showed slides of that rough-and-ready method of testing illuminants, which consists in the arrangement of two compartments separated by a partition, the front sides of the compartments being removed so that the eye can take in simultaneously the effect of two different illuminants, one placed in one room and one in the other. In this way the lighting effects produced on the walls, ceiling and floors of a



MOTOR-DRIVEN THRESHING MACHINE.

room by different kinds of shades, reflectors and globes are easily compared.

As brought out by the paper and discussion, it is evident that there is room for much more careful application of illuminating engineering than is now usual, and that the amount of special technical knowledge that the illuminating engineer should have at his fingers' ends is such that anyone who successfully deals with illuminating problems must have something beyond a knowledge of general principles.

Harold Almert of Oak Park, discussing the paper from the viewpoint of a central-station man, said that the problem of illumination was demanding more and more of his attention. He found that by careful study of the conditions of a particular installation he could, by a proper arrangement of the lights, give the customer better satisfaction and at the same time sell as much current. He remembered one case in particular where a customer upon a flat-rate basis was not securing the results he desired from the few arcs scattered about his store. Mr. Almert investigated the problem himself and found that by putting the customer on a meter basis and by properly distributing the lights, putting in a few incandescents and pointing out to the customer how certain lights may be burned for certain periods only, the customer had nearly twice the lights at his disposal that he had before and they were so situated as to give the best results. On the other hand the central station did not lose, the bills being practically what they were before.

W. J. Marland of the Gould Storage Battery Company, who years ago was in the employment of the Chicago Edison Company and later with the New York Edison Company as a solicitor, said that there is no question that there is ample field for the illuminating engineer. Wealthy customers, of which there are many in the large cities, want their homes lighted efficiently with due regard to artistic effects, and they do not care what the number of kilowatts is so long as they can obtain the effects they desire. The man who can do this for them is bound to find a field for his talent.

As pointed out by Albert Scheible, people are painfully backward in adopting new methods and efficient devices for one of the most important necessities, namely, lighting. It is often the most common every-day things that are neglected. Thousands of dollars are expended in improving generating machinery, line construction, wiring, etc., and when finally the current is brought to the point of its actual application to the purpose for which it was manufactured so elaborately it is oftentimes practically thrown away. The illuminating engineer is certainly needed.

Others taking part in the discussion were Peter Junkersfeld, J. R. Cravath and S. G. McMeen.

Electricity on the Farm.

Farming machinery offers an opportunity for the utilization of electric power which is worthy of greater attention than it receives. In almost every case the farmer has been compelled to operate his machinery either by hand, animal power or by the steam or gasoline engine. Steam engines, because of the necessity of licensed attendance, have never been widely used for farming purposes. Where electric current is not available, the gasoline engine is practically the only source of power which can be used by the farmer with any degree of success. In districts where electric current can be obtained, however, it is to be noted that electric motors have largely superseded the gasoline engine. By a canvass of the manufacturing districts of towns and cities it will very often be found that the majority of the smaller users of machinery derive their power from electric motors supplied with current generated in a central power house.

For several reasons the electric motor is the ideal

A MOTOR HOUSE ON THE FARM.

for agricultural power purposes. In the first place, it is absolutely reliable. Owing to its mechanical simplicity, there is nothing to get out of order. Further, it may be operated intermittently, with no costs when not in use. Finally, the first cost is low and operating expense reasonable. The installation of a motor should not increase the fire risk; and, properly installed, it may be placed in any convenient farm building without danger. Sometimes the motor is set up in a separate small building, but this is not necessary, as it occupies very little floor space, and may be readily mounted on wall or ceiling in any convenient place. There is a line of motors on the market made by the General Electric Company which possess this desirable feature. Motors of this type are slow-speed, and may be obtained from one-fourth horsepower to 20 horsepower. Being compact, light and well protected, they are particularly adapted for agricultural power work.

Motors of this description are used for cutting and grinding feed, separating cream, shelling corn, sawing wood, and other uses which readily suggest themselves. Indeed, the progressive farmer will find many things which may be performed advantageously by an electric motor. Not only are they suited to stationary work, but, as the motors are easily moved from place to place, they may be used for driving threshing machines and other agricultural appliances which it may be desirable to operate at a distance from the barn. An electric motor not only makes the agriculturist's work easier, but it costs him less. If current be available, he cannot afford to operate his machinery in any other way.

Experience of Wyandotte, Mich., with Municipal Ownership.

The town of Wyandotte, Mich., one of Detroit's suburbs talks of modernizing or doing away entirely with its electric-lighting plant. It was built about 12 years ago and has been the subject of much dispute and considerable hard feeling among its citizens, resulting in several law suits. It is estimated that the plant has cost the town $100,000. For the first time in its history it is almost self-supporting. The council has appropriated but $2,000 this year for its maintenance, or $25 per street light. A point has now been reached where new equipment must be purchased or the plant abandoned. It is stated that the Detroit Edison Company or the Pennsylvania Salt Company can furnish light for street and house lighting at a cost less than Wyandotte can produce it.

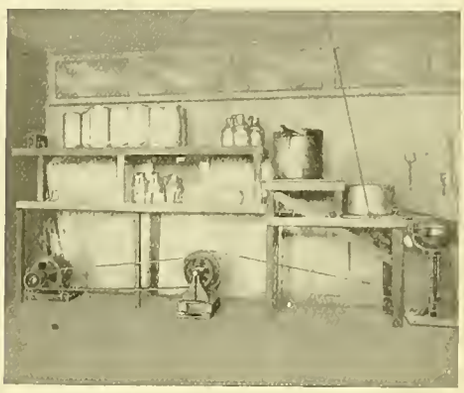
Annual Meeting of Boston Edison Company.

The annual meeting of the Edison Electric Illuminating Company of Boston was held on October 10th. The old directors were re-elected and were authorized to sell the property of the company in Milton, bought of the Milton Light and Power Company, and also authorized the borrowing of money and securing payment of the same by note and mortgage of the company's real estate. The annual report shows this income account, which is compared with previous years:

Year ended June 30:	1905.	1904.	1903.
Gross earnings	$3,346,027	$3,125,517	$2,667,809
Expenses	2,143,107	2,009,691	1,683,085
Net	$1,202,920	$1,115,826	$ 984,724
Other income	33,286	37,396	32,502
Total net	$1,236,206	$1,153,222	$1,017,226
Charges	94,021	102,408	151,303
Balance	$1,142,185	$1,050,814	$ 865,923
Dividends	1,070,770	973,405	804,668
Surplus	$ 71,415	$ 77,409	$ 61,255

Included in expenses this year are taxes amounting to $366,450, against $312,089 last year. Lamps and motors connected as of date June 30th follow:

	1905.	1904.	1903.
Incandescent lamps	708,384	627,441	493,402
Arc lamps	10,102	9,358	8,196
Motors, horsepower	26,416	24,150	20,801



ELECTRICALLY DRIVEN MILK SEPARATOR.

Of the increase shown for the fiscal year just closed 23,434 incandescent lamps, 251 arc lamps and 249 horsepower of motors were added in the purchase of the Woburn Light, Heat and Power Company. The remainder, viz., 57,509 incandescent lamps, 493 arc lamps and 2,017 horsepower of motors is the increase in new business for the year.

The capital stock on June 30, 1905, was $11,488,100, and $1,486,000 worth of mortgage bonds was outstanding. The installation is valued at $17,545,113; with total assets of over $20,000,000. Notes and accounts receivable were $1,856,075; notes and accounts payable, $1,012,096.

President Charles L. Edgar says: "The new turbine station has been in successful operation since early last fall, the installation of two 5,000-kilowatt units having been completed at that time. Another unit of the same size has recently been ordered, and will be installed during the summer of 1906. The sub-stations at 40 Summer Street and 56 Chatham Street have been completed and a new sub-station has been contracted for in the basement of the Pavilion Building, corner of Beacon and Tremont streets.

"The old generating station at Framingham has been discontinued and the property is for sale. The steam stations of Natick and Somerville have been turned into sub-stations, the steam apparatus having been retained as a reserve. The steam stations located at Head Place and Hawkins Street have been turned into sub-stations and the apparatus disposed of.

"Just before the close of the fiscal year, property numbered 33 to 39 Boylston Street was purchased, and as soon as possession can be obtained it is proposed to erect a modern 10-story office building upon the site for the use of the company.

"During the year preliminary steps have been taken by the city of Boston, which, if carried to their conclusion, will enable the city to install a municipal electric-light and gas plant, and your company has taken such steps as have been deemed necessary to protect its rights in the matter."

The Single-phase Railway System.[1]

By Charles F. Scott.

It is the purpose of this paper to present some of the salient features of the single-phase railway system and the results of the work which has been accomplished in the development of apparatus to meet the increasing demands in electric traction. The single-phase system accomplishes the same results in car movement that may be obtained by direct-current equipments, but in many cases with less first cost, less operating expense, increased flexibility and greater simplicity.

The motor is the feature which has received particular interest and comment, for it has been conceded that if a single-phase motor be available the other elements would follow as a matter of course. No one has questioned the adaptability of control apparatus, transformers and high-tension line construction to the requirements of the single-phase railway system. This simply involves the application of well-known apparatus and methods to the particular requirements of railway operation. But a perfected motor does not mark the completion of development work. Control apparatus for handling alternating current must be devised and constructed. It must be suitable for hand control for small cars and it must be adapted for the multiple-unit operation of heavier equipments. Still other forms must be suitable for operation interchangeably on either direct or alternating current. Transformers, line switches and other auxiliaries must all be combined into a workable equipment. Forms of trolley and overhead construction must be developed suitable for the new conditions of current and voltage.

As a guide to determine the conditions under which the adoption of the single-phase system is advantageous it will be useful to review briefly some of its features which are particularly concerned in its installation and operation.

The Motor.—A motor which is protected from the trolley voltage and lightning disturbances by an intervening transformer winding, which has only 200 to 250 volts across its terminals, which may have its brushes grounded or short circuited without "flashing" or "bucking," and which may have full voltage thrown on its terminals without disaster to itself is essentially a safe motor. The armature has a bar winding on sizes of 30 horsepower and upward. The increased current required at low voltage necessitates brush capacity equivalent to that on a direct-current motor of twice the output.

The Control.—One usually thinks of the direct-current street-railway motor as a variable-speed motor. Yet it is, in a sense, fundamentally a one-speed motor, for with definite trolley voltage, weight of car and grade, the motor soon attains a definite speed, at which it continues to run until there is a change either in the voltage applied or in the load. If two motors be operated in series there is a second definite speed, which is about half of the speed when they are in parallel. Other speeds are obtained by lowering the voltage on the motor by means of resistance, but this is inefficient and is admissible only in starting.

Certain results follow. The speed of the car depends upon the trolley voltage. If the voltage be low, the speed is low. The efficient speeds are fixed by the trolley pressure and not by the motorman. The relation between speed on level and the speed on grade is fixed by the inherent characteristics of the motor. A given motor with definite gear ratio has its one definite speed, depending upon train resistance and electromotive force. There is no range of adjustment like the throttling of an engine without the introduction of the wasteful rheostat. In a series motor the current determines the torque and the electromotive force determines the speed. Hence, for speed control there must be voltage control. In the direct-current system efficient voltage control is not attainable, but with alternating current it is easily secured. The simplest method of variable voltage is by means of taps from the transformer winding. The low voltage required for starting is obtained from a low tap and the successively higher voltages for increasing speeds and secured from successively higher taps from the winding. As there is no rheostat, the motor may run efficiently from any tap, thereby giving the motorman a control over his car movement which is not possible with direct current. If there be a tap giving a voltage higher than that required for normal running, it is available for giving a higher speed for making up lost time, or for supplying normal voltage to the motor when the line pressure is low. The car can run at any time at the pressure needed.

The number of points required on the controller for smooth acceleration is much less with alternating than with direct current. The whole control system, in fact, is simply half a dozen taps from the transformer to the controller, by means of which any one of them may be connected to the motor. An intervening preventive coil enables the controller to pass from one point to the next without opening the circuit or short-circuiting the two taps. The controller may consist of a drum of ordinary form on the car platform or of unit switches placed under the car and operated by a master controller. The latter type is used in heavy equipments and also when several cars are to be operated in the multiple-unit system. An effective form of switch with magnetic blow-out has been developed for heavy currents. The switches are assembled in a compact group, thoroughly protected and easily accessible.

Trolley Voltage.—Twenty years ago the electric railways of the United States, as measured either in miles, in cars or in kilowatts, comprised less than one per cent. of what they do today. In t' is enormously rapid growth two features of the electric railway have remained unchanged, although other elements have been greatly modified. These two features are: First, the series motor; second, the use of direct current at approximately 500 volts. During this time the generating plant has changed from small belt-driven to large direct-connected units, and then from direct current to alternating current. High-tension transmission circuits with rotary-converter sub-stations have been common. Motors have increased in size and have been improved in design and in reliability and the multiple-unit system of control has been introduced for larger equipments. The trolley voltage, however, has been limited to approximately 500 volts on account of the limitations of the direct-current motor and the inability to transform direct current on the car from a high voltage to a low voltage. The general trend of electrical engineering has been toward alternating current at high voltage. Many can remember the time when the use of 1,000 or 2,000 volts was decried as impracticable or unsafe and when 5,000 or 10,000 volts was the limit to laboratory experiments. Progress has been made in design, in construction and in materials until voltages which not long since were impracticable are now operated with greater reliability and safety than were the lower pressures a few years ago. Safety is very largely a question of mechanical excellence. In railway motors and control apparatus, in the mechanical equipment of heavy and high-speed cars, in overhead construction and in power-house equipment, reliability is primarily dependent upon mechanical excellence.

The Sub-station.—To one familiar with an ordinary rotary-converter sub-station interest will center chiefly in the negative characteristics of the single-phase sub-station. There is no rotary converter—a most essential link in the old system, one which behaves remarkably well when all is favorable, but is inclined to be fussy and obstreperous when the conditions are not to its liking. There is no synchronizing, no sparking, no flashing, no dropping out of step. The transformers are not arranged in banks of two or three little ones, with polyphase switches and auxiliaries in primary and secondary, and the direct-current switchboard has disappeared entirely.

The difference in the effect of a short-circuit on direct current and on alternating current is well illustrated in the underground circuits in New York city. In an 11,000-volt cable system a fault in the cable causing a short-circuit is usually confined within the cable and merely burns out a few inches of the conductor before the circuit-breaker opens. On a low-tension system, however, the currents are very large and considerable lengths of the conductor may be melted before the current is interrupted. In an alternating-current system the normal current in a circuit delivering a given amount of power is less in proportion as the voltage is increased, and as the increase of current above normal is not as great on account of the self-induction of the circuits and apparatus, accidents are less liable to be destructive.

If the single-phase road is to be an extension of an existing road it may be desirable to run the single-phase cars over the tracks which have a direct-current trolley wire. While single-phase cars can be arranged to operate from a direct-current trolley wire, it handicaps in some measure the single-phase equipment. The addition of resistance to the car equipment and the extra switches and the like for enabling the change to be made in the current supply are obviously objectionable. It is best, therefore, to keep single-phase equipments free from operation on direct current if it be practicable to do so. When it is found necessary for them to operate from an existing direct-current trolley wire the motors are connected two in series for 500 volts, and if there be four motors the two pairs may be connected first in series and then in parallel as in ordinary series parallel control. The transformer is cut out and the control apparatus and motors operate in substantially the same way as those on an ordinary car.

The standard frequency for the single-phase motor is 25 cycles (3,000 alternations). Generators may be wound for single phase, or current may be taken from one phase of a two-phase or a three-phase generator. Current from the several phases of a polyphase generator may be used for operating different divisions of the railway.

If power is to be taken from a power house which generates a higher frequency it cannot be applied directly but must be changed to 25 cycles. This may be effected by a motor-generator set. A polyphase motor taking power equally from each phase of the high-frequency circuit may drive an alternator, either single-phase or polyphase for furnishing current to the single-phase railway. The converting outfit may be located in the main power house or in a sub-station as may be found most convenient.

The development of a new and more efficient method for accomplishing a given result often leads on and opens new fields which had not been commercially practicable before. Such is the case with the single-phase railway. The direct-current interurban railway has its limitations. If a region be sparsely settled the available traffic will not show a profit on the cost of circuits and rotary converter sub-stations. There is a material reduction in the investment and operating expense incident to the single-phase railway that will enable it to be built and operated with a profit in cases where the traffic would not support a rotary-converter system.

On the other hand, in heavy service the direct current has not made much headway, being handicapped by the heavy cost of sub-stations and of conductors. Heavy and relatively infrequent trains are the hardest loads for sub-stations. For example, if sub-stations be eight miles apart, each will supply eight miles of track. A train running 40 miles per hour will receive current from a given sub-station for 12 minutes. In order that a sub-station may be continuously supplying current to trains in one direction they must have a headway of 12 minutes. If they be an hour apart the current from each sub-station is used but one-fifth of the time. Trains in two directions will double the sub-station output, but as the peak load is considerable when two trains pass near a sub-station, the load factor is extremely low. Therefore as the aggregate capacity of the sub-stations must be large in proportion to the actual power taken by the cars, it follows that the sub-stations will involve a relatively large expense if they are equipped with expensive rotary converters and require constant attendance, whereas the cost will be relatively small if they require simply lowering transformers having an efficiency very much higher than that the rotary converter sub-station and not requiring attendance. The reduction in the sub-station is therefore of especial value when the service is infrequent. Moreover, the single-phase equipment by reducing the size of conductors frequently enables the sub-stations to be more widely separated. This possibility in the reduction in the number of sub-stations and in the aggregate capacity of sub-station equipment, as well as the elimination of rotary converters with their energy losses and their attendants makes practicable the operation of long-distance roads which could be operated by direct current only at an excessive cost.

The single-phase system therefore decreases the cost of installation and operation for the kind of interurban service which has been successfully developed by the direct current, and it extends the field of commercial operation to include, on the one hand, rural roads with relatively light traffic and on the other a heavy, infrequent, multiple-unit or locomotive service for passengers or for freight, approximating steam-railway conditions.

The extension to long distances will soon be shown in the carrying out of the contract which has been closed by the Spokane and Inland Railway Company for 150 miles of railway running south from Spokane, Wash. The equipment will consist of 15 motor passenger cars, each with four 100-horsepower motors, six motor freight cars, each with four 150-horsepower motors, and six 40-ton freight locomotives, which may be in pairs for heavy trains. The engineer of this road has been intimately connected with the installation and operation of the single-phase road at Indianapolis.

The most notable recent event in electric traction is the purchase of Westinghouse single-phase locomotives by the New York, New Haven and Hartford Railway Company. The passenger trains on this road, which enter Grand Central Station in New York, run over the tracks of the New York Central railroad for about 12 miles. As steam locomotives cannot enter the new terminal station and as the New York Central is equipping its track for direct current it is imperative that the New Haven trains be handled over 12 miles by direct-current power.

Discussion (in Abstract).

At the conclusion of the reading of his paper Mr. Scott said that the development has not been for the purpose of supplying the street-railway manager with a new device, but it has been a development to meet the needs of railway men. The direct current has reached its limitations. The single-phase system must, however, be developed in the course of a few months or a few years not only to equal but more than to equal the result of the development of the direct-current system during the last dozen years. A great deal of that development can be done by the designing engineers and the testing engineers in the factory and laboratory. But the service test is the final test, and a great many of the practical points as to control and the interworking of apparatus come from experience. This has been begun, but just as with the direct current after its 15 years, so the

1. Abstract of a paper read before the American Street and Interurban Railway Association at Philadelphia, September 28, 1905. Mr. Scott is consulting engineer for the Westinghouse Electric and Manufacturing Company.

alternating current after its 15 months has not reached perfection. The point has been reached, though, where it is felt that with the present knowledge of the apparatus and with the experience which has been secured, it can be presented now to the operating street-railway man as a perfectly feasible and practical system.

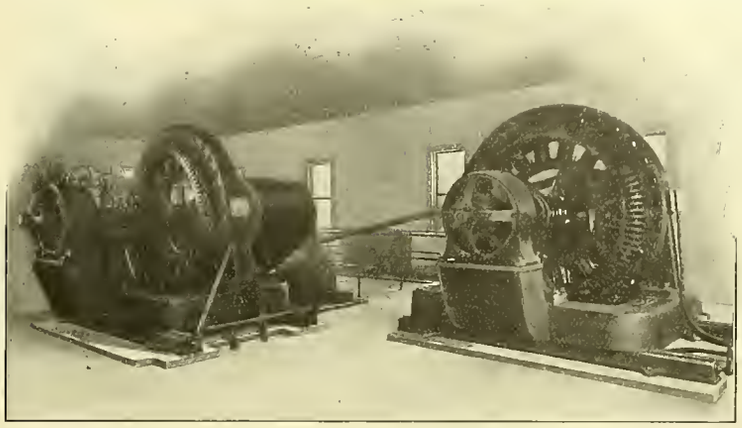
W. E. Goldsborough of New York said that to his mind the alternating current is destined to play a most important part in railroading. Presumably there will be no large electrification of steam railroads in the sense of miles of track extending across the country in which the single-phase system will not be used in some form. Regarding the specific characteristics of the apparatus under discussion, he for a long time has felt that the alternating-current system was coming to the front and that ultimately the single-phase system would take a place over all other systems. He did not believe any designer of electrical machinery today is satisfied in his own heart with the single-phase alternating-current motor. He said this in spite of the fact that he did not know of all the good things which the designers of this apparatus have in store. The fact that we can use a 220-volt motor with a larger commutator than that used in direct-current machines is an indication in itself that better things are to be hoped for.

When it comes to the question of maintenance of equipment Mr. Goldsborough thought the ground should be looked over carefully before throwing out direct-current equipment for alternating-current equipment. When a very large number of equipments are operated on a rather restricted mileage, one is confronted with a condition wherein maintenance is an important factor, and there is no question but that at this time it is much cheaper to maintain a direct-current system (meaning the maintenance of the motive-power equipment) than to maintain the alternating-current motive-power equipment. On the other hand, with a great deal of mileage and a relatively small number of units running over the mileage, then maintenance is a matter of secondary consideration. A long chance may be taken in the matter of maintenance, for the reason that the saving in investment is so large.

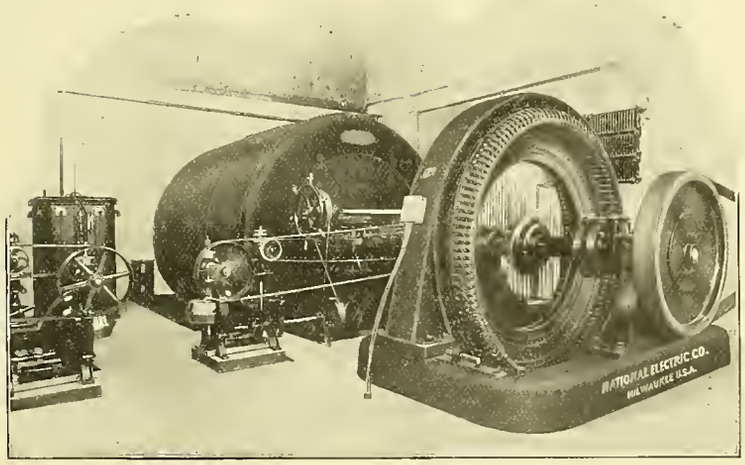
C. O. Mailloux of New York believed with Mr. Goldsborough in caution and moderation in using single-phase apparatus. He said that within the last month he had been called in consultation in regard to the equipment of a road and found that those who had undertaken to do the engineering for that company had received their inspiration from the manufacturers and had recommended an alternating-current system of generation and distribution with sub-stations. After looking over the case he advised sticking to direct current. He found that a director in the railroad company who was operating an electric-light plant in the city was in favor of the alternating-current system, though he himself was operating an Edison three-wire system. He had never understood the real inwardness of the situation until it was explained to the board of directors that in their particular case the electrical "center of gravity" of the system was within two miles of the station. That is, if you take the total car-miles for the heaviest day—and the heavier the day the more strongly the fact was shown—their center of distribution was an average distance of something like 1¾ miles, and over 75 per cent. of the car miles was within such limits.

He said the paper shows we have made a great deal of progress; that there are to-day two good systems, both of them very good, and sufficiently good for the great majority of these very cases, is interesting. In the particular case just alluded to he told the gentlemen that even granting the possibility that they may sometime or other want to go as far as 25 miles, it would still be better for them to generate direct current and transform what little portion of it they wanted in alternating current for the suburban lines. He made the suggestion which is practically made by Mr. Scott, namely, that they should run the lines in the city with the direct current. It would be cheaper to buy new equipment for the suburban lines, running on the direct current inside of the city limits. Then they could use the alternating current, single-phase, to operate the suburban lines.

D. G. Nicholl of Indianapolis said that the Indianapolis single-phase road began operating the first day of January of this year. On the first of April they ran within four miles of Indianapolis, all of the operation being on alternating current. They were handicapped in getting into the city of Indianapolis on account of two overhead bridges, which were so low that the cars could not pass under them. These were raised, and on the first of July they began operating into Indianapolis, the line being 36 miles in length, 32 of which was on alternating current and the remaining four miles on direct current into the city of Indianapolis. Up to the time they began operating into the city they had no trouble with the motor insulation. The worst trouble was the question of the transformation. This was overcome, but on operating the motors in the city of Indianapolis, defects developed in the motor windings. These were also overcome, and they are having no further trouble. They are operating the highest schedule that is maintained in the state of Indiana, collecting the current by means of a bow trolley as outlined. No trouble whatever is experienced with the bow trolley. He was not able to give any data as to the car mileage of the life of the shoe of the trolley, which is composed of wood plated with aluminum; but it would suffice to say that the cost of operation and of renewing the shoe is not more, and he considered it is less than would be the case with the ordinary trolley.



ALTERNATING-CURRENT GENERATORS IN SOMERSET (WIS.) PLANT.



HYDRO-ELECTRIC PLANT AT RIVERDALE, WIS.

Chicago City Railway to Use Edison Power.

The Chicago City Railway Company in pursuance of its scheme to use Chicago Edison power to take care of part of its load has nearly completed two new sub-stations, one located at Twentieth Street and Dearborn Street and the other near Sixty-third Street and Wentworth Avenue. The company has contracts for 7,000 horsepower from the lighting company and it is expected that the station at Twentieth Street will be in operation by November 1st. The other station will probably be completed inside of two months. The railway company will furnish its own rotaries. The additional power will be required partly for the new Indiana Avenue cars, which are equipped with heavy motors and heating apparatus that will require a large amount of current.

Power Transmission from Somerset and Riverdale, Wis.

The Western Gas and Investment Company, with headquarters in Chicago, owns and operates a number of electric-lighting and gas plants throughout the country. Some time ago it acquired the property of the Stillwater (Minn.) Gas and Electric Company. In conjunction therewith it also acquired waterpowers on the Apple River in Wisconsin, one at Somerset, Wis., approximately 12 miles from Stillwater; the second one at Riverdale, Wis., approximately 14 miles from Stillwater.

At Somerset the waterpower had been previously developed, and there was in operation an electric plant supplying current to a number of surrounding towns. The electric portion of this plant has been entirely remodeled and the company now has in operation two 250-kilowatt, 450-revolution, 2,300-volt, three-phase, 60-cycle, belted-type, alternating-current generators with direct-connected exciters.

At Riverdale the company has constructed a concrete dam with power house and has located therein two 250-kilowatt, 200-revolution, 2,300-volt, three-phase, 60-cycle generators directly coupled to waterwheels.

In each of the above stations are located three 200-kilowatt, oil-insulated, water-cooled transformers, which convert the generator voltage of 2,300 volts to 15,000 volts. The two stations, Riverdale and Somerset, which are located two and a half miles apart, are run in multiple with each other, and the combined output is transmitted to Stillwater, Minn., where it is reduced by means of three 400-kilowatt, oil-insulated, water-cooled transformers for use in commercial and city lighting, and also for furnishing a large amount of current for power purposes.

The generators and transformers in each of the stations were manufactured and installed by the National Electric Company of Milwaukee, and the waterwheels in the Riverdale station were furnished by S. Morgan Smith of York, Pa.

The plant has now been in successful operation for some time and is one of the best of its size in the Northwest. R. S. Feurtado, who is the engineer of the Western Gas and Investment Company, has given the design of this plant his entire attention, and its efficient operation is an evidence of his successful supervision.

Proposed "Tech" Merger Finally Dropped.

It was voted by the corporation of the Massachusetts Institute of Technology in Boston on October 11th to withdraw every proposal looking to a merger with Harvard University. This action was taken without contest, as the outcome of the recent decision of the Massachusetts Supreme Court that "Tech" cannot legally sell the land which it now occupies on Boylston Street. The vote was merely the formal recognition that this decision virtually nullified all that had previously been done toward a merger by the two corporations. If the project comes up again, it will have to be approached in an entirely new way. The vote also expressed appreciation of the courtesy and fairness shown in the consideration of the project by the Harvard corporation.

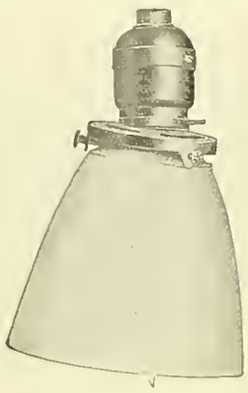
The alumni of the school have voted in the ratio of more than two to one against the proposed "plan of co-operation."

Electrolier Socket and Combined Socket and Shade-holder.

To be in keeping with the highly artistic appearance of electroliers as they are now made the accessories, such as key sockets, etc., should harmonize with the decorations of the electroliers. An electrolier key socket designed recently by the General Electric Company fulfills this requirement and is at the same time compact and has a finished appearance. One of the accompanying illustrations shows the appearance of this device. It has a neat metal key which is thoroughly insulated from all live parts. This key is removable, and an extension key may be used in its place.

The combined socket and shade-holder has a number of points of superiority over the socket with the ordinary detachable shade-holder. The shade-holder in the new device is permanently attached to the socket shell in such a way that it cannot slide or turn. This, together with the fact that three points of support for the shade are afforded, instead of two, as in the clamp shade-holder, eliminates any sagging of the shade. This comparison is shown in the accompanying illustrations.

Standard Socket Equipped with Socket Shell and Shade Holder.



Standard Socket with Ordinary Shade-Holder.

Electrolier Key Socket.

End view with Combined Socket Shell and Sbade Holder.

End view of Socket with Ordinary Holder.

ELECTROLIER SOCKET AND COMBINED SOCKET AND SHADE-HOLDER.

Annual Report of the Western Union Telegraph Company.

President R. C. Clowry presented his annual report to the stockholders of the Western Union Telegraph Company at the meeting on October 11th. The report covered the year ended June 30, 1905. From it these facts are taken:

Capital stock outstanding, $97,370,000.
Bonded debt, $28,504,000.
Gross revenues of the year, $29,033,635 (decrease of $215,755 from 1904).
Net revenue, $7,188,064 (decrease of $699,410 from 1904).
Surplus for year, $1,092,780.
Total surplus, $15,974,209.
Total assets, $150,236,577, including $4,011,726 in cash.
Miles of poles and cables, 200,224.
Miles of wire, 1,184,557.
Number of offices, 23,814.
Number of messages sent, 67,477,320.
Average tolls per message, 31.6 cents.
Average cost to company of message, 27.3 cents.

Col. Clowry says that the loss resulting from the discontinuance of race reports made a decrease of $215,755 in the total earnings. The substitution of dynamo or storage batteries for the old-style chemical main batteries was authorized at 13 important centers. At Cleveland, Ohio, arrangements were made with the company's landlords for enlarged and improved main-office accommodations in the same building. At St. Louis, Mo., a contract was made for the removal of the main office to a new modern building. At Indianapolis, Ind., the company has contracted to lease, reconstruct and remodel a building in conformity with its own requirements and move its main office thereto. Purchases have been completed of the properties Nos. 14, 16 and 18 Dey Street, New York, west of and adjoining the company's main building at the corner of Broadway and Dey Street. These properties are available for extension westwardly on Dey Street of the present main building when the necessities of the business require it.

Foreign Trade Opportunities.

The municipality of Madrid, Spain, contemplates the purchase of automobile sprinkling carts for street use.

The state of Maranhao, Brazil, invites proposals for exploiting the copper deposits near Grajahu, and for building railroads.

Large deposits of radio-active uranium have been discovered in the Escurial copper mines at Galapagar and Colmenarejo, Spain.

The "Direccion de Correos y Telegrafes" in Madrid, Spain, will receive bids for supplying 50 tons of galvanized iron wire and four tons of bronze wire for telegraphic use.

A project for utilizing the Liro-Scalcoggia and Drago waterfalls for the production of electric energy has been presented to the prefect of the province of Sondrio, Italy.

Suggested Improvements in Fire-alarm Telegraph Systems.[1]

By William Brophy.

The title of this paper might lead one to think that the author believed that great improvement is necessary, and can and should be made in the modern systems of fire-alarm telegraph. The author of this paper is not possessed of any such belief, for in his opinion there is nothing nearer perfect at the present time than the modern up-to-date fire-alarm telegraph system. The signal boxes, placed as they are on poles, buildings or any other convenient place, exposed to the elements, and the greatest extremes of temperature rarely fail to do the work assigned to them, and do it correctly. When "pulled" if the signal is not transmitted correctly, in 99 per cent. of the cases the failure is due to something other than the mechanism of the box.

While the apparatus which goes to make up the modern fire-alarm system has been brought up to such a high degree of perfection, little or no improvement has been made in the methods of constructing the circuits over which the electrical energy is transmitted to the various instruments, if we except the fact that wires are now placed underground and are operated with a fair degree of success. In the greater part of the fire-alarm systems of this country, bare uninsulated iron or copper wire is still used for the construction of the circuits, the same being supported on poles in the streets, fixtures on the house tops, and it is too often the case that they are attached to trees or any other convenient place. But few cities own the poles on which their fire-alarm circuits are strung, the result being that they cannot maintain that strict control over these circuits that they should, the nearest they come to it being the fact that they enforce their right to the top cross-arm on each pole, but in many cases this is not always done.

All the instruments on a fire-alarm circuit are adjusted for a given amount of electromotive force, and could the conductivity and resistance of the circuit remain constant, aside from the changes due to extremes of temperature, there would be no need of further adjustment of the instruments and scarcely a possibility of failure of any of the apparatus to give correct signals. But with the present method of overhead construction, wide variations in the electromotive force and resistance in the circuits must and does take place. The avenues for escape of the current to earth are so numerous that the utmost care cannot wholly prevent it from giving the instruments the go-by and with almost human instinct seeking any of the many paths that are open to it. These escapes can become so numerous as to reduce the electromotive force at the terminals of the instruments to such an extent that the power of the springs becomes stronger than that of the magnates, and of course the instruments cannot respond to the impulses that are sent out over the circuits by the box, repeater or transmitter. I refer now to the general leakage that must be looked for during long continued wet weather, which is much greater on circuits that are run through trees than those that are not. A "dead ground" of course should be looked up and removed at once, and with the style of overhead construction that prevails in all of the towns and cities in this country the opportunities for these to occur are always present, and as a result untiring and never-ceasing watchfulness is necessary in order to keep fire-alarm circuits "clear." Open circuits will occur from various causes, but more frequently during the cold winter months of our northern states.

In a majority of the cities of this country a portion at least of the fire-alarm circuits must remain overhead, even though in the densely populated and business portions they may be placed underground, while in many of the smaller cities and practically all the towns the entire circuits must, from motives of pure economy, remain overhead. Such being the case, why not make them as safe and reliable as possible?

All overhead circuits should be insulated with the best-known material and such insulation covered with a material that would protect the same from the action of the elements, abrasion and contact with any conducting material. The objection has been frequently made to me that with circuits insulated in this way "it would be very difficult to locate short-circuit breaks and other troubles." I can only say in reply that such statement does very little credit to their intelligence, for with the modern electrical measuring instruments it is as easy to locate such difficulties in an insulated wire that cannot be seen as it is in the ordinary bare wire, breaks, crosses and grounds in which are found by ocular demonstration, or to speak more plainly, by the sense of vision.

Owing to the fact that very few if any cities build their own conduits for wires, but require the private companies to furnish them the required number of ducts, they building only the subsidiary ducts to boxes, fire-department houses and other places, the underground cables of the fire-alarm systems are exposed to many kinds of accidents that they otherwise would not be. Public and private underground conduits have several different occupants, and the employes, or many of them, of the different companies do not use that care in handling the cables of others including those of the fire alarm as they do in handling their own, and for that reason they are all exposed to unnecessary and sometimes wanton injury at the hands of men bent on nothing but to reach their own cables, utterly regardless of what happens to those of others. Eliminate this outrageous abuse (and it can be done) and the wires of the fire-alarm system will do their share in making the system as near absolutely reliable as possible.

It may occasion some surprise in the minds of many to hear me make the statement regarding the utter unreliability of some of the underground cables that are manufactured and sold, but when I tell them of a case where wires for a fire-alarm system were placed in ducts, but not connected up at the time, but the attempt to do so was made a year later, when it was found that practically all the insulation properties had vanished, and the "stuff" finally pulled out and replaced by something better they should cease to wonder. When I tell them that in a very large city, owing to the condition of the underground cables of the fire-alarm system the tension of the springs of many of the relays have to be so slight that one or more rounds of the box are lost, owing to the fact that the tension of the spring is not sufficient to overcome the residual magnetism until such tension is slightly and carefully increased, prompt action on the part of the operator being necessary in order to get the signals correctly, if at all, you will begin to believe that all underground cables made, sold and used are not of the most reliable character.

It is the universal practice in this country to have but one operating room, from which radiate all the circuits comprising the fire-alarm system. This same rule applies to the smallest village system and to the central-office system of the largest city. Quite recently it has been asked of your secretary if it would not be well to discuss the advisability of a change in this practice at this meeting of the association. The secretary kindly requested me to prepare a short paper on the advisability of a departure from the present practice, and I very unwisely and thoughtlessly consented to do so, and right here it is proper for me to say that I believe it is desirable to have in some cases two or more operating rooms at widely separated points so interconnected that they will to all intents and purposes be practically one, and all that I have said up to this time was for the purpose of showing up the weaknesses of the present method of electrical distribution, the interruptions that are likely to occur to the service and the desirability of reducing the length of the circuits as much as possible. There is one more very important reason for duplicate or triplicate operating rooms, viz., say what they will, there is no such thing as a fireproof building, and I venture to say that there is not a fire-alarm operating room in this country that is located in what is called a fireproof building, and if fires occur therein the heart of the system is destroyed and ceases to pulsate, and the entire system is as "dead as a door nail," and will remain so until new apparatus can be procured and installed, to do which will consume months of valuable time, as such apparatus is not kept in stock like groceries and other creature comforts and necessities, both liquid and solid.

Assuming that it is possible to build a fireproof structure in which to place this apparatus, there are two other elements from which serious danger is to be apprehended, lightning and high-tension dynamo-electric currents, against which the best constructed building affords no protection. All overhead circuits are continually exposed to these dangerous elements, but where all or a considerable portion of the circuits are underground, lightning is not so apt to reach the operating room as it will in most cases reach the ground through the insulation of the cables. Danger from high-tension

1. Abstract of a paper read before the International Association of Municipal Electricians at Erie, Pa., on August 23, 1905. Mr. Brophy is the well-known electrical inspector of Boston.

circuits can be wholly avoided in underground circuits by keeping the fire-alarm circuits as widely separated from the former as possible, the two should never be placed in the same conduits, ducts or manholes.

In any city with a large extent of territory and one central office or operating room, the circuits upon which the signal boxes and other apparatus is placed must of necessity in some cases be of great length, say six, eight and 10 miles or more, and as such circuits are invariably metallic, the entire distance over them is very great, and when an open circuit, short circuit, ground crosses and other innumerable troubles occur thereon it takes a great deal of valuable time to locate and remedy the same; I say valuable time, for the reason that the circuit may be and most always is useless for the purpose for which it was intended until it is again placed in working condition.

In most all small towns and cities and in very many of the larger ones the old crude practice in vogue 30 years ago for locating open circuits, grounds and crosses is still followed, which is as follows: In the case of an open circuit, one side of the same is grounded at the switchboard and a man goes out on one side of the circuit making tests at boxes, gongs, etc., by grounding the circuit at these points until he comes to a point where the circuit will not close, when he is sure that the "open" or break is between that point and the one last visited. The same procedure is followed in the case of a "dead ground" on a circuit, one side of the circuit is grounded and opened and a man sent out over it, visiting the boxes, gongs, etc.; but in this case he does not put the line to ground; he simply notes whether the circuit is closed or not, and when he finds it open he knows that the ground is near by. All this consumes valuable time, and the longer the circuit is the more time is consumed, and for this reason fire-alarm circuits should be as short as possible. This is not the best and most approved method of locating breaks and grounds in a fire-alarm circuit, and is one that should not be followed when a much better one that will consume much less time can and should be adopted, but in either case short circuits are desirable.

The city of Boston originally consisted of Boston, South and East Boston, and this territory has been enlarged at different times by the annexation of Charlestown, Roxbury, Jamaica Plain, Brighton and Dorchester. All this wide expanse of territory is covered by circuits all radiating from one central office or operating room. In the case of Charlestown, East and South Boston submarine cables have to be used at the draw bridges, and such cables prove a source of anxiety and trouble at all times. The circuits to East Boston have to pass through the neighboring city of Chelsea before they reach their destination, and to my personal knowledge these circuits have been wrecked twice by the burning of a large elevator on the street through which they pass, thus absolutely cutting off East Boston from the fire-alarm system, and rendering it impossible to give an alarm for fire in that territory. The city of Charlestown had its own fire-alarm system, which was the Gamewell automatic, before it was annexed to Boston, and to my mind much better results would be obtained if it was retained in service, one circuit being established between it and the central office in Boston; then, in case of any interruption of this circuit, alarms for fires in Charlestown could be given as readily as though this circuit was intact. This statement applies with equal force to East and South Boston, Dorchester, Roxbury and Brighton.

We have at frequent intervals in New England snow and sleet storms that completely wreck overhead circuits of all kinds, bringing down wires, poles and fixtures in a tangled mass that requires weeks of time to restore to anything like their original condition. Such storms are liable to occur during any of our severe winters, and as a matter of fact they do occur with a great degree of uniformity. Boston, like most all other cities, owns but a very few poles on which to string its fire-alarm circuits, consequently after one of these periodical wrecks great delays occur in getting the circuits running to the districts here named in working condition, for which those in charge of the fire-alarm system cannot be held responsible, as they have to await the movements of the owners of the poles which they occupy.

The conditions in the city of New York are widely different from those in Boston and most any other city in the country. The Island of Manhattan is extremely long and narrow, and owing to this fact excessively long circuits have to be employed in order to reach the extreme ends of the island from the central office, but unlike most other cities, nearly all the fire-alarm circuits are underground, the only exception being those in the extreme northern portion of the city, so that snow, sleet and ice have but little effect on the general system, but as I have previously pointed out, the placing of wires underground and encasing them in lead does not insure complete immunity from all the troubles that overhead wires are subject to, and there are some that are unheard of in the latter that are extremely troublesome in the former. The popular supposition that all line troubles cease when they are placed underground comes a long way from being the truth. The underground electrical conduits are owned and controlled by private corporations who rent the same to different classes of electrical companies, the wires of the fire alarm being a joint occupant of the same with all the others. The employes of the owners of the wires and cables in these conduits have occasion—yes, frequent occasions—to enter the manholes to make changes and additions, seek and remedy all classes of troubles that may occur, and as a rule they are not overburdened with a sense of the rights of others and are not at all impressed with the sanctity or importance of the cables of the fire-alarm system, and as a result they are subject to outrageous treatment that does not add to their durability or efficiency. These cables are often cut by mistake, and when their true character is discovered no pains are taken to place them in the same condition that they were before. I might add here that this grievous sin has been committed as often apparently by the employes of the fire-alarm department as by others, which must be due to gross ignorance, for no sane man can fairly assume that ordinary tape is equal to lead for the protection of the wires of an underground cable. These cables were not laid originally with that degree of care that would be exercised today, owing no doubt to the lack of experience obtained during the time intervening since they were laid, and as a result serious troubles that could otherwise be avoided are of frequent occurrence, and the fire-alarm cables are not so distinctively and conspicuously marked and separated from others as to exempt them from the inexcusable abuses of irresponsible employes of private companies. All this and much more that could be said emphasizes the necessity of reducing the length of the fire-alarm circuits to the least possible.

When the average citizen pulls a fire-alarm box he expects he has done all that is possible to summon the fire department; he does not always see the importance of remaining at it until the department arrives so that he can direct it to the scene of the fire; he knows nothing about open circuits, "grounds" and other troubles that will prevent the box signals from being received at the central office; he generally returns to the scene of the fire; it in the meantime rages unchecked until it reaches proportions far in excess of what it would were the alarm sent to the fire department, the magnitude of the fire depending on the nature of the material it has to feed on.

Some Aspects of Municipal Ownership in England.

Mr. Mahin, the United States consul in Nottingham, England, writes about municipal ownership in his consular district, showing cases in which apparent success has been secured and others in which failure thus far is the record. He says:

"The official reports on the working of the various 'undertakings' of Nottingham during the corporation year ended March 31, 1905, having now been published, it is possible to take a satisfactory survey of the subject. There are now 50 miles of distributing mains, all the wires being laid in underground conduits. Consumption increased five per cent. during the year. The charge per unit has declined every year since the electric works were started in 1895, when the average price obtained was 11.94 cents. It is now 4.14 cents. The net profit of the undertaking in the 10 years exceeded $300,000, of which the sum of $158,161 was contributed to the rates—i. e., toward reduction of local taxation—the balance going to the reserve fund. In the past year the rates benefited to the extent of $29,199.

"The tramway traffic slightly declined during the last year in comparison with 1904, due chiefly to the closing of a suburban exhibition. The average fare collected was 2.16 cents. The penny stage averages 1½ miles; twopenny, 2.9 miles, and threepenny, 4.4 miles. Before eight a. m. workmen can ride double distance for single fares, and receive return coupons for evening use at the same rates. This feature is not a financial success. The cars are all double-deck; some have the upper deck enclosed. The total receipts averaged 23.78 cents per mile run and the working expenses 14 cents. The net profit exceeded $100,000, from which the rates profited by $72,997, and the balance went to the reserve fund, which now amounts to nearly $200,000.

"One fatal accident occurred during the year—a car colliding with a horse and cart, killng the driver. The last death caused by the cars previous to this was in January, 1902, since which time they have run 7,250,000 miles through the city's streets and carried 80,000,000 passengers. No other accident of a serious nature occurred during the last year. Forty-six persons were knocked down by cars or fell on the track while crossing it, but all were pushed away or picked up by the automatic catchers without serious injury. Twenty-one cyclists collided with cars, but no serious injury resulted in any case. The greatest number of injuries was to persons getting on or off cars in motion, 242 being injured in person or clothing. Altogether the record is remarkable, considering the miles traveled and passengers carried, and the fact that the tracks follow the busiest streets of the town, some of which are narrow and winding and have steep grades.

"During the year the gas undertaking yielded a net profit exceeding $150,000, of which the rates received $131,395. Consumption decreased in comparison with the preceding year, due largely to the extending use of incandescent burners, which, it is estimated, increase the light obtained from 3½ candles to 20 or 30 candles per cubic foot of gas consumed. The price charged for gas is 60 cents per 1,000 cubic feet to ordinary consumers; for power purposes, 44 cents per 1,000 if not exceeding 50,000 annually used, and 36 cents if more than 50,000. Such special rates, which generally obtain in all the midland cities, are found necessary to compete with gas power plants and to prevent factories from establishing gas plants of their own. The total mileage of mains is 351. The city area supplied with gas is 10,935 acres, but it is also furnished to surrounding villages and country houses covering an area of 72,426 acres. The gas department's chemical works produce, as by-products, large quantities of crude naphtha, light oil, carbolic acid, creosote, anthracene oil, naphthalene oil, black varnish, brick oil, grease, pitch, pressed napthalene, crude benzol, crude toluol, cyanides, sulphate of ammonia, oxide of iron, sulphuric acid and recovered sulphur, the sale of which yields a substantial revenue.

"The water undertaking yielded a net profit exceeding $25,000 during the year, which was carried forward to various accounts—nothing being available for the rates. The number of houses supplied was 72,576; other supplies, 47,408. Estimated population supplied, 326,592. The population of the city is about 250,000. Outside villages and country houses covering 37,482 acres were also supplied. The water comes from six wells, one artesian. The wells are each about 200 feet deep, several having an additional bore of 100 feet. They are scattered about the surrounding country, where the trend of the sandstone formation favors a copious flow—the most distant being 20 miles from the city. The water is pumped into five reservoirs, three in the city and three new ones in the country are being built. The total yield is 8,500,000 gallons, and the consumption 5,000,000 to 8,000,000 daily. In addition it is expected to receive 4,000,000 gallons a day from the Derwent waterworks project, now under way and to be completed in about five years.

"The waterworks at Derby were bought several years ago from a private company and have proved very profitable, a large reserve fund being accumulated. The past year's balance, after paying working expenses, was over £23,000 ($115,000).

"The horse railway was superseded by an electric system during the year. The balance of receipts over working expenses was about $35,000, but payment of various other charges reduced the net profit to about $10,000.

"The electricity undertaking yielded a gross profit of about $60,000, but payments on loans and interest reduced the net to about $3,000. The gas supply is from a private corporation.

"The gas undertaking of Leicester yielded last year a net profit of $184,927, which went toward reduction of taxes. The net profit from electricity was $20,682, the disposition of which is not stated.

"The gross profit of the horse street railway exceeded $45,000, which was consumed by various charges. An electric system is now in operation.

"The net profit of the waterworks was $69,216, which went to a reserve fund.

"The three cities also control various other undertakings, such as markets, educational institutions, allotment gardens, etc., but these are, altogether, more public conveniences than sources of financial profit."

Some of the dangers underlying municipal ownership are pointed out in the following report from Consul Daniels of Sheffield. He calls attention to conditions in that city and shows that all is not as pleasant as it might be. He writes:

"The city of Sheffield, in the management of its electric tramway system, finds itself confronted with a condition that some of the more far-seeing members of the City Council (notably Sir Joseph Jonas, the lord mayor) have insisted has existed for some time, and that condition is, despite the fact that the system has been operated at an apparent profit, while furnishing cheaper transportation than any system in the United Kingdom, due to a failure to properly charge off a reasonable amount yearly for depreciation of plant. This failure brings them face to face with the necessity of adjusting and raising the fares or operating the system at a loss, possibly, or, at any rate, no profit.

"The report of the tramways committee for the past year shows the following condition: The mileage run was, 1901, 2,315,347 miles; 1902, 3,791,993; 1903, 4,926,083; 1904, 5,768,231; 1905, 6,019,899. The passengers carried rose from 61,450,993 in 1904 to 63,952,283, and the revenue from all sources from $1,130,738 to $1,170,713, an increase of 2,501,290 in number and $39,975 in car mileage, 281,668 greater than that of the previous year. In 1901 each car earned on an average 27 cents per car-mile run, and the average fare per passenger was 1.8 cents. The figures for the following years were: 1902, 23½ cents and 1.8 cents; 1903, 20½ cents and 1.8 cents; 1904, 19 cents and 1.8 cents; 1905, 19 cents and 1.8

cents. If the fares per passenger in 1905 had been the same as in 1901 the revenue would have increased by the sum of $37,472. The average fare per passenger in Manchester was 2.38 cents; Bradford, 2.26 cents, and Liverpool, 2.22 cents.

"The average working expenses per car mile in 1901 were 14.5 cents; in 1904 they had gone down to 13 cents, while in 1905 they had been further reduced to 12.8 cents, which is the lowest in the history of the undertaking. Had the working expenses in 1905 been the same as in 1901 the charges would have been increased by $153,095.

"The net profit in 1904 was $132,412 and in 1905 $84,317, or $48,665 less. This decrease was not due to cost of management being excessive, because the percentage of that cost was less than ever before, nor was it due to the cost of production of energy, for that cost in Sheffield is among the lowest in the country. The decreased profit was in the first instance attributable to the increased charges in 1905 over 1904, without any corresponding decrease in revenue. Salaries and office expenses previously charged to capital are now transferred to revenue, and represent $10,123; rates and taxes caused by reassessment, $17,817; repairs to cars, permanent way and power station, $37,536; interest on loans, $35,132; installments for sinking fund, $22,193, making the total increased charges over the previous year $122,801. To be deducted from that were $10,738 decrease in traffic expenses, $2,655 saved in insurance, $12,348 decrease in power expense, a total of $25,741.

"A comparison of the Sheffield tramway undertaking with that of Leeds is given. Leeds has the advantage in the matter of gradients. The population of Leeds is 450,142; Sheffield, 432,940. Car-miles run: Leeds, 7,051,823; Sheffield, 6,049,899. Receipts: Leeds, $1,432,347; Sheffield, $1,170,709. Expenditures: Leeds, $784,951; Sheffield, $794,616. Passengers carried: Leeds, 64,223,660; Sheffield, 63,952,283. Average fare: Leeds, 2.19 cents; Sheffield, 1.8 cents. The average distance traveled in Leeds for 2 cents was 1.57 miles; in Sheffield, 2.48, or nearly a mile more. The lord mayor is authority for the statement that Sheffield fares are 17 per cent. cheaper than the next cheapest in the country. If they were based upon Leeds fares, Sheffield would have an increased yearly revenue of $253,058, provided the same number of persons traveled and the Leeds rates were adopted here.

"The corporation is constantly besieged with applications for extensions of the tramway service to outlying districts. This is felt to be a policy that ought to be adhered to, but it is apparent to all that no further extensions of the service can be made without providing in some way for increased revenue. It is also conceded now that the past policy of the tramway management has been wrong, in that they have not allowed enough for depreciation and renewals. The city of Glasgow sets aside 6 cents per mile for depreciation; Manchester allows 2.4 cents, and Liverpool 2 cents. Sheffield is supposed to allow 2 cents, but if it had the account instead of showing a surplus of $84,321 would have shown a deficit of $38,348.

"There the matter stands at present. The only remedy in sight appears to be to raise the rate of fare, and that no member of the city council seems to be ready to advocate."

A "Refrigerated" Motor.

What is announced to be "the next great success in the electrical world" is the Bidwell "cold" motor, which is introduced to the public through a stock-selling circular issued by a Chicago company which is developing the patented idea of Prof. Benson Bidwell. The principle upon which the claims of superiority of this motor are based is the use of artificial cooling for the armature and field windings rather than the ventilating methods now in use. The machine is built with a hollow shaft which connects with circulating ducts through the revolving armature. Through the shaft and ducts a gas under pressure is circulated, which upon expansion artificially cools the armature. The fields are cooled by a like process. The compressed gas is contained in tanks or cylinders. The application for which the motor is best adapted is said to be railway service, and the company asserts that by its use burnouts will be done away with. The machine is also applicable for generating purposes.

Some remarkable statements are made in the circular to which reference has been made. Here are two extracts:

"The Bidwell cold motors or generators (these words are interchangeable terms) will produce more electricity than any other kind now known. First, because they are kept cold. Second, because they can be revolved at a higher rate of speed, which means that they will produce double or more electricity per horsepower in size than any other motor built, which is also because they are kept cold."

"The Bidwell cold motors will last longer than any other kind because the wires with which they are wound will not crystallize. The lives of present motors are comparatively short because in running they get hot. Every time a motor is heated and then allowed to cool the wires crystallize or get harder just so much. The harder the wires get the less electricity they produce."

An experimental "non-crystallizing" motor is now in process of construction, it is said. Meanwhile the stock of the manufacturing company is offered for sale.

Space-telegraph Experiments in Germany.

Reporting on recent space-telegraph experiments in Germany, Consul-general Guenther of Frankfort says that the results as regards its use on moving trains, in the production of portable stations and in the regulation of clocks have shown remarkable progress. He writes as follows:

"Practical experiments have demonstrated that wireless telegraphy on moving trains will render valuable service in preventing accidents. It is stated by competent authority that the late railway horror at Spremberg, near Berlin, would have been prevented if the train had been supplied with an apparatus for receiving wireless messages. Two years ago the Prussian railway authorities made experiments with wireless telegraphy on moving trains upon the Zossen-Berlin military railroad. Each station was supplied with a sending and receiving apparatus, as were also the trains. For the transmission of signs the telegraph wires along the railroad were used, in order to save electric energy. These experiments, which were continued up to a few weeks ago, have clearly demonstrated that the apparatus for wireless telegraphy upon a moving train can communicate at all times with any telegraphic station on the line, and report instantaneously irregularities, accidents, etc. Private telegrams can also be sent calling for help, notifying anxious relatives of passengers waiting at stations, etc. On the other hand, telegrams from each station can reach the moving train and warn the locomotive engineer against collisions, impediments on the track and other dangers.

"Portable wireless-telegraph stations are now manufactured of such light weight that carts or wagons are no longer needed for their transportation, the parts being carried by the men; while with stations moved by wagons the air conductors are attached to balloons or kites. With portable stations they are attached to steel masts. These masts, three in number, can be pushed together like a telescope, and are then about 12½ feet long, but can easily be pulled out to a length of 33 feet. Owing to their light weight, which, for one mast, inclusive of braces and wire rope, is only 44 pounds, they can be put up in short order. They are supplied at the foot with cast-iron ground plates, and twice steadied, in three directions, by means of wire ropes fastened to ground anchors. Between the three masts zinc-coated copper ropes, consisting of eight twisted wires, are stretched as air conductors. The ropes are fastened to the masts by brass hooks, with light glass insulators.

"The electric energy required is furnished by a so-called 'tread dynamo,' mounted upon a sort of stationary bicycle with a light seat for the man, who keeps the machine going with his feet. The weight of this dynamo is 44 pounds. The electric energy can also be supplied by a portable storage battery. For the transportation of the complete wireless-telegraph station with a tread dynamo 10 men are required; 11 men where a storage battery is used. The net weight of a complete station with a tread dynamo is 440 pounds; if a storage battery is used, 506 pounds.

"So far these stations, on account of the limited height of the masts, can only be operated on level lands for 15 to 16 miles, but they can be easily moved, are quickly put up, and work with certainty."

It is stated in German papers that Dr. Max Reithoffer, professor at the Vienna technical high school, who is considered an authority with reference to the wave theory, has, jointly with the court watchmaker, Kral Morawetz, submitted to the Common Council of that city a plan for an electric system of clocks run by wireless electricity. The projected installation will consist of two distinct divisions, namely, the central station and about 80 sub-stations. In the central station there will be a powerful Ruhmkorff apparatus to produce the electrical waves, which will have one terminal connected with the earth and the other with an antenna about 82 feet in height. Further, in this station, there will be a free-swinging electrical pendulum, the invention of Morawetz, which, by means of an electric current, aided by electrical-contact mechanism, replacing the train of wheels in an ordinary clock, will be automatically maintained in action. Both the pendulum and the coil will be supplied with an independent current. The object of the pendulum is to connect and disconnect the current communicating with the wave apparatus at intervals of exactly one minute. The period of contact needed for this purpose amounts to about one-tenth of a second, and therefore requires but little expenditure of current. The distributing apparatus will thus emit into space, in the course of each minute, electric waves of absolutely definite length, which are taken up by the sub-stations.

Independent Telephone Men in Indiana Hold District Meeting.

Independent telephone companies in the seventh district of the Indiana Independent Telephone Association, composed of Hamilton, Hancock, Hendricks, Johnson, Morgan, Shelby, Boone and Marion counties, held their first quarterly meeting at Indianapolis on October 11th. About 50 of the 62 Independent companies of the district were represented. W. W. Mendenhall of Westfield, vice-president of the district, presided, and E. G. White of Arcadia was chosen as secretary. H. B. Sale, general manager of the Indianapolis Telephone Company, welcomed the representatives to the city and urged the importance of a complete organization in this stronghold of the Independents. He said that the Independent companies in the state had over $15,000,000 invested in telephone property for which expenditure they have 170,000 telephones in operation against less than 30,000 by all competitors. The Independent telephone companies in Indiana, he continued, have at least one-half of the toll lines in the state, and before the close of another year such extensions will be made as to give all points within the state ample facilities for their toll-line business.

C. S. Norton, secretary of the Indiana Independent Telephone Association, explained its plan of district organization, and said it was to hold quarterly meetings to discuss local matters and to have a local government. He said that prior to the organization of the state association and its branch district associations, there were seven distinct Independent telephone associations in the state, all of which had been absorbed by the state association. Mr. Norton said he had attended meetings in five of the districts, and all were well attended.

Various representatives present made reports of conditions in their localities, relating their experiences and troubles, and the exchange of ideas brought out quite a discussion, and all agreed that the meeting had been helpful and advantageous to them. The principal topic for discussion was the advisability of the companies in the seventh district adopting a uniform system of bookkeeping. The plan, as explained by several experts present, was generally indorsed as being conducive to economy, accuracy and simplicity. Standardization of apparatus was also discussed.

The advisability of merging all the Independent companies of the seventh district under one operating head was suggested, but this was strongly opposed by the representatives of the smaller companies present.

Organization was completed by the signing of the constitution and the appointment of an executive committee and a committee on by-laws and rules. The following managers of exchanges were among those in attendance: D. W. Wilson, Shelbyville; C. W. White, Arcadia; Everett Harrod, Flat Rock; C. M. Drake, Lewiscreek; John P. Dardoner, New Palestine; V. L. Early, Greenfield; Isaac New, Whiteland; J. H. Miles, Mooresville; A. S. Goldrich, Indianapolis; C. W. Cook, Carmel; A. B. Hawkins, Noblesville; Will Haugh, Greenfield, and Jesse Weik, Greencastle.

Telephone Situation in New York City

In last week's issue the formation of the United States Telephone Company was announced in the Western Electrician. In relation to New York city it is asserted that the new company has valid franchises antedating the present franchises of the Bell company, and is planning to install within the next two years a network of cables capable of supplying 225,000 subscribers. The New York Telephone Company has only about 145,000 instruments connected.

Apart from the threatened competition by this new organization there are also applications pending from four new telephone companies. These are the Atlantic Telephone Company, the Star Telephone Company, the Commonwealth Telephone Company and the Manhattan and Bronx Telephone and Teleautograph Company, all of which have been recently displaying signs of activity in Greater New York. The Atlantic company is said to have the strongest financial support. It is possible that these four new companies are in some way connected with the larger merger.

The new companies promise a five-cent rate for messages in the boroughs and a 10-cent interborough tariff, the present rates being 10 and 15 cents. A number of telephones are also offered free of charge for municipal use, representing an approximate saving of $30,000 yearly to the city departments.

On October 9th there was also incorporated at Albany, N. Y., a new million-dollar telephone company called the Great Eastern Telephone Company, which is to include the State Line company, which has already 2,200 miles of wire in Westchester County, and the Coast Line company of New Jersey, which has secured 10,000 subscribers in its first eight weeks of canvassing. This company is also supposed to have behind it the United States Independent Telephone Company.

An expert has named $7,750,000 as the value of a telephone franchise for 25 years in New York city. This amount was submitted to the Board of Estimate and Apportionment on October 13th. The Atlantic Telephone Company has applied for a 25-year franchise, and the estimate was made for this company's application.

Indiana Telephone Items.

The Milan Telephone Company of Milan, Ripley County, has filed articles of incorporation with the secretary of state, with the declared purpose of establishing an exchange and constructing a telephone system in Milan and Ripley County.

The Steuben County Electric Telephone Company of Angolia has increased its capital stock from $50,000 to $100,000.

The Fort Wayne Telephone Company has issued a new directory which contains the names and numbers of 3,300 subscribers in the city, 136, on country roads and 52 at New Haven.

The Princeton Home Telephone Company of Princeton, Ind., has connected with Patoka, a town of 700 inhabitants, and adjacent territory direct, and the Patoka exchange has been done away with. Work on the extension of the Princeton line to connect with the Independent system at Mount Carmel, Ill., is progressing rapidly. The Princeton company is moving into a new exchange building where a new switchboard of large capacity is being installed.

Among the improvements and noted developments made by the Independent telephone companies in Indiana during the present year may be mentioned the following: The Mutual Telephone Company of Shelbyville has completed the rebuilding of its entire plant; the Crawfordsville company is laying a large amount of cable; at Columbus, additional telephones are being installed at the rate of 50 a month; $15,000 additional is being expended in rebuilding the plant at North Vernon and improving the line; the New Long-distance Telephone Company has installed new circuits to Franklin, Greenwood and Veedersburg, and new circuits from Indianapolis to Bedford; the Lafayette company is expending about $75,000 in improvements; at Kokomo nearly 300 new applications for telephones have been filled. All told, about $4,000,000 has been expended on improvements by the Independents of Indiana during the present year.

A petition for a new franchise, extending over a period of 50 years, is asked by the Citizens' Telephone Company of Edinburg.

The United Telephone Company is making extensive improvements in its line in the city of Huntington. Three carloads of material is being strung to take the place of old material. Altogether, 30,000 feet of cable will be put up.

A number of the chief operators of the second Indiana district of the Central Union Telephone Company held a meeting in the Century Club room, Denison Hotel, Indianapolis, on October 11th, to discuss problems of the telephone business and to promote a spirit of friendship. Most of the chief operators were young women, who came from Eastern Indiana and as far south as the Ohio River. J. E. Stickney, district superintendent, gave a practical talk. Other discussions were by J. W. Brady, service inspector; Newton Rogers, traffic manager, and A. P. Allen, traffic engineer. At noon those in attendance ate lunch together, as the guests of the company. S.

Telephone News from the Northwest.

The Dakota Central Telephone Company has purchased the local telephone exchange at Pierre, S. D.

The Northwestern Telephone Exchange Company has been granted a franchise at Foley, Minn., after a long contest.

The Tri-state Telephone Company was successful at Albert Lea, Minn., in securing a franchise for a competing local exchange, the Northwestern Telephone Exchange Company having bought the local company's system there.

The Northern Pacific Railroad Company is constructing a telephone line from St. Paul to Fargo, N. D.

A peculiar combination of circumstances has arisen at Ortonville, Minn. The Tri-state Telephone Company was granted a franchise there for a toll-line connection, but it has since been found that the franchise of the Minnesota Central Telephone Company requires it to permit any other company wishing to enter the city to connect with its central office. Hence the Tri-state franchise is to be repealed, and it is to be directed to connect with the Minnesota Central. But the Minnesota Central is an ally of the Bell system and is probably under a contract with the Bell interests whereby it may not connect with any line which uses other than Bell instruments.

The City Council at Omaha, Neb., has voted down the proposed telephone franchise which was asked for by the Hunt-Parmalee-Pollock people.

E. N. Nelson has succeeded T. W. Wigton as manager of the Roland (Iowa) Mutual Telephone Company.

The State Independent Telephone Company of Huron, S. D., has filed articles of incorporation with $1,000,000 capital, K. S. G. Hutchinson and Coe I. Crawford of Huron heading the incorporators. E. H. Moulton of the Tri-state Telephone Company of Minneapolis is also a member of the company, which has for its object the consolidation of the different independent telephone companies of the state into one organization.

The Northwestern Telephone Exchange Company is building a line from Mankato to Eagle Lake, Minn.

The capital stock of the New Ulm (Minn.) Rural Telephone Company has been increased from $50,000 to $100,000.

The Mutual Telegraph Company has sold its holdings at Stillwater, Minn., to the Tri-state Telephone Company.

G. W. Smith has sold the Brighton (Iowa) telephone exchange to the Brighton Mutual Telephone Company. R.

Texas Telephone Progress.

The Gulf Coast Telephone Company, which has offices at ElCampo, Midfields, Blessing and Palacios, has completed its line to Markham.

The LaGrange and Waldeck Telephone Company has been organized with principal office at Oldenburg. It has a capital stock of $1,000. Louis Voekel is one of the incorporators.

The Commerce Telephone Company of Commerce has increased its capital stock from $5,000 to $10,000.

The Childress-Wellington Telephone Company of Childress is constructing telephone lines between Childress and Arlie, Olympus and Wellington. R. H. Norris is one of the stockholders.

The board of county commissioners granted a right-of-way to the Bandy Telephone Company to build a telephone line through Bexar County. The proposed line will run from San Antonio to Bandera, a distance of 50 miles.

The telephone system and exchange at Del Rio has been purchased by T. H. Sharp and L. Rust of San Angelo. They will make extensive improvements.

The H. R. F. Telephone Company will build a telephone line from Milano to other points. The company recently completed a line from Milano to Hanover.

The Texas Consolidated Long Distance Telephone Company of Dallas has increased its capital stock from $30,000 to $60,000.

The Fort Worth Independent Telephone Company is making important extensions of its long-distance system.

The North Texas Telephone Company of Sherman is constructing a long-distance line from Sherman to Gainesville via Pottsboro and Woodbine.

The Fayette County telephone system will be extended to Weimer.

The principal office of the Lone Star Telephone Company has been moved from San Antonio to Beaumont. C. W. Emmer was recently appointed manager of this company by Receiver Mackay.

The Riddall Telephone Exchange, which has operated an independent system of telephones at Waxahachie for the last few years, has been purchased by J. R. Thomas and Charles Clark. The new owners are preparing to extend the system to outside points. H.

Ohio Telephone Notes.

Plans for the expenditure of a large sum of money, said to approximate $170,000, on the plant of the Stark Telephone Company at Canton, have been made.

A meeting of representatives of the seventh district of the Ohio Independent Telephone Association was held at Lima a few days ago, all of the 41 companies in the 10 counties of northwestern Ohio being represented. President and Manager Frank L. Beam of the state association, and C. Y. McVey, A. D. Kramer and M. B. Overly were also present. It was shown that every company in the district had made an increase in the number of subscribers. The district now holds fifth place in the state.

Tax valuations have been placed upon telephone companies in Cuyahoga County as follows by the state board of equalization: Citizens' Telephone Company, $10,350; Cleveland Telephone Company, $1,091,170; United States Telephone Company, $20,500; Central Union Telephone Company, $6,079; Ohio Telephone and Telegraph Company, $73,584; Bainbridge Telephone Company, $150; Cuyahoga Falls Telephone Company, $5,032; Cuyahoga Telephone Company, $447,073.

The North Fairfield Telephone Company, North Fairfield, has been incorporated with a capital stock of $5,000 by C. R. Irwin, Leroy Hoyt and others.

The Home Telephone Company of Dayton, starting operations in 1903, has 5,000 subscribers and is adding about 100 a month. In all the company has 12 exchanges in Montgomery County outside of Dayton. The last one to be completed is at Centerville. A specialty is made of farmers' telephones, and most of the better class of farmers now use the service.

Regulation of Telephone Rates in Wisconsin.

The attorney-general of Wisconsin has ruled, in an inquiry regarding the right of a city to fix or limit the charges of a telephone company, that no right to such action exists. Where a list of rates is fixed by franchise, that portion is illegal. There is still recourse against exorbitant rates, however, for any patron may bring suit to have the rates complained of declared unreasonable.

W. C. Moeller has purchased the telephone business of W. J. Skewis in Rock Valley, Iowa.

Berlin Telephone Service.

According to Mr. Mason, former consul-general of the United States at Berlin, the telephone service of the German capital is well worth study. It has grown to large dimensions and has features that will strike many as desirable. Mr. Mason writes:

The telephone system at Berlin is a branch of the imperial postal service and is administered throughout by employes of the government, who hold their positions for life or during good behavior, and receive pensions when they finally retire by reason of old age or disability. From a beginning somewhat tardy in comparison with other large European and American cities, the service here has grown to one of the largest in the world, not less than 86,000 telephones being now installed in the public system of greater Berlin. The long-distance telephone service of this city embraces within its scope more than 2,600 cities and towns in Germany and other European countries, including capitals like Paris, Brussels, Rome, Vienna and St. Petersburg. For this branch of the service the central telephone bureau is equipped with a staff of operators, mostly women, who are competent in the various European languages. The short-distance service includes the city of Berlin proper, which is divided into nine districts, each with its central exchange, and 18 branch exchanges in the various suburbs within a radius of five miles from the central station in Berlin.

The cost to subscribers per annum for a telephone installation in Berlin is from 180 to 200 marks ($42.84 to $47.60) per annum, while for certain suburbs, where the instruments are less frequently used, the cost varies from 80 marks ($19) at Adlershof to 140 marks ($33.32) at Steglitz, and 160 marks ($38.08) at Westend, which is the extreme western section of Charlottenburg. The largest number of instruments embraced in one district or exchange is district or "Amt" I., with 13,538 connections; next comes Amt IV., with 12,884, and III. with 10,503. In the organization of the various exchanges one female operator is required to attend to the calls of from 100 to 200 telephones. The operators are carefully educated and selected, ably directed, and are for the most part alert and efficient. The connections between the various district exchanges are cased in earthenware conduits laid underground, but the wires to subscribers' instruments are mainly strung on high wrought-iron frames set on the roofs of the tallest buildings, and are never permitted in any position so low as to interfere with the fronts of buildings or the traffic of the streets. At all the branch postoffices and district exchanges as well as at various other prominent places throughout the city are prepayment public telephones which any person may use after dropping in the slot a 10-pfennig piece, the value of which is 2½ cents in American currency.

The rates for long-distance service are as follows for a communication which does not exceed in duration three minutes. The following schedule includes only Germany:

To all places within a radius of	Cents
15 miles	5
30 miles	6
63 miles	12
315 miles	24
625 miles	48

The rates for telephone service to foreign countries are specially arranged with the governments of the several neighboring nations and are relatively higher than those between points within the German Empire.

GENERAL TELEPHONE NEWS.

The O'Dell Independent Telephone Company of Del Rio, Texas, has sold out its business.

The Bassett-Springview Telephone Company at Bassett, Neb., is arranging to build a line from Sybrant to Butka.

The Ericsson Telephone Company of Stockholm, Sweden, is about to erect large workshops at Buffalo, N. Y., it is reported.

At Chanute, Kan., the Wareham-Wood Telephone Company is erecting a new exchange building which will be thoroughly modern.

The Bell people want to put their wires underground in Camden, N. J. The plans of the company contemplate the laying of its conduits without disturbing the pavement or otherwise damaging any improved street

The Delaware and Atlantic Telephone Company is putting its wires underground on all the principal streets of Riverton, N. J. It is said that, when completed, it will be the best system of underground wiring in any small town in the state.

A direct telephone line is to be constructed between Kingston, Ont., and Watertown, N. Y. At present telephone connection between these two places is obtained by way of Ogdensburg. What is needed is a line over Wolfe Island to connect with Cape Vincent. A survey was made recently, with the result that satisfactory arrangements can be made for the construction of a line over the island, and thence across the river to the cape. It is likely that work upon the proposed line will be started shortly.

CORRESPONDENCE.

Great Britain.

London, October 4.—The conversion of the lighting of one or two streets in the city from arc lighting to incandescent gas lamps was completed last week and the new illuminant was used for the first time on Saturday. Quite apart from a certain partiality for electric lighting, one cannot disguise the fact that the change is a retrograde movement, and but for the brilliant illumination of many of the shops, outside which there are numerous flame arc lamps, the change would be noticed by the public more than it is. The gas company has given out figures that the saving to the corporation for approximately the same candlepower will be a few hundred pounds per annum. Doubtless some figures will be forthcoming as to what could be done with a really modern system of arc lighting, for it must be remembered that the old arc lamps were of the very earliest design and that the housings (chosen by the city officials) were protested against by the electric supply company from the commencement. In two places the company has substituted flame arcs for the old type, and the contrast—the lamps are at the extreme ends of a street now lighted by high-pressure gas—between them and the new gas lights is so pronounced that it may be safely assumed that even the obstinate city councillors will be forced to perceive it when they chance to pass that way. The Electric Supply Company has a genuine complaint, in that it was not allowed an opportunity of putting in a competitive bid under present-day conditions with the gas companies.

The electrical exhibition on the outskirts of London has now been open a week and careful inspection justifies the earlier impressions that it is a popular show, and not one at which any great number of novelties are to be encountered. The exhibition was avowedly intended—and is amply fulfilling this object—to bring before an hitherto unappreciative public the great advantages of the elasticity and adaptability of electric power. The small user is aimed at, and consequently the domestic applications of electricity loom large. While there are some fine examples of heavy machinery, this branch of electrical engineering gives way before a lavish display of electrical fittings, lamps, heating and cooking apparatus, etc. Generally speaking, the educational value should be considerable, for the past history of electric supply here has been to a large extent that it was only available to the rich. It may safely be stated that such an exhibition as this ought to have been held several years ago and that an interval of 13 years since the last show ought never to have been allowed to elapse.

Two matters concerning the London County Council have been discussed within the last few days. When the County Council first took up the tramway question its advocacy of the conduit system all over London was strongly criticized. This criticism has served a most useful purpose, for the tendency now is to adopt the overhead system wherever the traffic is not too dense. In changing its attitude, however, the council has had to encounter opposition from the borough councils, which are strong supporters of the conduit system. After much negotiation it is pleasing to see that some of the councils are adopting a more commonsense view of the matter and that gradually they are giving way, although it cannot be denied that the original action of the County Council has been the cause of still further hindering an already backward and necessary reform in London's means of communication.

Another point concerning the welfare of Londoners is that the County Council is being asked to promote a bill enabling it to supply electricity in bulk—a bill to be presumably after the pattern of the $25,0000,000 scheme which was heard so much of in Parliament last session. In the first place I do not believe the council will seriously consider such a proposal, and if did the futility of any such proposal to Parliament is apparent to all who know their London and Parliament. Further, to carry out such a scheme, it would have to be directed upon lines similar to those suggested in connection with the scheme just mentioned. But the whole point of the opposition of the London County Council was that the conditions in London rendered any such scheme unworkable. The conditions cannot alter, it seems to many good judges, since Parliament authorized the borough councils to undertake electricity supply and so erect a large number of comparatively small stations. It is this curious inconsistency of municipal traders that creates so many of its enemies.

Local authorities owning telephone undertakings in Great Britain are still in a very disturbed frame of mind in their doubts as to the security of their future as a result of the agreement between the postmaster-general and the National Telephone Company. The postmaster-general, however, has repeated his willingness to enter into negotiations with the local authorities for the acquisition of their systems in order to avoid duplication of plant where competition now exists. The government, in reply to a request by the Hull corporation, has refused to grant an extension of that license or to bind itself to purchase the whole of the corporation's plant. In the case of the company only that plant which is suitable for the purposes of the postmaster-general will be purchased, and the same terms are offered to the municipalities, who do not, however, seem disposed to accept them.

Some extensive frauds upon electrical fittings manufacturers have been practiced recently and long Police Court proceedings have been taking place in connection therewith. The amounts involved have run into several thousand dollars, but no sentences have yet been pronounced.

Another power company will inaugurate its system at the end of the week, viz., the Lancashire Electric Power Company. G.

Dominion of Canada.

Ottawa, Ont., October 14.—The Canadian minister of marine and fisheries has been recently in consultation with Mr. Fisaback of the Marconi company, regarding the installation of wireless telegraphy on the Pacific Coast. The intention is to have stations built along the British Columbia shore, and to have them placed where it will serve for communication with outgoing and incoming vessels to and from the Orient and Australia.

It is said that the reason for the delay of the Grand Trunk Railway Company in equipping the St. Clair tunnel with electricity is because the company is anxious to investigate the feasibility of Niagara power. It is a year since the fatality occurred in the tunnel, when six men lost their lives by gas. The Board of Railway Commissioners for Canada recommended the electrification of the tunnel, but this work has not yet commenced.

The par value of electrical concerns in Mexico, Cuba, Jamaica and South America, promoted and owned principally by Canadian capitalists, is now over $107,700,000.

The retirement of Sir William Mullock, the postmaster-general of Canada, may not be without interest to the Bell Telephone Company. Sir William was the author and promoter of the movement looking to government ownership of the telephone systems in this country, and his successor may not be so great an enthusiast in this particular. The special telephone committee of the Dominion Parliament which investigated the public-ownership question last winter, will likely report early in the coming session of Parliament, but it is not thought that any action will be taken to follow up the policy of Sir William Mullock. W.

Winnipeg, October 14.—The Peterboro radial railway has awarded a contract for the extension of its car barns on King Street; the addition will be built at the rear of the present ones and will be 40 by 60 feet, one story high and built of brick. This company during August carried 80,000 passengers.

The council of the city of St. Catharines has passed a by-law granting the Cataract Power Company a 25-year franchise, for which the city gets, free of cost, 215 incandescent lights of 16-candlepower capacity, which is estimated to be worth $1,000 a year. In addition the company is to erect a generating station at Decow Falls. This will make the cash value of the extensions about $150,000. The Toronto and Niagara Power Company has also applied for a similar franchise to that granted the Cataract Power Company, which was also carried, but held over, and not to come into force until the company has handed over to the city a lease of its hydraulic canal for waterworks purposes. The council at the same time gave the Bell Telephone Company a renewal of its franchise for another five years.

Entrance into Toronto is a formidable barrier to be overcome by the Ontario Electric Company's railway projected along the river and lake front from Cornwall to Toronto.

The City Council of London, Ont., has passed a by-law giving the London street railway permission to build the Edward Street belt line. This will add another mile and a half to the city's trolley system. Tenders will be called for at once, so as to get the line built by the end of the year.

Frederic Nicholls, general manager of the Canadian General Electric Company and also a director of the Electrical Development Company, states that all the plans are about completed for the extension of the power-transmission lines through the western peninsula of Ontario, from Niagara Falls. London is the objective point from the Falls for the present. Plans are complete and surveys will be made at once, going through Brantford, Paris, Galt, Guelph, Berlin, Hespeler, Woodstock, Ingersoll and the smaller towns, and supplying electric power to all the electric railways for operating purposes. The power house at Niagara will be completed sooner than was expected, as the steel frame for this is now being erected. The overhead work from Niagara has been completed, with the exception of a few intersections, where legal formalities have to be complied with. Power is promised for Toronto within three months, but not enough at first to run all the street cars.

The development of electric current from a water power at Lac du Bonnet on the Pinnewa channel of the Winnipeg River about 30 miles from Winnipeg, is rapidly approaching completion. At the present time over 1,000 men are employed. The power house is completed and is almost sufficient for the transmission of 10,000 horsepower. The rock excavations in the channel are also about completed. Already no less than 75,000 cubic yards of rock have been moved. This will provide sufficient water for the ultimate development of 30,000 horsepower, which will supply power to the street railway for running its cars, the balance being used for power and light for the city and also power for the manufacturers. H.

New York.

New York city, October 14.—Today on the Long Island Railroad a special train made up of the new steel electric motor cars made a trip to the Metropolitan race track near Jamaica, L. I. Representatives of the Westinghouse company and President Peters of the Long Island road were on board. The regular service will start next week, the trains being designed to run at 50 miles an hour. It is interesting to note that a portion of this line has been constructed through a marsh, special expedients having been adopted to keep out the water.

The Interborough Rapid Transit Company is persisting in its refusal to abolish the cumbersome transfer system between the subway and elevated trains in the Bronx. It says it cannot consider any proposal to do away with this system unless the Rapid Transit commissioners are willing to permit the construction of an additional track on the East Side elevated lines. Public sentiment is distinctly against any such suggestion.

President H. H. Vreeland of the New York City Railway Company (which controls all the surface traffic on Manhattan) in his annual report to the stockholders said that it was too early to determine whether the opening of the subway had been the cause of a falling off of receipts. He attributed a decrease of $596,881 in gross earnings mainly to the bad weather of last winter and to the excessive cost of snow removal. For 1905 the gross earnings were $20,888,124 and net $8,616,700. But with charges of over $11,000,000 the deficit is $2,796,943.

F. D. Underwood, president of the Erie Railroad, stated on Tuesday that a committee was considering the electrical equipment of the line. "At first," he said, "this equipment will be in suburban territory. It has been demonstrated that electrical service is all right there. Arrangements are also being made for the installation of the most modern and efficient railway-signal service on the market."

The city of Paterson, N. J., has granted a franchise to the New York and North Jersey Rapid Transit Company, which proposes to build an electric railway between New York and Paterson and promises that the journey shall be performed in 20 minutes.

The new bridge over the Newtown Creek, Brooklyn, is now ready for use. This bridge has two large leaves, each weighing more than a thousand tons, but they are operated by means of electrical machinery in 30 seconds. Two trolley tracks will cross this bridge.

The New York Edison Company reports that there are now connected with its mains in Manhattan motors aggregating 100,275 horsepower. Among new or pending contracts for the service of the Edison company is a supply of current for the New York Custom House. Contracts for the equipment of this building were announced recently.

The Electric Vehicle Company is now exhibiting a new electrically propelled brougham, designed to travel at 18 miles an hour. The Baker Motor Vehicle Company is showing a very light electric delivery wagon, weighing only 750 pounds, with a radius of operation of 40 miles, at 16 miles an hour. Several other electrical vehicles are about to be put on the New York market.

The new Hamburg-American steamship Amerika, the largest steamship in the world, will arrive at this port in a few days' time. This vessel, which was built at Belfast, is fitted with electric elevators, telephones in the staterooms and electric baths.

The lockout of Electrical Worker' Union, No. 3, has now lasted 14 months and the International Brotherhood, as a last resort, has decided on a national strike against the members of the New York Electrical Contractors' Association.

D. W. W.

Texas.

Austin, October 13.—John A. Wallace of Chicago is promoting the building of an interurban electric line between Dallas and Tyler. The preliminary survey is being made. The proposed road will traverse a thickly populated section and touch at several towns. It will be about 125 miles long.

It is announced that sufficient funds have been subscribed by the people of Campbellton, Pleasanton and other places to insure the building of an interurban electric railway from San Antonio to Campbellton, a distance of about 50 miles. The proposed road will pass through Pleasanton. W. A. McCoy, a wealthy citizen of Campbellton, is promoting the enterprise. The road will carry both freight and passengers.

J. V. Watkins, who is promoting the building of an electric railway between Palestine and Corsicana, states that good progress is being made with the preliminary arrangements for the construction of the line. The road will be 57 miles long. Mr. Watkins has applied to the City Council of Palestine for a franchise for a street-railway system for that place. An eastern syndicate has also made a proposition to build an electric line between Palestine and Corsicana. The length of

the road by the route proposed by this syndicate would be 75 miles. It proposes to operate its power plant by waterpower.

D. P. Shepherd of Houston and associates have been granted a franchise by the board of county commissioners of Harris County to construct an electric railway over certain roads of the county, adjacent to the city of Houston. The proposed line will connect with the lines of the Houston company.

Mexico.

City of Mexico, October 12.—At a general meeting of the stockholders of the Aguascalientes Street Railway Company the proposition to increase the capital stock to $500,000 was ratified. At a meeting of the board of directors the work of converting the street-railway system of the company into electric lines was authorized. The officers elected were: President, Leon Signonet; vice-president and general manager, John Douglas; secretary and treasurer, Dr. Guadalaupe Ortega.

The work of constructing an interurban electric railway from Santa Rosalia to Ciudad Camargo is in progress. Ramon Favela is the engineer in charge of construction.

It is announced that an electric railway is to be built from Parral to the Palmilla mining camp by Pedro Alvarado, the multi-millionaire owner of the Palmilla mine. A preliminary survey for the proposed road has been made. It will handle both freight and passenger business.

La Electra Company has completed plans for improving and extending its street-railway system at Guadalajara and has submitted them to Governor Miguel Ahumada for official approval. These plans call for the expenditure of more than $3,000,000. The new power house which the company will build will cost $500,000. It will be located near the falls of the Santiago River at Juanacatlan. The plant will be 7,000 horsepower.

George G. Bergman of the City of Mexico has applied to the federal government for a concession to install a large electric power plant on the Blanco River, near Cordova. The electric current will be transmitted to towns and industrial centers in that region.

Ignacio Saldana will install a large electric power plant on the Rio del Salto. He has made application to the federal government for a concession for the establishment and operation of the plant.

Jose H. Rico, president of the Guadalupe de los Reyes Mining Company, has made application to the federal government for a concession to install and operate an electric-light and power plant near San Ignacio. The company which he represents will erect a dam at the juncture of the Plaxtla and Arroyo rivers and obtain waterpower for operating the electric plant from that source. The power will be transmitted to towns of that section and will also be used for operating the machinery of the mines of the Guadalupe de los Reyes Mining Company.

Luis E. Reyes of the City of Mexico will establish an electric power plant in the state of San Luis Potosi, at a waterfall on the Los Naranjos River. The electric power will be transmitted considerable distance.

An electric power plant will be installed on the Laguna de Catemaco, state of Vera Cruz, by Juan Simon Rodriguez.

Ohio.

Cleveland, October 14.—The Mansfield News, Mansfield, has arranged with the DeForest Wireless Telegraph Company for a station to be placed on the top of the building the newspaper occupies at the corner of Fourth and Walnut streets.

The proposed sale of the Springfield, Charleston, Chillicothe and Washington C. H. road will be considered by Judge Kunkle at Springfield in a few days.

The City Council of Cleveland passed a resolution at the last meeting providing that the applications of the Bradley Electric Lighting, Heating and Power Company and the Cleveland Light and Power Company for franchises shall be submitted to a vote of the people. M. A. Bradley, the well-known vessel owner and proprietor of power blocks in Cleveland, is the principal owner of the former, and C. V. Hard is president of the latter company.

Plans for the interurban depot at Toledo have been approved and Manager L. E. Beilstein of the Toledo Railways and Light Company has been authorized to proceed with the building. When it is completed four or five of the roads entering that city will make their headquarters in it.

The Bruce Electrical Company of Columbus has been incorporated with a capital stock of $25,000 by Robert L. Bruce and others. Mr. Bruce was elected president and general manager of the company, which will manufacture and sell electrical supplies, taking over the business started by Mr. Bruce three or four years ago.

City Solicitor Butler of Columbus has brought ouster proceedings against the Columbus Railway and Light Company, alleging that as a constituent company it has failed to pay over to the city two per cent. of its gross earnings as provided by the franchise.

With R. B. Van Courtland, a New York banker, as a passenger, the private car Josephine lowered the record 18 minutes on the Lake Shore Electric a few days ago. The gentleman wanted to make the distance from Toledo to Cleveland and catch a train home. The time for the 120 miles was three hours and 26 minutes.

The Wellman-Sever-Morgan Company of Cleveland has reduced its capital stock from $3,000,000 to $2,700,000.

The Ohio Central has arranged to meet competition on the electric roads by issuing twin tickets good for two people one way or one person for the round trip, with a five-day limit. The fare between Toledo and Bowling Green for a ticket of this kind will be 25 cents and between Toledo and Findlay $1.50. The Lake Shore and some other roads have issued commutation tickets between points where they are paralleled by electric roads. O. M. C.

Indiana.

Indianapolis, October 14.—Negotiations are well along for the disposal of a controlling interest in the Columbus Street Railway and Light Company to Chicago capitalists.

The Fort Wayne and Wabash Valley Traction Company, operating 80 miles of interurban road, is arranging to furnish power to run machinery for farmers along the line. Gasoline and steam engines are used extensively by farmers, but corn-shelling feed-cutting and other work is done by hand, and the company offers to furnish motors and build lines for a distance of one mile on each side of the track at cost. The farmers are agreeing to pay a reasonable sum yearly for the current, and the company expects to build up a big demand for power in a field which is now without electric service. Likewise the Indianapolis and Cincinnati Traction Company, operating between Indianapolis and Rushville, is furnishing current for lights to the intermediate towns and cities for street fairs free of cost. The increased traffic that these fairs occasion is sufficient incentive to induce this liberality.

The Louisville and Indianapolis Traction Company has filed articles of incorporation in Clark County, indicating its intention to build from Jeffersonville north to Columbus. The chief place for the business of the company will be at Jeffersonville.

The Muncie & Portland Traction Company has won every point in the litigation with the Pennsylvania road over the matter of a crossing at Red Key, where the contention became very bitter. The court dissolved the temporary restraining order granted the steam road and granted to the traction company a permanent injunction against the steam road from in any way interfering with the construction of the traction company's crossing.

A contract has been awarded to E. S. Russell of Chicago to build an interurban electric line from Columbus to French Lick by way of Seymour. The company will be incorporated with a capital stock of $1,000,000. This is the same interest that is reported to have secured control in the Columbus Street Railway and Light Company with a view of using the latter's plant to furnish power for the new road.

It is announced that the Indiana Union Traction Company will inaugurate the fastest schedule ever attempted by an interurban line in Indiana between Marion and Indianapolis by way of Anderson. There will be two fast trains, each one to be known as the "Marion flyer." The purpose of this fast train is to compete with the Big Four railroad "Winona flyer," which parallels the Union Traction line the greater part of this distance. The reduction of 30 minutes in the old schedule will make it the fastest interurban train in the state. S. S.

Michigan.

Detroit, October 14.—The village of Morrice made an offer of $2,000 bonus to Sutton & Mackey for erecting an electric plant. The Supreme Court has decided that the village had no right to give a bonus, and when the contractors sued the village officials the judge decided the contract also was illegal.

The state capitol at Lansing will have its dome illuminated with 1,000 incandescent lamps.

A new automobile system is in service at Monroe which furnishes transportation by the means of large automobiles seating 15 each. They are run on a three-cent-fair basis. At present but two machines are in use running between the depot, factory and down-town districts. Later it is proposed to operate a line to Adrian, touching at Milan, Tecumseh, Dundee and smaller towns. The plan seems to be a success, as over $2,000 worth of ticket books have already been sold. Monroe has not been provided with a street-railway system yet.

The trouble between the proposed electric line from Durand to Owosso and the Durand council has been settled and the erection of poles will be commenced in Durand at once.

The Michigan Hydro-electric Company of Grand Rapids and Manistee was incorporated under the Maine laws for $500,000 to furnish electric power from dams in the White and Manistee rivers.

The power house of the Detroit, Flint and Saginaw electric line is completed and cars are now in operation between Saginaw and Frankenmuth, furnished with power from Bridgeport, where the new power house is located. The building is situated on the bank of the Cass River and is 75 by 100 feet, with a stack 129 feet high. It has two engines of 350 horsepower each, direct connected to two 250-kilowatt generators. This will furnish the necessary power to operate all the cars when the line is extended to Flint, there to connect with the Detroit United railway for Detroit.

The plant of the Richmond Electric Light Company is said to be inadequate to run the new arc lamps ordered by the council, about a one-third larger engine being necessary.

The old welcome sign which blazed forth a welcome to each convention visiting Detroit from the City Hall has been torn down and sold for scrap. The City Hall is being remodeled and the new administration will dispense with the electric-light welcome.

The Detroit-Bay City Traction Company is not the successor of the Detroit, Pontiac, Lapeer and Northern Company as stated last week, as the Detroit-Bay City company will use an entirely new route between these cities. C. G. W.

Northwestern States.

Minneapolis, October 14.—Plans for an extensive increase in the size of the underground system of of the Minneapolis General Electric Company are being prepared. It is understood that Stone & Webster of Boston have come to the conclusion that relief from overhead wires is needed in many parts of the city, and that they will take immediate steps for the purpose of affording this relief.

The Electric Light and Power Company of Big Timber, Mont., has begun work on a new power station.

The question of purchasing power for the municipal lighting system at Sioux Falls, S. D., will be submitted to the people.

An electric-lighting system is proposed for Annandale, Minn. An election will probably be called shortly.

J. L. Robb has been appointed receiver for the Carroll (Iowa) Light, Heat and Power Company. The indebtedness of the company is estimated at $35,000, aside from a bonded debt of $100,000.

The Menominee (Mich.) Electrical and Mechanical Works, which were recently destroyed by fire, will be replaced at once with a complete new plant.

The Union Traction Company has been incorporated for the purpose of building an interurban line from Waterloo to Newton, Iowa, by way of Marshalltown. The company is capitalized at $100,000, with D. T. Denmead as president, and L. C. Norris, secretary.

The survey has been completed for the proposed trolley line from Muscatine, Iowa, to Iowa City. The line will cost about $900,000 and will reduce the distance to about eight miles less than the present steam road.

William and S. Mainland have sold their interests in the Union Light, Heat and Power Company of Fargo, N. D. Paul Doty was elected as president and O. G. Barnes as secretary of the reorganized concern.

The Ellendale (Minn.) Milling and Light Company has been organized and will build a mill and electric-light plant there. Frank Kycek is president and H. L. Dolge, secretary.

The council of LeRoy, Minn., has decided not to replace the electric-light plant recently burned until next spring.

The electric-lighting plant at Charles City, Iowa, has been sold by H. V. Fussell & Co. to F. O. Martin of Floyd, and A. L. Dodd. A number of extensive improvements are planned.

The Village Council at Belle Plaine, Minn., has voted to install a municipal electric-lighting plant. R.

Pacific Slope.

San Francisco, October 13.—With the passing and signing of an ordinance granting the Ocean Shore Railway Company a franchise and terminal privileges in the city and county of San Francisco, as stated last week, that company now has all the franchises necessary for the construction of its long-distance electric railroad between San Francisco and Santa Cruz, a distance of 83 miles. Important contracts for the construction of its power house and for electrical equipment are to be let within a few days. Construction work on the company's roadbed in San Mateo County is already under way.

Articles of incorporation of the Pacific Gas and Electric Company, the new corporation which is to take over the San Francisco Gas and Electric Company and the California Gas and Electric Corporation, were filed in San Francisco on October 10th. The new company has a capital stock of $30,000,000, one-third of which is in preferred stock and the balance in common stock. The incorporators include Eugene J. De Sabla, Jr., John Martin, Frank G. Drum, Garret W. McEnerney, John S. Dunn, Cyrus Pierce, John A. Britton, George K. Weeks, Frank B. Stringham, C. R. Parker and S. Foster Young of San Francisco, Carl Taylor of New York, Merrill O. Evans, Jr., of Berkeley, A. N. Kemp of Oakland and George W. Lewis of Alameda.

The Yosemite Valley Railroad Company of this city was reorganized this week with a new board of directors. The board as now constituted includes the following-named gentlemen: William H.

Crocker, Henry T. Scott, N. D. Rideout, Harry L. Tevis, Thomas Prather, W. W. Garthwaite and Frank G. Drum. Mr. Drum was elected president, Mr. Rideout vice-president, and J. H. Ellis, secretary. After the first meeting of the new board of directors it was announced that the proposed electric railroad between Merced and the Yosemite Valley will be built at once. Construction work has already been started, and it is expected to have the road, which is approximately 80 miles in length, completed within one year.

The Rathdrum Light and Power Company of Rathdrum, Idaho, has been reorganized and will hereafter be known as the Rathdrum Electric Company. The ownership is largely the same as before.

I. W. Anderson of Spokane, Wash., and A. Welch of Salem, Ore., representing Rhoades, Sinkler & Butcher of Philadelphia, have bought the plant of the Lane County Electric Company at Springfield, Ore., and contemplate a number of changes in the near future.

The Valley Electric Company has been incorporated at Los Angeles, Cal., by R. F. Davis, E. A. Miller and A. Morris of Los Angeles, and T. D. Allin and B. Galbraith of Pasadena. The organizers of the company had already secured an electric-lighting plant at Santa Maria, Cal., and the company was organized to take over and operate this property.

Among the franchises for electric street railways which have been granted or applied for within the last few days are: Two for interurban electric lines connecting Centralia and Chahelis, Wash.; one by the Central California Traction Company for a line connecting Stockton, Cal., with Lodi and other towns in San Joaquin County; one by T. W. Sheehan, for the construction of a line connecting Sacramento, Cal., with the towns of Perkins, Florin and Elk Grove, and one to the St. Helens Public Service Company, for lines along the streets of Vancouver, Wash.

The West Coast Electric Light and Power Company has been incorporated in San Francisco with a capital stock of $25,000 by J. F. Hathaway, T. F. Fogelsang, C. R. Lundberg, W. T. Hume and C. Ulmer. A.

PERSONAL.

The death is reported of Mrs. Annie Burleigh, wife of Vice-president John Burleigh of the Public Service Corporation of New Jersey.

J. Robert Crouse of the National Electric Lamp Company of Cleveland was one of the visitors at the Chicago advertising show last week.

Among the new directors of the Wabash railroad elected recently is Col. R. C. Clowry of New York, president of the Western Union Telegraph Company.

W. Jac Marland, an electrical engineer well known both East and West, is now associated with the Chicago office of the Gould Storage Battery Company.

J. F. Hawkins, manager of the Department of Publicity of the Cutler-Hammer Manufacturing Company of Milwaukee, was in Chicago last week. Mr. Hawkins was on a short vacation trip and took the opportunity to visit the advertising show held in Chicago.

Thomas F. Ryan, the New York traction magnate, has given orders for the construction of a tomb for himself and his wife in the new Catholic Cathedral at Richmond, Va. Mr. Ryan is spending approximately half a million dollars for the erection of this cathedral.

H. M. Klingenfeld, for many years advertising manager for the National Electric Company, Milwaukee, will sever his connection with that company on October 31st. Mr. Klingenfeld has accepted a position in the advertising department of the Iron Age, with headquarters in Chicago.

Arthur Frantzen, secretary and treasurer of the Arthur Frantzen Company of Chicago, has just returned from a four months' sojourn in Mexico City, Mex., where he has been arranging business affairs. The company has leased new quarters in that city for the next two years to handle its supply and construction business. Charles W. Cobb, who was formerly with the Central Electric Company and the Western Electric Company of Chicago, has left for Mexico City to represent the Arthur Frantzen Company as manager of the business at the new office.

The Niagara Falls Power Company announces the following changes, occasioned by the death of the late William B. Rankine: Mr. deLancey Rankine has retired from the office of third vice-president of the power company, and it is understood that at its first meeting he will be chosen to fill the vacancy in the board of directors caused by the death of William B. Rankine. Mr. deLancey Rankine will devote all of his time to the affairs of the Cataract Power and Conduit Company, of which company he is both treasurer and secretary. Mr. Philip P. Barton, heretofore superintendent of the Niagara Falls Power Company, has been appointed general manager of the business and operations of the company at Niagara Falls. The office of second vice-president remains unfilled.

ELECTRIC LIGHTING.

C. V. Fuller is installing at Kansas City, Mo., an electric plant to charge the batteries on coaches of the Chicago and Alton.

The Grand Island (Neb.) Electric Company has been incorporated with a capital of $60,000 by Arthur F. Villa, G. H. Payne and others.

The Chas. DeWatteville Electric Light and Ice plant in Holdenville, I. T., valued at $25,000, was destroyed by fire. The plant will be rebuilt without delay.

Powers, Higby & Co. have a franchise for 25 years for furnishing electric light and power in the city of Valparaiso, Ind. The overhead work has just been completed, and current was turned on October 16th.

There is talk of a municipal electric-light plant in New Brunswick, N. J., owing to some dissatisfaction with the rates and service of the Public Service Corporation.

The shareholders of the Mexican Light and Power Company, at a special meeting held in Montreal, ratified the plan of the board of directors to increase the capital stock of the company. The capital has been $12,000,000, which has now been increased to $16,000,000.

ELECTRIC RAILWAYS

The Union Traction Company at Marshalltown, Iowa, has been incorporated with a capital of $100,000.

It is expected that the electric-railway system of Belfast, Ireland, will be in working order about November 25th.

The St. Louis, Lakewood and Grant Park Railway Company of St. Louis has been incorporated with a capital stock of $300,000.

Serious industrial disturbances are reported from Moscow. The employes of the electric street railways by a secret ballot voted to continue the strike, and as a consequence no cars are running.

The Chicago and Milwaukee Electric Railroad Company reports net earnings for September of $42,014.34, an increase of $5,698.04 over September of last year. The net earnings from January to September inclusive were $239,019.67.

The supplemental report of the Interborough Rapid Transit Company of New York for the year ended June 30th shows a total income of $7,960,907, a decrease of $722,231 over the preceding year. The total charges were $7,009,514, a decrease of $252,102. This leaves the net income $951,393. The total income of the subway division was $1,970,119, the net income being $1,330,528.

The Delaware Electric Traction Company, incorporated at Dover, Del., some years ago, with the intention of constructing a trolley line from Smyrna, the northern boundary of Kent County, to Milford, the southern boundary, has been turned over to new directors, who will secure a new certificate of incorporation under the name of the Smyrna, Kent County and Delaware Bay Traction Company. Already the rights-of-way have been secured through the towns of Clayton and Smyrna, with the privilege of extending the line to Woodland Beach. As soon as the nine miles of road from Clayton to Woodland Beach are completed the extension will be made on down the line to Dover, and thence to Milford.

Bids for the construction and equipment of an electric line from South St. Louis to Hillsboro, the county seat of Jefferson County, Mo., will soon be asked for by the St. Louis, Hillsboro and Southern Railroad Company. The road will be 40 miles long and will run through the foothills of the Ozark Mountains. The company is incorporated for $1,200,000, the bond issue being $1,600,0000. Grading will be begun soon and the road will be standard gauge, it being the intention to do a freight, express and passenger business. Both steam and waterpower will be used. Henry M. Bowen, formerly with H. M. Byllesby & Co. of Chicago, is the general manager of the road, with offices at 415 Locust Street, St. Louis. Later it is the intention of the company to extend the line 168 miles farther south than the present terminus through a rich lead, zinc, coal and timber district.

SPACE TELEGRAPHY.

The first official wireless telegram or aerogram over the route of the American De Forest Wireless Telegraph Company from Cleveland to New York was a message of congratulation from Tom L. Johnson, mayor of Cleveland, to Mayor McClellan of New York, on the latter's renomination.

Gen. Greely, chief signal officer of the army, has decided to install a space-telegraph system between Zamboango and Jolo, Philippine Islands. Gen. Greely has not been inclined to establish a wireless system in the Philippines on account of the necessity for experts, but the cable between Zamboango and Jolo has been so often interrupted that wireless seems the best system.

One of the features of the recent National Firemen's convention in Kansas City was a demonstration of a wireless fire-alarm system by Bert Halderman, superintendent of the American DeForest Wireless Telegraph Company. The sending apparatus was contained in a small cabinet on the stage, the cabinet being not much larger in size than the ordinary fire-alarm box. Two hundred feet away alarm bells were rung at the will of the operator.

PUBLICATIONS.

A new weekly publication, to be known as the Interurban Railway Journal, and devoted exclusively to the interurban-railway field, will be issued in Indianapolis on November 4th by a $50,000 company formed for the purpose. E. H. Talbot, formerly of the Railway Age, will be the manager.

The first number of the Journal of Engineering of the University of Colorado at Boulder, Colo., has made its appearance. It is an annual, published by the associated engineering societies of the university. The editor-in-chief is Harold Fulwider of the Electrical Engineering Society. The magazine contains 84 pages of reading matter and is well printed and illustrated. The table of contents shows, among others, articles on multiple-voltage speed control for motors, the differential telephone, compounding of rotaries, insulator testing and a large electromagnet for eye surgery. The first issue of the new journal is entirely creditable to the editors and authors and compares well with similar publications.

SOCIETIES AND SCHOOLS.

The Franklin Institute of Philadelphia has announced its programme of lectures for the season of 1905-1906. The winter course, to be given in January and February, 1906, includes as lecturers Dr. F. A. C. Perrine of New York on "Power Transmission," Charles E. Waddell, electrical engineer, Biltmore estate, Biltmore, N. C., on "Forest Denudation and Its Effects," and H. F. J. Porter of New York on a subject to be announced. On the preliminary programme of the sections appears an opening address before the mining and metallurgy section by A. E. Outerbridge, Jr., of Philadelphia, besides a number of papers of engineering interest.

The first meeting of the second year of the Electrotechnic Club of Fort Wayne, held last week, brought out a good attendance. The meeting was addressed by Mr. Wood, and the subject of transformers, which was to have been treated in a paper by Mr. Edwin Agnew, was postponed until the next meeting. The club is sending out its year book, giving the constitution and by-laws, and the names of all the members of the club. It is the purpose, during the present year, to have talks and papers on various topics, including electric arc lamps, series arc dynamos, steam turbines, gas engines, railway boosters, air brakes, electric meters and transformers. E. N. Jenison is president, and C. C. Burr, secretary.

The next meeting of the American Institute of Electrical Engineers will be held at No. 44 West Twenty-seventh Street, New York, on Friday evening, October 27th. The general subject to be discussed at this meeting is "Lightning and Lightning Protective Apparatus." The following papers will be presented: "Some Experiences with Lightning Protective Apparatus," by Julian C. Smith of the Shawinigan Water and Power Company, Montreal; "Performance of Lightning Arresters on Transmission Lines," by A. J. Neall, electrical engineer with the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa.; "Lightning Arresters on Italian High-tension Transmission Lines," by Philip Torchio, chief electrical engineer of the New York Edison Company.

MISCELLANEOUS.

A unique method is to be employed by the Providence (R. I.) Young Men's Christian Association in connection with the teaching of its evening classes in electrical work. In addition to the ordinary classroom work, arrangements have been made with the Rhode Island company and the Narragansett Electric Lighting Company by which practical lessons will be given at the power houses and substations in line with the work taken in the classroom.

It is announced by the management of the Madison Square Garden Electrical Show of New York that reservation of space can no longer be guaranteed to intending exhibitors. In explanation of this stand the management reports that it has on hand enough applications for reservation to fill the garden twice over, and in justice to itself and to the exhibitors who have already signed contracts for their space it feels that it is now necessary to establish the rule of "first come, first served."

When the shafts from the bore of the Chicago subway tunnels to the tracks of the Chicago and Alton at Van Buren Street were opened on October 13th the first actual connection between a railroad and the tunnels was accomplished. Five shafts connect the railroad with the subway and will be used for coal traffic. The Alton brings from 75 to 100 carloads of Illinois bituminous coal daily, and

all intended for the downtown district will be delivered through the tunnel. Connection with the warehouse by elevators will be made later.

Aluminum production in the United States, according to the report of the United States Geological Survey for 1904, has increased nearly tenfold in as many years. Two reasons explain this large growth—economic production, which has initiated low prices and increased consumption, especially in the electrical industry. The output of 1904 was 8,600,000 pounds, as compared with 7,500,000 pounds in 1903 and 7,300,000 pounds in 1902. It was not until 1891 that the output reached 100,000 pounds, but from that date the increase has been rapid.

Reinforced concrete is now used for chimneys and other construction exposed to hot gases and disintegrating fumes. Some remarkable chimneys are now being put up in different parts of the country made entirely of concrete, reinforced by steel rods. A number of these would be remarkable alone for their height and size aside from their unique construction and in their resistance to the action of gases and heat. One stack of this type is under erection at Butte, Mont., for one of the large smelting works. This chimney, when completed, will be 350 feet high, and will measure 18 feet inside diameter, constituting one of the largest chimneys in the country. By means of adjustable, segmental, sectional molds the entire chimney is built in one continuous solid mass.

The Canadian government, on the recommendation of the minister of the interior, has voted a sum of $15,000 to be expended in making a trial of the Héroult process of manufacturing steel by electricity. The plant is now in course of construction at Sault Ste. Marie, and will include not only the production of steel but the smelting of pig iron, by the electric current. It is stated in addition that Dr. Héroult, who has spent some time recently in the United States, has arranged with a steel company at Syracuse, N. Y., to build a plant for the production of electric steel billets as material for the manufacture of tools, piano rods and other special lines. The process to be adopted will consist of the combination of an electrical furnace with the ordinary converting plant, the steel being purified by the Héroult electrical treatment.

TRADE NEWS.

At a directors' meeting last week of the Crocker-Wheeler Company, manufacturer and electrical engineer of Ampere, N. J., the regular quarterly dividend of 1¼ per cent. was declared.

Probably the most brilliant exhibit at the advertising show at the Coliseum in Chicago, just closed, was that made jointly by the Chicago Edison Company and Federal Sign Company and showing to advantage a variety of electric signs.

Plans are being prepared and building operations will be commenced at once on a four-story-and-basement brick and steel factory addition to the plant of the National-Acme Manufacturing Company of Cleveland. The company builds the Acme automatic multiple-spindle screw machine and manufactures also the product therefrom—set screws, cap screws and special milled parts.

The General Electric Company says that it has been awarded gold medals by the Lewis and Clark Exposition for a long list of its products. A gold medal was awarded for the best exhibit in the electrical department and the list includes steam turbines, motors, arc lamps, controlling apparatus, etc., besides a gold medal for progress and development in the art and one for the new metallized carbon-filament lamp.

The Navy Department, through the Bureau of Supplies and Accounts, is inviting sealed proposals until October 31st for furnishing eastern navy yards with the following: Schedule, 181, incandescent lamps; schedule 182, electric soldering irons. The bureau is also inviting sealed proposals until November 14th for furnishing the torpedo station at Newport, R. I., with the following: Schedule 188, conductor cable, testing magnets, copper wire, dry-battery cells, battery boxes, firing-battery and junction boxes. On November 21st the bureau will open bids for furnishing western navy yards with the following: Schedule 178, electrical fittings; schedule 179, motors. Blank proposals for all the above can be obtained on application to the bureau at Washington, D. C.

The Bureau of Supplies and Accounts, Navy Department, is inviting sealed proposals until October 24th for furnishing eastern navy yards with the following: Schedule 167, electrical cable; schedule 168, incandescent lamps, thermostats, sockets, wire, conduit and fittings, electrical supplies. On October 24th the bureau will also open bids for furnishing a quantity of elevating and ramming electrical equipments at the works of the William Cramp & Sons' Ship and Engine Building Company at Philadelphia, for the U. S. S. Idaho and Mississippi. The schedule number is 173. Blank proposals will be furnished on application to the bureau or to the navy pay offices in New York and Philadelphia.

BUSINESS.

National sparkers, manufactured by the National Battery Company of Buffalo, N. Y., embody in the 1906 model a number of improvements. The company points out that there are no complicated parts to confuse the user, and the terminals are noncorrodible and will not break off when the connections are tightened. Ten thousand of these sparkers were sold in the last year.

The Galveston, Houston and Henderson (Tex.) railroad, of which T. J. Powers is roadmaster, installed on June 28, 1905, on a portion of its road where there is an exceedingly heavy traffic, including switching, 25 Percival concrete steel railroad ties manufactured by the Percival Manufacturing Company of Galveston. Mr. Powers announces that after 60 days' trial the ties are in good condition, and it is his opinion that they are as near everlasting as anything could be made.

Three orders of large size have recently been received by the Westinghouse Machine Company of East Pittsburg, Pa., for its Roney mechanical stoker. One order is from the Jones & Laughlin Steel Company of Pittsburg, Pa., and calls for 16 114-inch by 24-grate stokers; one is from the Lehigh Valley Traction Company of Philadelphia, Pa., for eight 130-inch by 20-grate stokers, and the last is from the Pressed Steel Car Company of Pittsburg, Pa., covering six 100-inch by 20-grate mechanical stokers. These stokers are of the inclined rocking-grate type with removable fuel plates, and are provided with the necessary actuating mechanism for automatically controlling the motion of the grate-bars and the supply of fuel. They will be capable of burning low-grade bituminous coal efficiently and without smoke. In addition to these orders several smaller ones have been received.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) October 10, 1905.

801,199. Process for the Production of Metals of the Alkali Group by Electrolysis. Edgar A. Ashcroft, Weston, via Runcorn, England. Application filed October 3, 1903.

An alkali metal may be obtained by providing a suitable compound of the alkali metal as an electrolyte, using an alloy of the alkali metal as an anode and directly producing the alkali metal by dissolving it from the anode by a suitable current, depositing the metal at the cathode without consuming the electrolyte.

801,201. Reversing Switch. Isaac F. Baker, East Orange, N. J., assignor to the Sprague Electric Company. Application filed June 28, 1904.

Two spiders are secured to a shaft side by side with means for rocking the shaft. Uninsulated contacts are carried by each spider, one or more of the contacts of each spider extending over but not contacting with the other spider. A set of stationary contacts are opposite each spider and adapted to engage therewith.

801,214. System of Motor Control. Frank E. Case, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 2, 1904.

A controller of the separately actuated contact type has several electromagnets for operating the contacts of the controller. A master controlling switch controls the supply of current to the actuating windings of the electromagnets. Operating means are provided for the master controlling switch, a spring connection being between the switch and the operating means. A governing device retards the movement of the master controlling switch.

801,224. Automatic Electric-motor Starter. William M. Cummiskey, Newark, N. J. Application filed July 20, 1904.

Associated with an electric motor are resistances in a series therewith and a manual switch. Cut-outs for the resistances are provided with magnets for holding the cut-outs open. Current is controlled by the manual switch, and means less powerful than the magnets tend to close the cut-outs.

801,225. Trolley and Trolley Support. Harry P. Davis, Pittsburg, and Christian Aalborg, Wilkinsburg, Pa., assignors to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed January 3, 1905.

In a trolley and trolley support are a boom, a bow pivoted to the outer end of the boom, means for raising the bow and means actuated thereby for raising the boom.

801,226. Trolley for Electric-railway Vehicles. Harry P. Davis, Pittsburg, and Christian Aalborg, Wilkinsburg, Pa., assignors to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed March 6, 1905.

Combined with a cylinder adapted to receive pneumatic pressure are a piston and a lazy-tongs structure, resilient connections between the structure and the piston and a contact device that is supported and raised and lowered by the structure.

801,231. Index Attachment for Telephones. Fred E. Farmer, Alliance, Ohio. Application filed April 28, 1905.

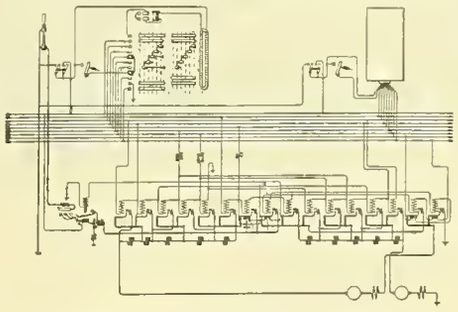
A cylindrical index-card holder is revolubly mounted on the telephone.

801,238. Means for Controlling Circuit-breakers. George H. Hill, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 8, 1904.

Devices for setting the circuit-breaker are associated with means for controlling their operation. A holding coil maintains the circuit-breaker in its set position, and an overload coil is adapted to open the circuit through the holding coil to permit the circuit-breaker to open. (See cut.)

801,239. Control Apparatus. George H. Hill, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 1, 1905.

A series of electrically controlled main switches and a normally closed auxiliary switch connected to one of the



NO. 801,238.—CIRCUIT-BREAKER CONTROLLER.

main switches by means of a dashpot and arranged in the controlling circuit of another main switch are the features of novelty.

801,243. Electric Measuring Instrument. Frank Holden, Rugby, England, assignor to the General Electric Company, Schenectady, N. Y. Application filed January 2, 1904.

In an electric meter of the motor type are two binding posts and two sets of laminations of conducting material, one set connected at one end to one binding post and the other set connected at one end to the other binding post, the laminations carrying the field current of the meter motor.

801,245. Electrical Controller. Henry D. James, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed February 27, 1905.

Co-operating with the motor and a resistance are means for effecting changes in the potential on the leads of the armature circuit of the motor, means for cutting the resistance into the circuit and automatic means for cutting the resistance out of the circuit. Other devices delay the cutting of the resistance out of the circuit and are dependent in their operation upon the difference between the electromotive force applied to the armature circuit and the counter electromotive force of the motor.

801,250. Supporting Clamp for Electric Conductors. James R. Kearney, Topeka, Kan. Application filed December 15, 1904.

A pair of superposed clamping-plates, binding means connecting these plates and a hanger connection disposed at one side of the plane of the conductor extending between the plates are the parts of the device.

801,255. Armature Cross Connection for Electrical Machines. Chester B. Mills, Wilmerding, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed October 20, 1904.

In an electrical machine are an armature winding having bracket clips attached to and in electrical contact with the ends of certain of the coils and a set of overlapping ring segments symmetrically disposed around the armature, each of the segments having its ends fastened to two of the bracket clips.

801,260. Base Cup for Incandescent Lamps. William D. Packard, Warren, Ohio. Application filed September 14, 1903.

The base cup of porcelain has a centrally perforated elongated securing stem adapted to fit in and be cemented to the coupling sleeve of the ordinary incandescent-lamp base. An enlarged cup shaped holding portion is adapted to receive the neck of a bulb too large to fit within the same base.

801,261. Electric-lighting System. Granville E. Palmer, Boston, Mass., assignor of one-half to Charles B. Price and Frank S. Price, Boston, Mass. Application filed November 16, 1903.

An electric-lighting system comprises a number of lamp circuits in multiple branches with means operable from one point and independent of the lamp circuits for selectively cutting out the lamp circuits. Other apparatus under the control of the first-mentioned means automatically cuts out each lamp circuit independently of the others on the failure of the circuit. (See cut on next page.)

801,265. Conductor Terminal. Raoul Prugger, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed January 3, 1905.

One terminal is provided with a split sleeve having a contact face. A second terminal has a similar contact face, and means are supplied for clamping the two faces together.

801,285. Electric Controller. Robert Wellens, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed December 19, 1904.

Combined with a contact ring are a concentric set of contact strips and two flexibly and electrically connected contact blocks that respectively engage the ring, and the strips. A spring-actuated lever and a single means interposed between the lever and both of the contact blocks permit independent automatic adjustment of the blocks.

801,288. Quick-break Electric Switch. Herbert C. Wirt, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 5, 1902.

A switch and cut-out are mounted in recesses in one face of a base, and a single-piece connecting strip is placed between a contact of the switch and a contact of the cutout passing through the base.

801,308. Lock for Automatic Telephone Switch-Shafts. John Erickson, Chicago, Ill., assignor to the Automatic Electric Company, Chicago, Ill. Application filed December 31, 1904.

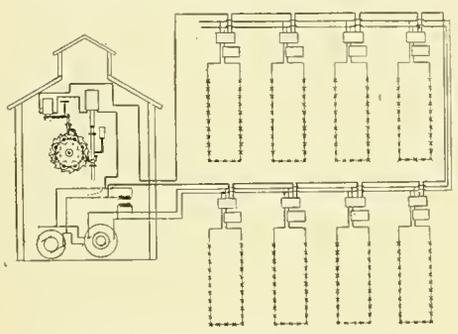
Electrical connections are established by a switching mechanism and a locking device is adapted, when a connection of a certain character is made, to prevent the person who brought about the connection from restoring the switch to its normal condition. The switch, however, is releasable by the subscriber when used for making other connections.

801,335. Trolley. Eugene J. Parker, Providence, R. I. Application filed December 23, 1904.

A yoke is pivotally mounted upon the trolley head on antifriction bearings. A wheel is mounted in the yoke and springs are disposed between the pivot and the bearings and intermediate the head and yoke.

801,364. Safety Device for Lamp Signals. Fred B. Corey, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 19, 1904.

A lamp for lighting the signal has a thermostat exposed to the heat of the lamp, an electric circuit being controlled by the thermostat. A train-stopping device, a



NO. 801,261.—ELECTRIC-LIGHTING CIRCUIT.

magnet winding included in the circuit and controlling the device and a switch for breaking the circuit independently of the thermostat are the other features.

801,380. Apparatus for Electrostatic Separation of Substances of Diverse Electric Susceptibilities. Charles H. Huff, Brockton, Mass. Application filed August 6, 1904.

In an electrostatic separator are a rotary metallic electrode and an oppositely charged electrode of conductive material provided with a dielectric envelop having an effective area so small in relation to the repelling electrode as to effect a material convergence of the lines of force.

801,419. Electric Measuring Instrument. Elihu Thomson, Swampscott, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 15, 1905.

An electric measuring instrument comprises a magnet having a small air-gap, a metal damping plate movable in the magnetic field with small clearance and a current-measuring coil carried by the plate through the field and bounded by planes co-incident with those which bound the plate.

801,440. Apparatus for Moving Switch Rails. John P. Coleman, Edgewood Park, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed June 23, 1905.

An electric motor moves the switch rails.

801,452. Sparking Device. Benjamin G. Gilbough, Chicago, Ill. Application filed December 30, 1904.

An ignition device comprises a casing, an insulated core provided with a fluid passage, a wheel having blades registering with the passage and an electrode actuated by the wheel and carried by the casing.

801,467. Electric Fuse or Cut-out. Benjamin S. Luther, Boston, and Leonard B. Buchanan, Woburn, Mass., assignors to the Chase-Shawmut Company, Newburyport, Mass. Application filed March 6, 1905.

In an electric fuse or cut-out are a shell or case having a hole, a fuse wire contained in the shell adjacent the hole, an indicating device at the hole and a flame-resisting screen crossing the hole.

801,487. Controller. Leonard A. Tirrill, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 3, 1904.

A rotatable member provided with cylindrical contacts co-operates with contact fingers. A thin ribbon conductor is wound edgewise upon the member in a spiral having its convolutions insulated from each other and the member. Rings are located at the opposite ends of the spiral for clamping the spiral to the member.

801,497. Electric Meter Bearing. James J. Wood, Fort Wayne, Ind. Application filed November 8, 1904.

The armature spindle has a socket in its upper end forming an oil cup; the free lower end of a flexible pin enters the socket.

801,532. Device for Increasing the Adhesion Between Wheels and Rails. Robert C. Lowry, Seattle, Wash. Application filed December 5, 1904.

The adhesion of the brakes on the wheels is increased by the action of an electromagnet.

801,536. Face Plate for Electric Switches. Norman Marshall, Newton, Mass. Application filed January 19, 1905.

Details are described.

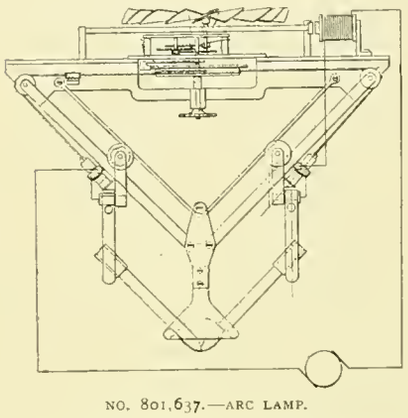
801,543. Railway Signal. Frank P. J. Patenall and George H. Dryden, Baltimore, Md. Application filed May 23, 1905.

The system embodies an indicator adapted to indicate danger, caution and clear. Two independent motor mechanisms for each indicator are adapted to move one motor from danger to caution position only, the other from caution or from danger positions to clear position. Switches are moved by the indicator, one controlled by the indicator at the home station to cut out the caution motor mechanism when the indicator is at clear and the other controlled by the indicator at the distant station to cut out the clearing motor mechanism when the distant indicator is at danger.

801,588. Transformer Cut-out. John P. Hetherington, Logansport, Ind. Application filed December 15, 1904.

In a three-wire system in combination with the high-tension mains are transformers, service-lines and switches. A motor and connections control the switches. Means controlled by the motor shunt the current.

801,589. Transformer Cut-out. John P. Hetherington, Logansport, Ind. Application filed January 4, 1905.



NO. 801,637.—ARC LAMP.

In a transformer cut-out mechanism are a large transformer, a small transformer, a motor, a switch and connections between the parts for automatically cutting in or out either of the transformers.

801,602. Electric Locomotive. Lincoln Moss, New York, N. Y., assignor to the Robins Conveying Belt Company, New York, N. Y. Application filed February 2, 1904.

One claim reads as follows: "In an electric locomotive, the combination with a truck, axles journaled in yieldably supported journal blocks on the truck and wheels on the axles, of a motor, a sprocket driven by the motor, a shaft mounted below the motor and substantially in the normal plane of the axles, a sprocket on the shaft, a sprocket chain connecting the sprockets, and means for continuously driving said axles from said shaft."

801,631. Apparatus for Controlling the Operation of Railway Switches. Charles C. Anthony, Philadelphia, Pa. Application filed March 6, 1905.

A push button machine is connected with a circuit controller. An electric motor, an indicator operated by the motor and a lock for the circuit controller effective when the motor is de-energized are essential parts.

801,637. Electric Arc Lamp. Emile Batault, Geneva, Switzerland. Application filed July 19, 1902. Renewed March 1, 1904.

Electrodes of the arc lamp have a thermic arc-striking device connected thereto, the device consisting of a resilient arc or bow held under tension by a conductor of electric conducting material. The conductor forms the chord of the arc and means support the electrodes in operative relation. (See cut.)

801,655. Means for Operating and Controlling Railway Points. Théophile Ducousso and Ferdinand Rodary, Paris, France. Application filed March 12, 1901.

A motor operates the points of the railway switch.

801,664. Adjustable Electric Lamp Holder. Henry F. Holtmann, Indianapolis, Ind. Application filed December 23, 1904.

Mechanical features are described.

801,718. Trolley Harp. Charles L. Hooper, Rochester, N. Y. Application filed December 27, 1904.

The trolley harp comprises parallel arms, a shaft supported by the arms, spring contacts embracing the shaft and secured to the arms at one end and a connection between the opposite ends of the contacts and the arms.

801,733. Automatic Block-signal System. Ross Logsdon and Elza S. Stotts, Perry, Iowa, assignors of one-third to Bayard T. Lindley, Des Moines, Iowa. Application filed January 18, 1904.

An automatic block-signal system embodies means whereby a passing train may set signals electrically and lever mechanism whereby a passing train may set signals mechanically, the electrical and mechanical operations being synchronous.

801,774. Conduit for Electric Cables or Conductors. Thomas E. Devonshire, London, England. Application filed November 5, 1904.

The conduits are provided with spigot ends having metal ferrules which are adapted to fit together.

801,778. Telephone System. Charles E. Egan, Chicago, Ill., assignor to the Egan Electric Telephone Manufacturing Company, Petersburg, Ill. Application filed September 26, 1899.

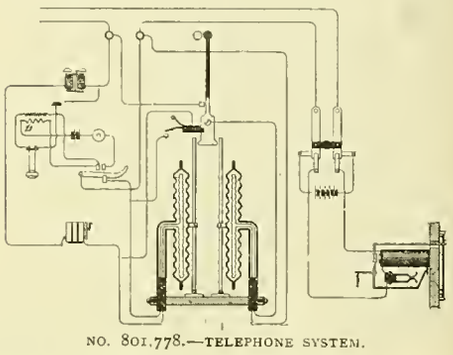
Heating coils are arranged in the circuit and chambers having corrugated diaphragms are adapted to be expanded by air heated by the coils. A circuit controller is provided for each telephone, the controller being operated in one direction by one corrugated diaphragm, and in the other direction by the other corrugated diaphragm. (See cut.)

801,779. Telephone System and Apparatus. Charles E. Egan, Chicago, Ill., assignor to the Egan Electric and Telephone Manufacturing Company, Petersburg, Ill. Application filed September 29, 1904.

Sub-station circuits of the system comprise a signal-receiving branch and a transmitter branch, a ringer magnet and means to switch the magnet into the signal branch for receiving signals, and into the transmitter branch to serve as an impedance.

801,780. Telephonic Apparatus. Charles E. Egan, Chicago, Ill., assignor to the Egan Electric and Telephone Manufacturing Company, Petersburg, Ill. Original application filed September 29, 1904. Divided and this application filed August 16, 1905.

In a telephone set are combined a ringer, a condenser, and an impedance coil in one unitary structure, the condenser and the winding of the ringer extending parallel and in close proximity to each other. They are elliptical in cross-section, with the major axes of the elliptical figures parallel.



NO. 801,778.—TELEPHONE SYSTEM.

801,784. Automatic Electric Switch. William S. Guthrie, Terrell, Texas. Application filed November 29, 1904.

Associated with a switch lever is an operating motor, a rigid spring-supporting strip and a spring normally imposed against the strip and rigidly secured thereto at one end, the spring being disposed to be moved back from the strip by the lever and to be suddenly arrested by the strip as the lever is retracted.

801,794. Electric Signal Device for Railroads. Ephriam H. B. Knowlton, Superior, Wis. Application filed April 27, 1905.

Details are described.

801,800. Signaling Through Submarine and Like Cables. Oliver J. Lodge, Birmingham, and Alexander Muirhead, London, England. Original application filed October 3, 1904. Divided and this application filed April 25, 1905.

Means for transmitting signals through submarine cables comprise a local circuit, a condenser and inductance in series in the local circuit, means for closing the local circuit to discharge the condenser, the capacity and inductance in the local circuit being such that the discharge is oscillatory and a cable adapted to receive electric impulses due to the discharge.

801,823. Automobile. Ernst J. Berg, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Original application filed April 20, 1904. Divided and this application filed May 22, 1905.

The invention contemplates the sparking mechanism of an internal combustion engine.

REISSUE.

12,393. Leading-in Wire for Incandescent Electric Lamps. Thomas A. Edison, Llewellyn Park, N. J., assignor to the Edison Electric Light Company. Application filed July 12, 1905. Original application filed January 13, 1891.

An incandescent electric lamp has leading-in wires composed of sections of different metals, each of such leading-in wires having a section of a metal whose co-efficient of expansion is substantially the same as that of glass.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on October 16, 1905:

391,010. Electric Meter. H. Bentz, York, Pa.
391,070. Dynamo-electric Machine. M. W. Parrish and W. R. Cole, Detroit, Mich.
391,224. Hand Magneto-electric Machine. E. B. Blair, Chicago, Ill.
391,270. Dynamo-electric Generator. G. Pfannkuche, Cleveland, Ohio, and A. Pfannkuche, Exeter, N. H.
391,351. Electrical Switch. J. S. Adams, Indianapolis, Ind.
391,356. Telephone Transmitter. W. H. Collins, Chicago, Ill.
391,394. Electric-railway System. D. G. Weems, Baltimore, Md.

WESTERN ELECTRICIAN

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LIBRARY OF ELECTRICAL ENG'G.

Development of the St. Croix Falls for Power Purposes.

By Charles H. Coar.

The usually quiet little town of Taylor's Falls, Minn., is now the basis of extensive operations which will mean much to the consumers of electricity in Minneapolis and St. Paul, Minn., for the falls of the St. Croix River will soon be utilized at that place to generate electricity for transmission into the Twin Cities.

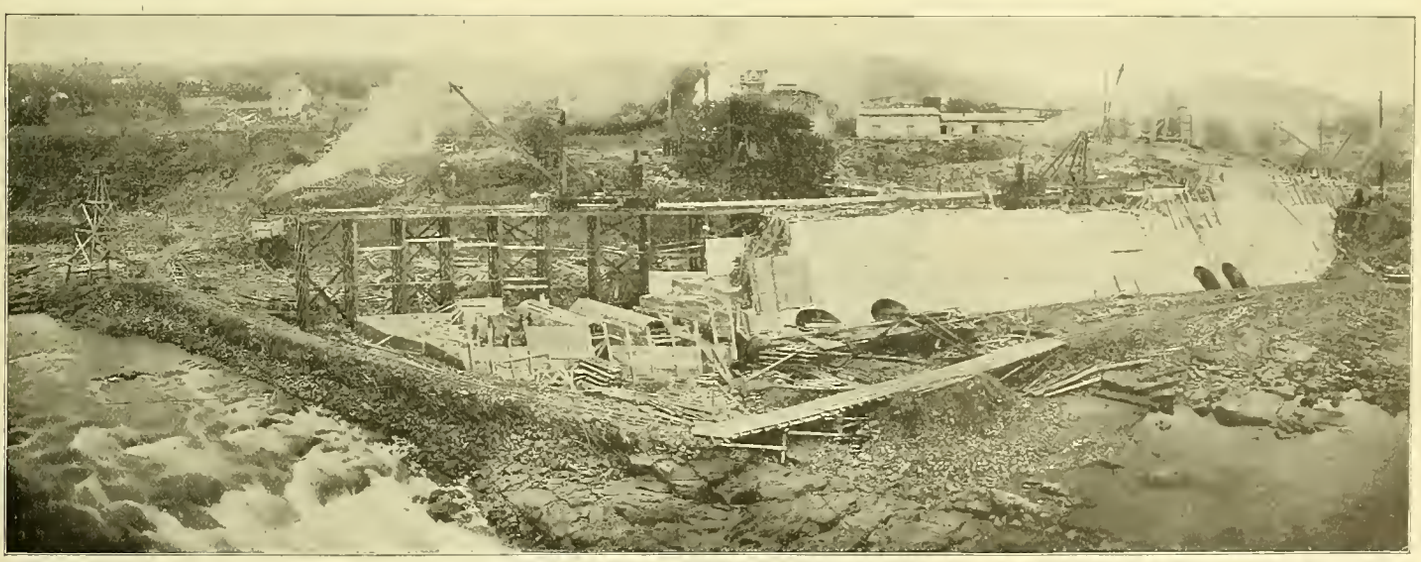
The St. Croix River forms part of the boundary line between Wisconsin and Minnesota, and has its source in the northwestern portion of Wisconsin. The river is a typical mountain stream and flows in a southerly direction, through some of the most picturesque scenery of the Northwest, into the Mississippi, which it joins a short distance below St. Paul. The high and rocky banks on each side of the river afford many natural opportunities for reservoir construction.

The point on the St. Croix where the dam is being constructed is about 40 miles from Minneapolis by air line and abounds in natural resources for heavy engineering construction, the rocky banks and river bed being especially firm and permanent here. The general view downstream from the site of the dam gives some idea as to the immediate surroundings. The developing company has acquired 21 miles of shore and flowage rights on each side of the river, including the Never's Dam property, situated about 10 miles up stream from the site chosen for the new dam. Never's Dam has heretofore been utilized principally for logging purposes. It is of timber construction and causes a reservoir to be formed by back flowage extending 11 miles up stream over considerable area.

The new dam, 10 miles below Never's Dam, will make a total of 21 miles of reservoir. An enormous amount of water will therefore be held in reserve by means of the two dams.

Concrete and trap rock, supported on the solid bed rock of the river, are the materials of which the new dam is being constructed. The view shown of the upper end of the dam will give some idea as to the nature of the work. Coffer dams have been constructed to change the river from its natural course while the first half of the new dam is under construction, after which the water will be forced to flow through the openings, provided in the portion of the dam completed while the remaining half is being finished.

General View Looking Down Stream.



Upper End of Dam on September 15, 1905.

POWER DEVELOPMENT AT TAYLOR'S FALLS, ST. CROIX RIVER.

The dam is to be 740 feet long by 50 feet high and will be 40 feet thick at its base, tapering to 10 feet at the top. The reservoir formed by this will be about 50 feet in depth, extending up stream to Never's Dam. A concrete dike, 1,200 feet in length, is also being constructed on the Minnesota side of the river a short distance above the site chosen for the dam, for the reason that there is a dip in the usually high banks along this portion. The dike will be 15 feet in height, which will be sufficient to prevent any overflow to the adjacent land. The arrangement is plainly shown in the accompanying sketch map.

The amount of temporary work in an undertaking of this size is necessarily great, but the work is being accomplished by the aid of modern machinery on as large a scale as possible. All modern appliances are being used, such as steam drills for rock drilling, of which there is a large amount, modern blasting facilities, rock crushers and concrete mixers. Concrete and crushed rock are handled in large quantities; approximately 500 yards of this material is laid daily.

The material is handled by derricks, steam tramways and overhead cables, the last-named being installed across the river for the purpose of conveying material between the two banks. The fact that the larger portion of the excavating is done in solid rock greatly increases the task, both from an engineering and financial view. But, by using dynamite liberally in conjunction with the steam drills, satisfactory progress has been made.

The new dam will be provided with a new type 40-foot automatic-trap log sluiceway in addition to a fishway. The canal through which the water will be diverted to the penstocks is to be 30 feet deep by 125 feet wide, cut in solid rock. Ultimately eight 14-foot steel penstocks will direct the water from this canal to the waterwheels under an effective head of 55 feet.

The power house is to be located on the Wisconsin side of the river and will be 100 by 200 feet, constructed of concrete on a permanent ledge of rock, the surface of which causes the walls of the power house to be much higher on one side than on the other side. At present the intention is to develop here about 12,000 horsepower, although the plant is being constructed for an ultimate output of 24,000 horsepower. Four steel penstocks will be utilized to supply four 4,200-horsepower horizontal turbine waterwheels of the Victor type. Four 2,500-kilowatt Westinghouse alternating-current generators will be directly connected to the turbines. The turbines will be controlled by Lombard governors. There will also be two 225-horsepower horizontal-turbine waterwheels directly connected to two 100-kilowatt exciter generators.

Current will be generated at 2,300 volts and transformed by banks composed of three transformers, one in each phase, to 50,000 volts for

transmission. The generators will be directly connected to the step-up transformers. Eight current and potential transformers will also be used in conjunction with the wattmeters, frequency meters and other recording instruments mounted on the totaling panels.

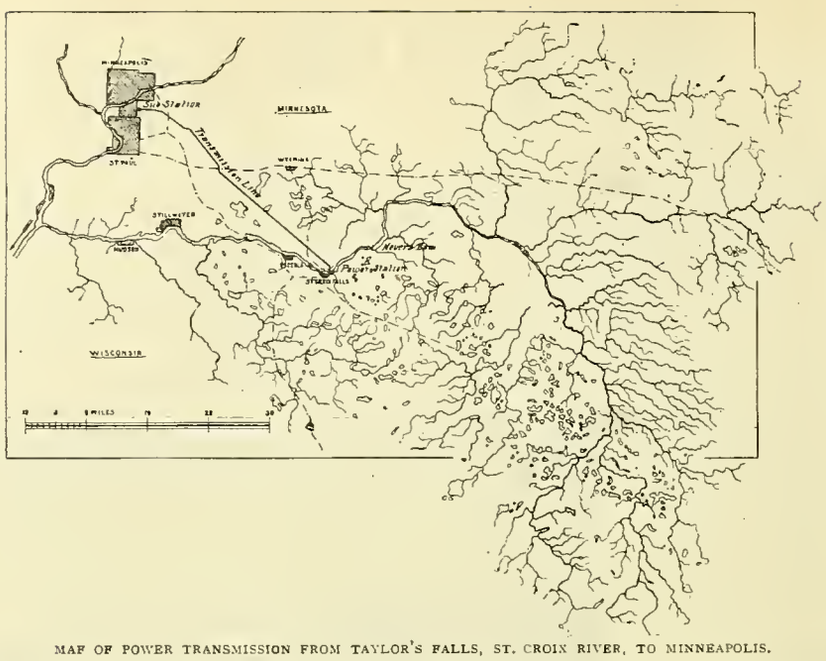
The generator panels in the switchboard are to be blue Vermont marble, 24 inches wide by 60 inches high, including a sub-base 25 inches high, thus making a total height of 90 inches. A galleyway will lead up to these panels, which will be arranged in a semi-elliptical form in the middle of one side of the generating room.

The totaling panel, upon which the various instruments are to be mounted, will be of the same material, but will be 40 inches high and will be located in the center portion of the generating room. Such instrument parts and oil-switch controls and accessories as appear on the face of the boards will be finished in dull black.

The greatest precaution will be exercised during the construction with a view to having the plant operate with the minimum amount of danger. The entire equipment of the power house will be of the most modern type and will include a large electric traveling crane for handling machine parts.

The company has purchased a 60-foot right-of-way in fee through some of the richest land in Minnesota. The location of the right-of-way is shown in the accompanying map. This right-of-way is in as direct a line as possible and is 40 miles long, terminating at the main or Broadway sub-station outside the city limits of Northeast Minneapolis, whence the power will be distributed as needed in that city and in St. Paul.

The right-of-way is cleared from all obstructions, and provisions are made for two transmission lines, one of which is being constructed at the present time. About 2,000 specially selected Idaho cedar poles will be used in this line, and also several steel towers. These steel towers will be used where long spans are unavoidable, the topographical surroundings in some parts necessitating spans of over 500 feet in length. The three-phase system of transmission being used, the arrangement



MAP OF POWER TRANSMISSION FROM TAYLOR'S FALLS, ST. CROIX RIVER, TO MINNEAPOLIS.

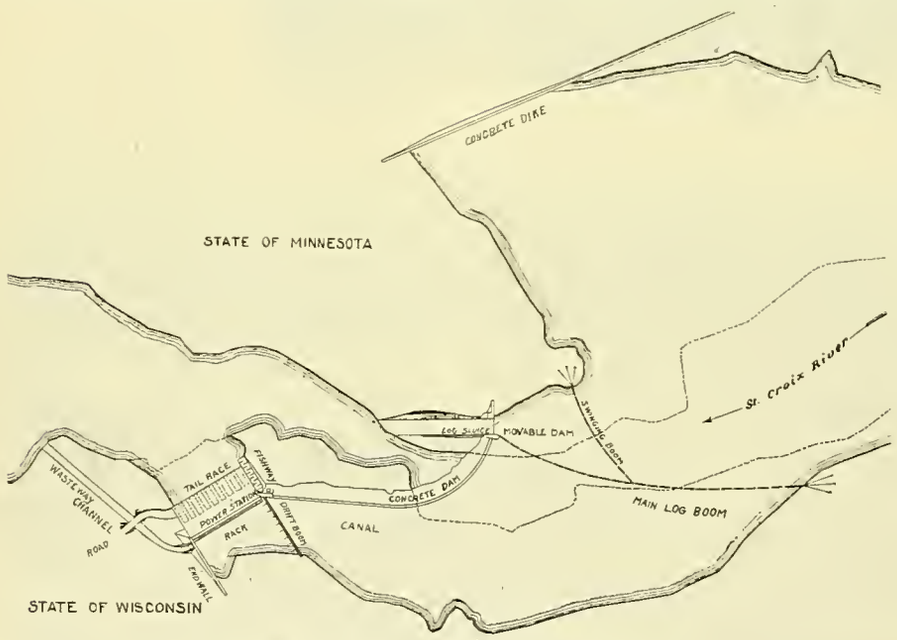
will be to mount one insulator on the pole top, while the remaining two will be placed on a cross-arm. The cross-arms are constructed for this special purpose, and are seven feet four inches in length.

Cross-arms are placed at such a point on the poles as will cause an 84-inch separation between any two of the transmission wires. Three-piece high-tension Locke insulators, each weighing about 23 pounds, complete, will be used throughout, mounted on steel pins.

Three conductors of No. 0000 stranded copper will be used for the transmission wires. For a short distance at each end of the transmission lines horn arresters will be provided for lightning protection, in addition to banks of Multiplex arresters in the stations. A dummy ground wire will also be stretched a short distance on the poles at each end to aid in obviating the effects of the current surges.

The main step-down sub-station, located on the outskirts of Northeast Minneapolis, will be constructed of brick and equipped with the most modern type of transformers, switchboards and other high-tension accessories. In this sub-station there will be located nine transformers, connected in banks of three each. Each bank will step the incoming voltage from 50,000 down to the voltage chosen for distribution purposes.

A system of line patrol will be begun upon the completion of the line, and a private telephone line is being installed to facilitate this work. In addition to this private line, the company has leased a toll line from the Northwestern Telephone Exchange Company, which can be used as an auxiliary in cases of emergency. Accommodations are being provided easily to enable the patrol men to connect their talking sets to the telephone wires.



POWER DEVELOPMENT AT TAYLOR'S FALLS, ST. CROIX RIVER.

The contract for this power development has been let to the Columbia Improvement Company of Boston. Stone & Webster are the general engineers who drew up the plans and outlined the entire improvement. Thomas Phee & Co. are subcontractors for the dam, canal, dike and power house, and the Platt Iron Works will furnish the turbine equipment under a sub-contract. It is hoped that the plant will be in operation by the spring of 1906.

Two different railroads have laid tracks directly to the works, large warehouses have been constructed by the different sub-contractors for storing material, offices and residences of a permanent character have been built—in fact, nothing has been left undone which would facilitate the work. At present about 600 men are employed, these being divided into day and night shifts. The work at night is readily carried on under the glare of arc and incandescent lights, a temporary electric-light plant having been erected for this purpose.

The Columbia Improvement Company is represented in the field by Mr. G. O. Muhlfeld, who is construction manager in charge of the entire improvement. Stone & Webster are represented by Mr. A. W. Hunking, hydraulic engineer, and Mr. Lee H. Parker, electrical engineer. The companies maintain offices at both St. Croix Falls and Minneapolis.

The Platinum Supply.

The war between Russia and Japan is probably responsible for the fact that the output of platinum in the United States increased from 110 ounces in 1903, valued at $2,280, to 200 ounces, valued at $4,160, in 1904. Owing to anxiety in regard to the fate of the platinum industry in Russia, the price of platinum rose about 10 per cent. during 1904. "It should not be understood," says Dr. David T. Day of the United States Geological Survey in a recent report on the production of platinum and allied metals in 1904, "that the slight rise of 10 per cent. in the price of platinum would serve as any great stimulus to the placer gold miners of the West, who furnish the platinum products of the United States, for these miners are comparatively indifferent to a slight change in price."

The world's total supply of platinum for the year amounted to about 300 kilograms, or 9,625 troy ounces from South America, and 6,000 kilograms, or 192,500 troy ounces from Russia. All the American platinum came from California and Oregon. The imports of platinum into the United States during 1905 showed a decline of more than 8,000 ounces, due to European control of the supply, which also, of course, aided the rise in price. The present prices are the highest that platinum has commanded in recent years.

These facts are obtained from the annual volume on "Mineral Resources of the United States, 1904." Copies may be obtained, free of charge, on application to the director of the Geological Survey, Washington, D. C.

Natural Gas in the United States.

The United States is especially fortunate in its natural-gas resources, as it produced 98 per cent. of the entire known world's production of natural gas in 1904. This production amounted approximately to 256,645,000,000 cubic feet, or 6,159,480 tons of 2,000 pounds. The value of this production was $38,496,760, which was an increase of $2,688,900 over the value of the 1903 production. The figures here given are taken from an interesting report to the United States Geological Survey by F. H. Oliphant.

There was much active work in 1904 in the new fields of Central Ohio and Southeastern Kansas. In Kansas a number of remarkably large wells were developed. A large amount was expended in drilling wells, extending many pipe lines and piping cities and villages in these states. In West Virginia a considerable number of new wells of large capacity were drilled and connected to the main lines.

Four states, Pennsylvania, West Virginia, Indiana and Ohio, produced 93.3 per cent. of the entire value of natural gas produced in the United States in 1904. The output of Pennsylvania alone represented 47 per cent. of the entire value.

Handling and Storage of Coal by Central Stations.

A central station should be as free as possible from shutdowns due to lack of fuel. This can only be guarded against by providing ample storage facilities and coal-handling apparatus so that in case of pending strikes or in the summer months when coal may be obtained in abundant quantities and at reasonable prices a reserve stock may be laid in against time of future shortage. An interesting example of modern methods in handling and storing coal is presented by the plant of the Edison Electric Illuminating Company of Boston. The apparatus there used is admirably described and illustrated in a paper read before the recent meeting of the Association of Edison Illuminating Companies at Bluff Point, Lake Champlain, N. Y., by Charles H. Parker of that company. In the paper Mr. Parker describes coal handling and storage at the South Boston plant. The following extracts will be found of interest.

In a general way the plant consists of a tide-water pier with two unloading towers, an open-air storage field with a traveling bridge for handling coal in the field, bunkers of a limited capacity at the boilers and a system of conveyors connecting all of the above.

The unloading wharf or pier is 320 feet long and and 42 feet wide, and has a channel on both sides with 25 feet of water at mean low tide. The head of the pier is 176 feet inside of the pier and bulkhead line, approved by the secretary of war, so in case it becomes advisable at any time the pier can be lengthened to 496 feet. On the pier two unloading towers are now installed with plans for a third tower when the growth of plant warrants its installation.

The old tower was built in 1898 by the Ledgerwood Manufacturing Company, and operates on the Ward Leonard system. It has a single boom rigged to unload coal only from the westerly side of the pier. The motor is rated at 85 kilowatts, and the Rawson & Morrison grab bucket has a capacity of 40 cubic feet. The maximum capacity of the tower is 180 tons an hour.

The new tower was built in 1904 by the Robins Conveying Belt Company and is operated by a hydraulic hoist. The water is in a closed system, and the pressure of 220 pounds is secured by a three-stage centrifugal pump of involute type, driven by a 250-horsepower three-phase 550-volt induction motor. It has a cantilever boom capable of being run out over either the easterly or westerly channel, and so unloading coal from either side of the pier. This is a one-man tower; that is, all the operations of opening and closing of the bucket and hoisting and trolleying are controlled by one man. The Hayward grab bucket has a capacity of 58 cubic feet, and the maximum capacity of the tower is 250 tons per hour. This tower is equipped for weighing the coal unloaded by it.

Fig. 1 gives a good view of this tower with the boom run out over the westerly unloading channel. At the bottom of the picture is shown one of the hoppers for loading coal on to the belt.

The storage field is situated on the easterly side of the property. The graded portion of the field is 510 feet long by 290 feet wide, and at depth of 20 feet about 45,000 tons of coal can be stored within reach of the reclaiming bridge. At a depth of 30 feet the field has a capacity of about 65,000 tons. Four hydrants are here placed for fire hose in case of spontaneous combustion taking place in the coal.

A reclaiming bridge, built by the Brown Hoisting Machinery Company, is part of the equipment, and started operation in the fall of 1903. It is a single-span bridge with cantilever at the sheer end. Over all the length of the track stringers is 249 feet 11 inches; the total trolley travel is 227 feet two inches; the main span is 155 feet two inches; the overhang to the end of the track stringers, 84 feet nine inches; the overhanging to the end of the trolley travel, 72 feet; bottom of the rail member, 60 feet above the field; the clearance line of the dumped bucket is 46 feet above the field; the wheel base of the pier is 30 feet, and of shear legs, 33 feet. Total height of the structure is 77 feet.

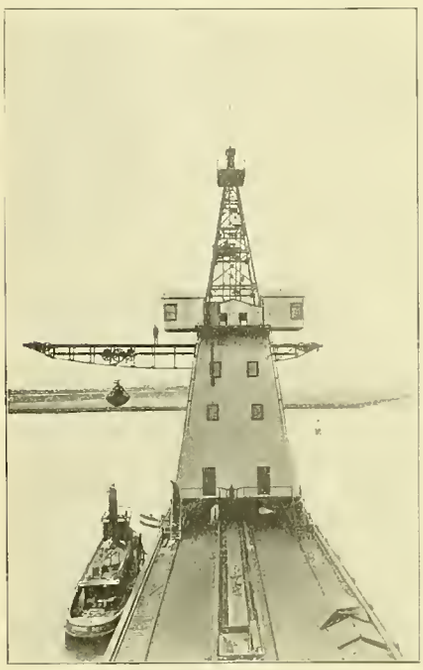


FIG. 1. HANDLING AND STORAGE OF COAL.—NEW UNLOADING TOWER OF BOSTON EDISON COMPANY WITH BOOM EXTENDED.

In general the conveying system comprises four 36-inch and three 20-inch Robins conveying belts and one Hunt bucket conveyor.

No. 1 conveyor belt receives coal from both the unloading towers and takes it into the end of the old coal bunker. The belt is 36 inches wide and 460 feet long between centers and is being operated at about 450 feet per minute.

No. 2 conveyor belt receives coal from No. 1 belt and raises it to the trestle in the coal yard. It is 36 inches wide and 87 feet nine inches between centers, and is being run at about 450 feet a minute.

No. 3 conveyor belt runs on a trestle parallel with the tracks of the Brown bridge and can be run in either direction to suit the conditions. When a vessel is being unloaded it receives coal from No. 2 belt and delivers it to the storage field, but when no vessel is at the dock the direction of travel is reversed and coal is received from the field via the Brown bridge and delivered to No. 4 belt. The center line of conveyor is 48 feet from the shear legs track of the bridge and under the overhang. On each side of the belt are rails which carry the automatic tripper and the hopper for filling the belt.

FIG. 2. HANDLING AND STORAGE OF COAL.—BELT COAL-CONVEYING SYSTEM OF BOSTON EDISON COMPANY BEFORE IT WAS HOUSED IN.

Fig. 2 shows the belt system before it was housed in. No. 1 belt is shown in the foreground running up into the end of the old coal bunker building. The hopper at the end of No. 2 belt over No. 3 belt has a deflecting plate or gate which can be set to divert any proportions of the coal desired from No. 3 to No. 4 belt. No. 3 belt cannot be seen, but it is on the top of the long trestle. No. 3 belt is 36 inches wide and 475 feet long between centers, and is running at about 450 feet per minute.

No. 4 conveyor belt receives coal from either No. 2 or No. 3 belt and takes it back into the end of old coal bunker at a sufficient elevation to deliver it to the coal-crusher station, from which it flows by gravity to the distributing conveyors. It is 36 inches wide, 94 feet six inches long between centers and is running at about 450 feet per minute.

The crusher station consists of a set of grizzly bars placed 3½ inches apart and a two-roll crusher of 30-inch rolls set to crush for a two-inch lump. The capacity of the crusher rolls is 125 tons of coal per hour.

The Hunt conveyor serves the old station bunker and is a part of the original plant installed in 1898. As originally installed it received coal from the unloading tower and delivered to the bunker. It receives coal from the crusher station, is 232 feet long between centers and has a capacity of about 50 tons per hour.

No. 5 belt receives coal from the crusher station and carries it up through the roof of the old boiler room and over the roof of the engine room, switch house, and turbine room into the monitor over No. 1 turbine fireroom, where it will deliver coal over any one of the eight boilers, a tripper driven from the belt being supplied for this purpose. This belt is 20 inches wide, 385 feet long between centers, and is running about 450 feet per minute. This belt has been so installed that a 36-inch belt can be installed in place of the 20-inch belt when the station has been extended sufficiently to require it. The conveyors are motor-driven.

The steepest slope in the whole conveying system is 23 degrees, where No. 1 belt leaves the dock level and rises into the end of the building. If there is very little coal being carried and that little is very lumpy, some of the lumps will not be carried up but will keep rolling back. If the belt is carrying a quarter full there is practically no spilling from this cause, although once in a while a large lump will roll off.

Success of the London Electrical Exhibition.

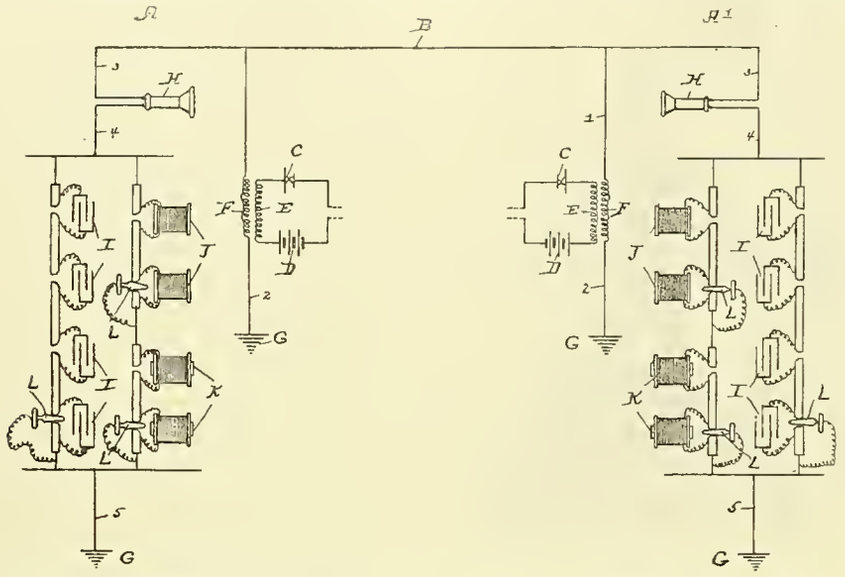
Writing under date of October 13th, the London correspondent of the Western Electrician says: "Despite the efforts of the gas journals to throw cold water upon the venture, the electrical exhibition in London, now in its third week, has been a pronounced success in all directions. The raison d'être of the show was to educate a public, which has not had the opportunity of seeing what can be done with electricity. In fulfilling this function the exhibition has been more than successful, while, on the other hand, the exhibitors are booking orders in a manner not anticipated when the idea of holding such an exhibition was first suggested. A series of lectures on various subjects, delivered in a style which recommends itself to the lay person, has been well attended and appreciated, while a number of electrical cookery demonstrations revealed many things hitherto unsuspected by the public. The exhibition also is being made the meeting place for a large number of deputations from the provinces, and as an educational factor—at any rate toward chairmen of municipal committees and councilors—the value of the exhibition may very well be exceptional."

Chattanooga Power Development.

The Chattanooga-Tennessee River Power Company has awarded a contract to a firm in Knoxville, Tenn., for the construction of the concrete work of the lock and dam and the foundations for the power plant in connection with the former company's proposed power developments at "The Suck," 12 miles below Chattanooga, Tenn., details of which have appeared in the Western Electrician. This dam will be 50 feet high and the power plant will have a capacity of 36,000 horsepower. It is estimated that the contract referred to will amount to more than $1,500,000. J. C. Guild of Chattanooga is chief engineer of the company, and John Bogart of New York is the consulting engineer.

Elimination of Inductance and Capacity Effects in Telephone Lines.

Self-inductance, capacity and the resistance of the line are the nightmares besetting the telephone man. Especially is this so on the grounded single-conductor systems, where, added to the troubles enumerated, is that of the inductive influence of neighboring lines. In a series of experiments carried out by Isidor Kitsee of Philadelphia it was sought to overcome these influences by the use of various devices in which the generated impulses were of sufficient strength to overcome and drown out the induced impulses from the external influences.



ELIMINATION OF INDUCTANCE AND CAPACITY EFFECTS IN TELEPHONE LINES.

This necessitated the use of a secondary of a very large number of turns, even as high as 10,000 turns of No. 40 wire.

In some of Mr. Kitsee's experiments, in which he used a one-line conductor connecting two cities about 250 miles apart, he employed these high-wound inductoriums. He found, however, that while he was able to drown all the "inductive noise" on the line from the ground, as well as from neighboring wires, and while the speech could be distinctly heard at the receiving station if only an ear telephone was inserted in the line at the station, speech could not be distinguished if high-wound inductoriums were inserted at both ends of the line. These experiments were repeated on an overhead line of greater length than above, and with like results, showing that the generated high impulses are capable of overcoming resistance, capacity, and self-inductance of the line, as well as inductive influence from neighboring lines or the ground, but that they cannot overcome the resistance and inductance of the high-wound coil. If, however, at one of the stations the secondary was shunted when the speech was transmitted from the other station, and vice versa, communication could be carried on between these stations, and the speech was said to be distinct and clear. But as soon as the shunting was omitted no speech could be heard in the receiver. These experiments necessitate a change in the arrangement of the devices as employed in the telephonic circuits upon which the inventor has received a patent.

The accompanying illustration shows one form of the device in which (A) and (A') are the two stations connected by the line of transmission (B). Each of the stations is provided with the transmitting device, consisting of the microphone (C), battery and the primary (E) of the inductorium, the secondary (F) of which is connected through wire (1) with the line and through wire (2) with the ground. The receiving device consists of the receiver proper (H), connected through a wire with the line and through another wire to what in reality is an artificial line, consisting of the condensers (I), the non-inductive resistances (J) and the inductive resistances (K), each provided with means (L) to shunt one or more of each of these devices. This artificial line is connected through a wire with the ground. In the other form of the invention each of the stations is provided with the transmitting device similar to the transmitting device in the form described, but in the latter case the receiving device consists of the secondary of an inductorium connected through a wire with the line of transmission and through a wire with the ground. The primary of this inductorium is connected to the receiver proper.

As will be seen in the diagram, the high-wound secondary, instead of being connected in series as to the line of transmission, is connected in multiple arc as to the line and to the ground. The primary of this inductorium and the telephonic microphone are of the usual type as employed today. The variation produced with the aid of the microphonic transmitter in the flow of the current in the primary induces, as is well known, corresponding impulses in the secondary. But as the transmitting station is provided with a second ground the impulses would divide in accordance with the resistance of the line and would almost entirely flow through the receiver (H) of its own station were it not that between the receiver (H) and the ground a resistance, inductance and capacity are inserted about equal to the electrical condition of the line. The transmitted impulses will therefore divide and will flow partially through the aerial and partially through the artificial line.

In his experiments Mr. Kitsee found that the employment of such an artificial line allows the transmitting and receiving of speech through high-tension impulses, whereas, otherwise, when the secondary is inserted in series in the line, the impulses are "choked up," so to speak, and cannot be distinguished in the receiver of the receiving station.

Chicago Street-railway Situation.

At this week's meeting of the Chicago City Council Mayor Dunne presented a short message which was accompanied by an order directing the local transportation committee, in co-operation with the legal advisers of the city, to proceed without delay to prepare an ordinance for the purpose of acquiring ownership of the street railways of Chicago under powers conferred by the Mueller law, and that the matter of the preparation of such an ordinance take precedence over all other matters now under consideration by the local transportation committee. After some debate action on the order, by unanimous consent, was deferred one week. As stated in the Western Electrician of last week, the council had previously defeated a similar measure proposed by the mayor.

The receivers of the Union Traction Company have made formal request for permission to reconstruct the tunnels and in the meantime to change all cable lines to overhead trolleys. The application was sent to the committee on local transportation. The receivers say their traffic cannot be handled over the bridges alone, and although they are assuming a risk, as their franchises for use of the tunnels expire in 1906, they are determined to reconstruct the tunnels in accordance with the federal order if permission can be procured.

Early this week arguments in the quo warranto proceedings brought against the Chicago City railway companies and the Union Traction Company to determine the right of the street railway companies to the streets began before Judge Dupuy of the Superior Court.

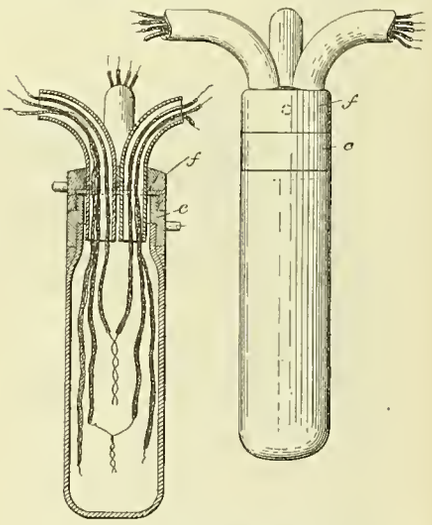
Bion J. Arnold, the well-known engineer, who made such an exhaustive study of the Chicago traction situation nearly three years ago, has again been called in consultation by the local transportation committee, which has under consideration the proposed ordinances of the Chicago City and Union Traction companies and needs engineering advice. Mr. Arnold has already advised the committee in relation to the important subject of through routes between the two companies and the different sections of the city. The committee is considering the formal retention of Mr. Arnold as the consulting engineer for the city, and that gentleman has offered to act for a compensation of $15,000 a year. If retained, he would expect to be the recognized engineering head of the city in relation to traction matters and would place a first-class assistant in his office to devote practically his whole time to the work and to represent Mr. Arnold during the latter's absence from the city.

Marshall Field, the well-known merchant, who is also interested in the ownership of street-railway properties, has returned to Chicago after his trip abroad. He is thus reported: "Municipal ownership is a fad, like the silver question was, and we will find that it will drop out of the public mind soon. I predict that within five years we in America shall not hear anything about it. I certainly don't agree with the proposition that municipal ownership would tend to do away with graft. On the other hand, I believe that opportunities for corruption would be greatly increased. Besides, a city under public officials could never be operated as a private corporation. The business of the municipality would fall into untried hands, and what would seem everybody's business would prove to be nobody's business."

Moisture-proof Terminal Covering for Lead-armored Cable.

Cable terminals, in order to be moisture proof, are generally sealed by "wiping" the lead cover around the ends of the wires or else providing a terminal box. The wiping is a process that takes considerable skill and time and moreover does not allow of easy access to the wires when it becomes necessary to splice on, or for testing purposes. Charles E. Tenth and Luther Hagis of Evansville, Ind., have patented a cable covering which is illustrated herewith and which contains some points of advantage.

The invention consists of a sleeve of lead or other suitable material forming a case-covering for the splices and joints. This covering is healed or completely closed at one end, while the other end is "sweated" to a collar (c) of brass or other suitable material provided with a screw thread on its outer extremity to fit the internally screw-threaded lower end of a cap (f) of brass or other metal. This cap is provided with an internal annular ledge and an extended rim or



MOISTURE-PROOF CABLE TERMINAL.

margin above the ledge, creating, with a lead gasket resting upon the ledge, a shallow cup on the top of the complete casing. The gasket is provided with a series of holes for the reception of any number of lead-armored cables that it may be desired to use, hot solder being poured around the cables in the shallow cup formed, preferably until the solder rises to a line a little above the top of the cap.

By the use of this device it will be seen that to reach the terminal wires to make splices or tests all that is necessary is to unscrew the brass collar from the cap, when the hollow casing may be removed and the wires exposed.

Overhead Traveling Cranes at the Liége Exposition.

By Frank C. Perkins.

At the time of writing a most attractive and interesting exposition is drawing to a close at Liége, Belgium, where there are over 100 buildings erected and a total area of nearly three-fourths of a million square meters of ground, the exhibit buildings covering a space of over 100,000 square meters.

One of the accompanying illustrations (Fig. 1) shows the interior of Machinery Hall. Several engine-generator sets will be noticed, while in the rear is a large switchboard. Spanning this hall is an electric overhead traveling crane, equipped by the Cie. Internationale d'Electricité of Liége. Another electric overhead traveling crane operating in the German-French Engine Hall, exhibited by Ludwig Stuckenholz of Wetter-on-the-Ruhr, Germany, is shown in Fig. 2.

The Liége crane is of 30 tons capacity. There are two lifting hooks provided, the smaller hook operating at a maximum hoisting speed of 11 meters per minute with a load of 12,000 pounds and the larger hook operating at a speed of 2.5 meters per minute with a load of 60,000 pounds. This crane has a traveling speed of 50 meters a minute, the power for this movement being supplied by an 11-horsepower motor of the enclosed type. The trolley is provided with three electric motors of this type, a seven-horsepower machine being used for operating the trolley along the bridge, and the other motors being utilized for hoisting and for the traveling motions.

The German electric crane mentioned has a span of 24.13 meters and is provided with four electric motors. This crane has a maximum capacity of 30 tons, provision being made to lift lighter loads at a higher rate of speed by using the auxiliary lift of five tons capacity. The crane girder is, owing to its long span, constructed with a frame having the lower part of parabolic shape and the main girders are made rigid against component forces by means of gantry girders with transverse braces. The upper cross braces are covered with perforated sheets, thus enabling the whole machinery to be conveniently inspected, this being particularly necessary for the proper lubrication of all of the bearings. The gantries are provided on both sides with hand railings, so that they can be mounted easily and without danger.

The traveling electric motor is located in the middle of one crane-gantry in order to secure an equal start at both ends and make it impossible for the crane to get out of line. The wheels of the traveling gear are of steel, the motor pinions, to obtain a noiseless working, being made of rawhide and all toothed wheels having cut teeth.

The traveling motor is suspended on springs, the starting of the crane being therefore effected, it is asserted, without jerks. Provision is made to prevent the further running of the crane after stopping the motor by fitting the shaft with a brake, actuated by means of an electric solenoid. The traveling motor has a capacity of 40 horsepower, operating at a speed of 420 revolutions per minute. The traveling speed of the crane is said to be about 100 feet per minute with a full load. The electric motors are operated by direct current, the pressure being 400 volts. The electrical equipment was installed by the Siemens-Schuckert works, and forms a part of their exhibit at the Liége Exposition.

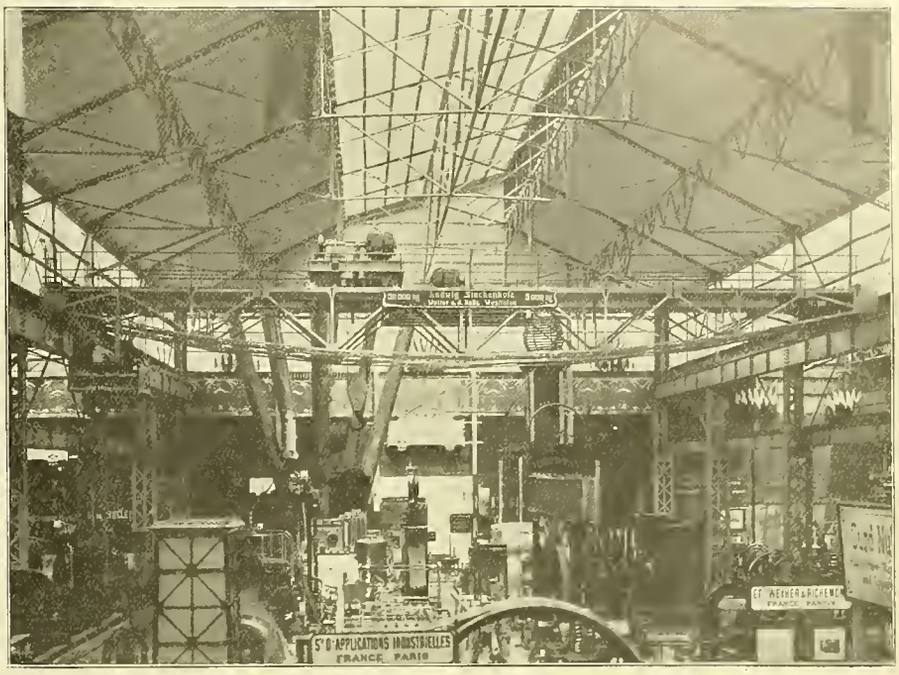


FIG. 2. GERMAN-FRENCH ENGINE HALL AT LIÉGE EXPOSITION SHOWING GERMAN CRANE.

The traveling winch of this crane, or trolley, has a hoisting gear of 30 tons capacity, the auxiliary lift being of a capacity of 10,000 pounds. A four-part flexible steel-wire rope is used for lifting the load and is arranged in a way that tends to stop the swinging or pendulum action liable to occur at high traveling speed. This method also secures a perfectly vertical hoist and an equal distribution of the load on the girders at all positions of the hook. The hoisting drum has right and left grooves turned on its face, and the bearings of the hook mechanism are of hardened and ground-steel balls, resulting in an easy turning of the load in all positions.

The communication of the movement at the main lift gear from the hoisting electric motor upon the rope drums is effected by means of spur gearing, and the first axle of the transmission gear is provided with an electromagnetic band brake. The communication of movement at the auxiliary lift gear acts through worm gearing upon the rope drums, and the worm shaft and worm wheel are running constantly in oil in a tightly enclosed casing. The axial pressure of the worm shaft is taken up by ball bearings, the balls of which are readily exchangeable. The worm shaft and the motor axle are connected by an elastic coupling, which is actuated by an electric solenoid mounted on the worm shaft extending above the box.

The two motors are arranged for braking the load when it is lowered, the motor acting during this motion on the resistances as a dynamo, while the empty hook can be lowered with current supply. The speeds of hoisting are 4.35 meters per minute for the main hoisting gear and 25 meters per minute for the auxiliary lifting gear. The hoisting electric motor has a capacity of 40 horsepower and runs at a speed of 420 revolutions per minute.

The transverse traveling motor acts through two bevel gearings upon one of the traveling axles. On the first bevel-wheel axle an electromagnetic brake is mounted, and the transverse traveling wheels are of steel construction. The electric motor for driving the trolley or cab has a capacity of 12 horsepower and runs at a speed of 490 revolutions per minute, the transverse speed being 50 meters per minute.

The operator's cab, from which the crane motors are controlled, is located in a favorable position which allows a free and unobstructed view of the field of operation. The laterally suspended operator's stand or cabin contains all of the controllers and resistances and is fitted with a switchboard on which is mounted the necessary switches, measuring instruments and safety devices.

Arrangements have been provided in order to prevent the hook from being lifted too high, and provision has been made to avoid a movement of the trolley too far by a system of signals operated by electrical contacts. In order to attain this end the drum axles are extended and provided with threads on which nuts are moved. In the highest position of the hooks, these nuts form electrical contacts which cause bells, fixed over the operator's stand, to sound, and thus the driver is warned in time to avoid damage to the gearing and other mechanism of the crane, and in the same way the trolley makes similar contacts and signals.

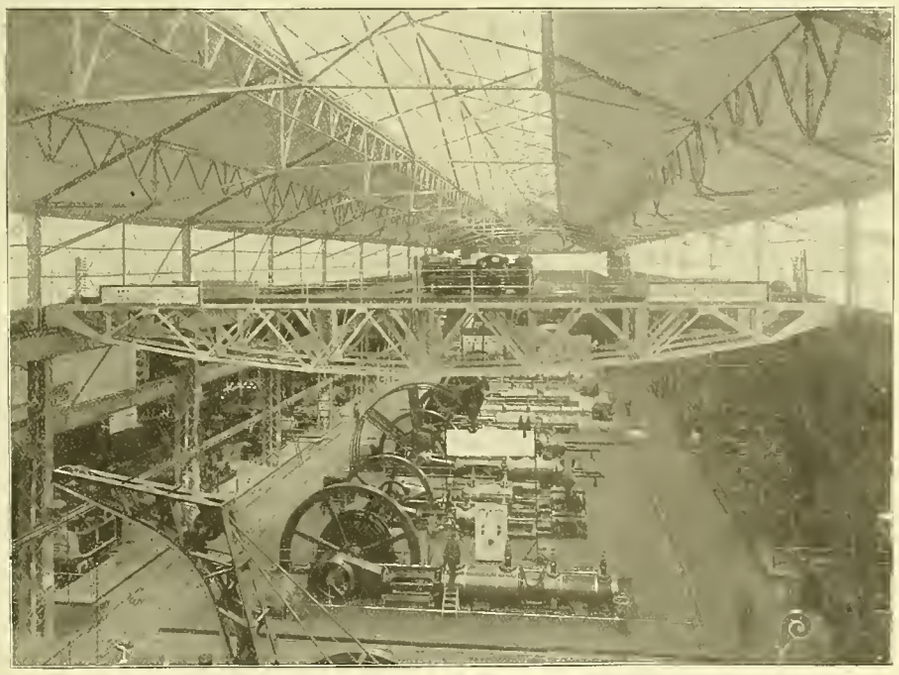


FIG. 1. MACHINERY HALL AT LIÉGE EXPOSITION SHOWING 30-TON BELGIAN CRANE.

Municipalization Sentiment in Detroit.

The Municipal League of Detroit has received 284 letters in answer to 700 letters sent to prominent citizens of that city asking for opinions on the ownership and operation of street railways of the city. Of those answering 183 do not believe in municipal operation, but 215 do believe in the municipal ownership of the tracks. Mayor Codd's plans—one for the acquisition of tracks and leasing to the company for short periods, and the other for a 25-year franchise, with eight tickets for 25 cents—were well received.

J. A. McLaughlin of Putnam, N. Y., and associates have incorporated the Ticonderoga Home Telephone Company with a capital of $25,000.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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DATES AHEAD.

Ohio Society of Mechanical, Electrical and Steam Engineers (annual meeting), Canton, Ohio, November 17th and 18th.

Automobile Club of America (annual exhibition), Sixty-ninth Regiment Armory, New York City, January 13th to 20th.

Chicago electrical exhibition (first annual exhibition of Electrical Trades Exposition Company), Coliseum, Chicago, January 15th to 27th.

IN EXTENDING the load of the central power station the possibilities of artificial refrigeration in which electric motors play a part should not be overlooked. This is a class of business which should be available in every small town that has butcher shops, as well as having more varied aspects in larger places. It has the great advantage of being a day load, heaviest during the summer months, interfering but slightly with the peak. Mechanical refrigeration is growing rapidly and is capable of great extension. Electric drive is particularly well adapted for the apparatus needed, and every central-station manager will do well to ask himself if he cannot turn this fortunate combination of circumstances to his advantage. Mr. Goddard's paper on this timely subject, read at the recent Edison convention and partially reprinted in this issue of the Western Electrician, gives much information of value to those concerned. One point to be remembered is that an effort should be made to interest all using ice or refrigeration in considerable quantities, not alone those now using some kind of mechanical refrigeration.

LIKE any other manufacturer, the central-station manager is constantly confronted with the problem of increasing the demand for his product, either through existing channels or by creating new outlets. To help him in this endeavor the Western Electrician will, from time to time, present hints, suggestions and examples, under the general heading, "Selling Electricity," the department appearing for the first time in this week's issue. We shall be grateful for the co-operation of all electrical men to make this department more effective. It is intended for the good of all, not only of central-station men, but also engineers, manufacturers and dealers, for the more widely electricity is sold and applied, the better for the industry as a whole. Let us have examples of successful soliciting, advertising, sign work, cooking and heating applications, attractive interior lighting, artistic fixtures, treatment of customers, automobile charging, instructive methods of promoting the motor load, etc.—in fact, any fact that will add to the common stock of knowledge about "Selling Electricity." With a little effort on the part of the central-station men much valuable material should be collected.

WHETHER the ether is a form of matter presents a question in relation to which there is a difference of opinion among physicists. The preponderance of belief seems to be in favor of the materiality of this wonderfully interesting but little-known medium. Among the very few who hold that the ether is not a form of matter is Professor A. E. Dolbear. One of the arguments advanced to show that it is not matter is the fact that all particles of matter gravitate, whereas no such phenomenon has been observed in connection with the ether. This argument cannot be held as conclusive, however, since gravitation does not affect all matter equally and the ether may be made up of particles of matter so far separated that the phenomena ordinarily observable in connection with the comparatively dense bodies with which we are familiar are not readily observable in the case of the ether. For instance, it is often asserted, and by those well versed in the subject, that the ether presents no frictional resistance to any body passing through it; therefore it cannot have material existence and is not matter. How, then, is the light of the stars impeded in its progress to the earth? Whence originated the expression, "the unseen universe?" Astronomers tell us that the light of the stars of the first magnitude lose as much as one per cent. of their power in passing to the earth, while stars of the ninth magnitude lose 30 per cent. Since light waves are transmitted by vibrations in the ether, there is plainly a retarding effect during their progress which can only be explained by the frictional resistance in the ether itself. If the phenomenon of frictional resistance were not present in the ether, then the light of the stars would be transmitted with undiminished power and "the unseen universe" would become visible. It would seem, then, that the fact that the ether presents the phenomenon of frictional resistance would indicate its existence as matter—in a greatly attenuated form, it is true.

IN AN article in an English journal describing the entire remodeling of the Victoria terminal station in London of the London, Brighton and South Coast railway occurs this interesting paragraph:

"Another significant element of the innovations is that the new station is to be lighted, not by electricity but by gas. This apparently retrograde step seems to be fully justified by considerations of economy and questions of distribution. The system to be adopted is 'high-pressure' gas lighting. After long investigation the company has satisfied itself that, under present conditions of prices, this method is cheaper than electricity. It also is of opinion that by reason of the smaller units that can be used there will be better distribution of light throughout the station than would be obtained by electricity. The new station exhibits no trace of the advent of electric traction, and there is no indication that provision has been made for any change in the means of propulsion. One thing tolerably certain is that the London, Brighton and South Coast Company would give preference to overhead conductors, and that no middle-rail scheme would be admitted as practicable to its lines. The overhead conductors could be erected without any serious disorganization or structural changes at the new station."

This determination illustrates a mental attitude—a lack of quick and real sympathy with progressive ideas—which many persons on this side of the Atlantic will term characteristically British. Under similar circumstances an American railroad manager would reason probably something like this: "Yes; we might possibly save $1,000 a year by lighting by gas rather than electricity; but what of it? By doing so we should probably drive $10,000 worth of business to the other road, whose brilliantly lighted station would furnish just the amount of attraction to balance the scale of competition against us." If there is no competition, the manager doesn't sit down, with folded hands, contented. He is constantly on the alert to create new business. He studies to make travel pleasant and attractive as well as safe and rapid. To this end, what wiser provision can be made than to use electric light, and plenty of it, in offices, waiting rooms, train sheds, and in the trains themselves? The best American trains are not only electrically lighted, but are provided with electric fans and telephones to use at stations. As for lighting a great metropolitan terminal station with gas, what American railroad manager would think of it? The man who proposed it would be scoffed at, for the superiority of electric light is generally recognized. In the constant effort to make traveling a pleasure the railroad stations in important centers have been enlarged, beautified and supplied with all manner of comforts and conveniences. It would be a trumpery and unwise saving indeed (if it really is a saving) to light these handsome, imposing buildings with the comparatively uncleanly, unhealthful and unattractive gas.

As to the asserted belief that "by reason of the smaller units" there will be better distribution of light throughout the station with gas than with electricity, the idea has no foundation in fact. With several types of electric lamps to choose from—arc, incandescent, Nernst and others—and with many varieties of scientifically calculated bulbs, shades and globes, the lighting engineer could have chosen, in the case under consideration, the size of electric units needed, and produced a much better, more artistic result. The problem of economical light distribution in large areas is one that is receiving much study, but there is no warrant for the assertion that gas has any advantage over electricity in this respect. The possibilities of electric light are far greater. For instance, the plan is under consideration of indirectly lighting the central waiting room of a railroad station in an eastern city by a vertical beam of light from an arc projector in the room beneath, this shaft of light to proceed through a properly protected central opening in the floor of the waiting room to a very large reflector in the ceiling, whence it will be distributed to all parts of the spacious apartment. This idea may not be adopted, but it is considered worthy of attention; with gas, it would not be practicable at all. In the retrogression to gas lighting the company has, we think, shown a short-sighted policy that, when considered as a national trait, may answer many of the heart-searching questions propounded by English publicists and having to do with the relative decline of British industry.

Motor Tests in Different Industries.

By G. E. W.

A great many industrial concerns demand exact data concerning the amount of current required for operation of electric motors before adopting this power for general work. A good many figures are given in regard to motor performance, and underestimate of power used is quite as general as overestimate. In the effort to secure reliable data companies have made tests with motors extending over a period of many months, and in some cases the variation has been great enough to cause no little anxiety as to the relative average to be maintained. Common figures upon which averages can be based are very desirable, both for the consumers of power and the manufacturers of electricity.

Estimates of the number of hours of each day that motors are employed are so varied that no actual standard has been established. In making prices for supplying current it is quite important that a power company can figure upon actual and not fictitious figures. Agents and engineers place the operation of motors all the way from 50 to 100 per cent. of their capacity for every working hour of the year.

Investigations of a great number of plants have shown that, as a rule, the average daily use of a motor is almost invariably overestimated. In some industries this overestimate runs as much as 50 per cent., and in others only five to 10 per cent. A single plant or a group of two or three fail to establish an average, and to make the investigation of value, upward of 30 to 50 different motors in the same kind of industry should be tested. An average then obtained is of some practical value. Theoretical averages are of little value to the engineer or consumer who wishes actual practical tests.

In tests of motors in over 15 smelting works where electricity is employed in different capacities it was found that the average daily use of all of them was as low as 0.48 hour for each horsepower of the rated capacity. Low as this average was, it was greater than that found in 20 different wood-working plants. A high daily average of working hours is not expected in driving wood-working machinery, as only a part of the machines are used at one time, and the work of changing the feed consumes a great many hours in the course of a week. The average in such plants was found to be only 0.36 hour for each horsepower of the rated capacity.

The next lowest daily average use of the motors for driving machinery was found in driving meat-chopping machinery. In the test of more than a score of shops the average was found to be 0.9 hour, although in some shops the daily average was higher and in others lower. The use of the motors for driving the choppers depended a good deal upon the amount of work or trade the shops commanded.

The hat-manufacturing plants are rapidly increasing their electrical equipments, and it has been found that current can be economically employed in hat making. But the machinery used for this work is not constantly employed, and many of the motors are idle a good part of the time. The result of an investigation of a dozen hat concerns showed that the average daily use of the motors was 1.49 hours for each horsepower of the rated capacity, according to the wattmeter readings. In a number of marble works, where electricity is employed for cutting and polishing the stones, the daily average use was a little higher, reaching 1.63 hours.

The average machine shop has been largely overestimated in connection with the average use of electricity. The daily average was found to be only 2.1 hours, while many have placed it as high as five and six hours, or even higher. It is quite apparent that such difference in the figures would prove of serious moment to an electric power company in making estimates of the load required for supplying a number of machine shops with power. In order to make low prices for supplying current the daily average amount consumed must always prove a formidable factor in the estimations. One company provided with exact figures could underbid another and still make a profit. The most economically operated plant is one which can dispose of the maximum load throughout the greatest number of hours of each day. Where the full capacity is used at all hours the rates can be made lower and the profits higher.

As the power load is generally a day load, the central-station company should find the skirt-making and general machinery shops the most profitable customers. The former use heavy machinery in their tailoring branches, and the number of hours of use on the average is as high as 7.14 hours for each horsepower of the rated capacity, while in the general machinery shop the average was 4.56 hours. Waistmakers likewise show an average comparatively high, reaching 3.77 hours. Instrument-making shops show a daily average of three hours, jewelry factories an average of 2.93 hours and printing shops, where presses are operated by individual motors, 2.48 hours.

Undoubtedly these figures have their value in pointing out to central-station companies the importance of different consumers, and also in making it clear how many different shops could be supplied on a given rated horsepower of a plant. The load factor must be kept well into the foreground in making contracts for day loads. With a plant using its full current for lighting streets and buildings at night, the profits can be nearly doubled if power-working shops can be supplied in the daytime, so that 90 per cent. of the current is daily used. To secure such highly desirable results a central station must know pretty accurately what the daily average consumption of the different shops is. Among 50 plants using electricity, including almost equal divisions between woodworking shops, machine shops, printing houses, tailoring establishments, marble-polishing and cutting factories, hat, waist and skirt makers, and smelting and meat-chopping works, a series of tests showed that the average use daily amounted to 2.25 hours for each horsepower of the rated capacity. This appears like a low average for such a miscellaneous collection of plants employing electricity for driving machinery, but the meter readings were taken by the individual plants, and the figures represent actual practical work and not theoretical. In view of such a low average, it is possible for a central station to supply more customers at a given load than is generally considered safe by engineers. In other words, by overestimating the daily average consumption of power by different shops central stations have often been forced to limit the number of their customers much below actual necessity.

One of the great benefits of electric power in driving machinery is the elimination of loss when machines are not in actual operation. Every idle machine ceases to be a consumer of power for the time being. This fact has been emphasized to manufacturers in the effort to induce them to adopt this power in preference to steam or gas. It is natural, therefore, to find manufacturers taking advantage of it to economize. In nearly all of the shops visited stringent rules were enforced regarding the shutting off of power when a machine was temporarily idle. In many of the shops violations of this rule meant reprimand and discharge upon failure to comply with it. The work of economizing in the use of the current has therefore been carried to a fine point of development, and the result is that the daily average consumption of electricity has proven much lower than usually estimated by engineers and central-station companies. Intimately connected with this question is that of the amount of power consumed in belting and shafting transmission. Where this amount has been large, changes have been made, where practicable, to individual motors. By eliminating, so far as possible, the loss through belting and shafting transmission, the daily average consumption has thus been further reduced in many shops and factories.

It is quite apparent that shop improvements have advanced rapidly in the last few years since electricity has been introduced, and that the tendency is toward the use of individual motors in preference to those driving machines by belts or shafts. This improvement has resulted in the saving of thousands of dollars to consumers of power, and indirectly it has greatly affected the central stations. It is a condition that must eventually work benefit to both consumers and producers, but certain readjustments must be made by the latter in order to secure the highest results. Economy is the object of the manufacturers in using current as well as of the central stations in manufacturing and transmitting it.

In half a dozen machine shops wattmeter readings reported by the manufacturers showed that great variations in consumption of power were made daily in driving both large and small machines. With motors running light and shafting together consuming about 2.112 kilowatts, the average hourly consumption when the shop was running at an ordinary load was only 3.6 kilowatts, and the average percentage of power consumed doing useful work was 41 per cent. This result was obtained in shops equipped with small and large machines, including drill presses, lathes, milling machines, screw machines, buffing wheels, emery wheels, grinders, hack saws, metal band saws, gas forges and shapers. The larger shops showed more economy of operation than the smaller, and their daily average consumption of power was higher.

In driving printing presses the amount of current used, and the daily average load, showed less variation, but in this case most of the current was consumed at night, which makes this class of shops less desirable customers for electric-light companies than the shops which use the current almost entirely in the daytime. The use of current for printing presses and linotype machines is constant, however for the few hours in the middle of the night and early morning when the papers are going to press. A morning paper rarely needs its maximum of power until after midnight, when the electric-light consumption has been materially reduced. A large number of the leading printers of daily papers use electric motors for the different presses and linotype machines, and they have secured economy in time and money over the steam presses. For this reason it is apparent that nearly all of the printing establishments, both large and small, will within a few years be placed upon an electrical basis. There is no question about the advantages to the consumer, but the power companies have not succeeded in all instances in placing their business on the highest plane of efficiency. There has been too much uncertainty regarding the daily average use of power. Manifestly, a great number and variety of customers always increase the question of profitable distribution. It is essential to know the relative amount needed by each plant or group of plants, and then strike an average of daily use and consumption. Improvements in the large presses have greatly helped the consumers in reducing cost of operation. For instance, one of the largest web octuple printing-press machines in New York is driven by two 37½-horsepower motors placed at either end. This enables the operator to stop half the press without interfering with the operation of the other half, or the two can be run together. Most of these printing presses are today manufactured with direct-connected motors, and they are under such perfect control that they can be stopped or started in an instant without a jar or break. The speed of the presses is likewise regulated by a device which shows exactly the number of revolutions being made. As the large newspapers use a cheap grade of paper, there is always the danger of interruptions through the breaking of the rolls. Speed indicators are therefore made for different grades of paper, and these show just how fast the presses can be run with safety when fed with certain grades of paper. The inferior grades require slow speeds, but if a higher grade of paper is employed the highest speed can immediately be turned on. This proves of great value to publishers of daily papers who in emergencies wish to run out special editions at very high rates of speed.

A modern sextuple web press turning out about 40,000 copies hourly of a complete eight-page newspaper can be operated by a 65-horsepower motor directly attached at full speed within 50 seconds after the current is turned on under a pressure of 240 volts and current of 60 amperes. A similar octuple press driven by two 38-horsepower motors at 240 volts for each motor and 85 to 90 amperes prints at slow speed 35,000 12-page papers, with an expenditure of about 40 kilowatt-hours of energy. This gives an average of 1.112 kilowatt-hours for each thousand copies printed. Under full or fast speed, the consumption of energy amounts to about 920 watt-hours for each thousand papers. This shows results when a good grade of paper is used, but where inferior grades are employed the increased energy needed for the slow speeds exceeds 20 per cent. Until manufacturers of printing presses improve their machines so inferior grades of paper will not break, or until paper manufacturers find a way to prevent cheap paper from blocking the presses, the difference in the cost of driving the presses at low and high speed must continue.

It is announced that the waters of the Etowah River about half way between Rome and Cartersville, Ga., will be developed before long. It is estimated that 3,000 horsepower can be obtained readily, and this will be transmitted by electricity to Rome and Cartersville for power and lighting purposes. A $400,000 stock company is being organized to undertake the enterprise, among the projectors being R. L. West of Atlanta, Ga.

SELLING ELECTRICITY.

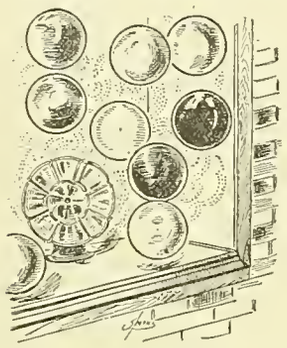
Under this heading will appear, from time to time, articles, suggestions and examples which will be of assistance in the coostant effort to increase the existing demand for electric current and to create new demands.

Window Display.

To the central-station manager who is anxious to improve his load factor the lighting of store windows would seem to be an attractive field. The value of sign business is appreciated, yet the field of window lighting, which should prove fully as lucrative, lies in a state of more or less neglect.

One cannot travel about the country, especially if he visits the smaller towns, without realizing more and more that such is the case, and that the art of window illumination, as practiced by many so-called enterprising merchants, falls far short of what good practice demands. The cause of this state of affairs seems to be a lack of co-operation between the merchant and the light man, with the result that the window installation is off duty during the period when both of them need it the most.

During the rush of business hours people have not so much time to stop and view window displays.



ELECTRIC FANS AND TOY BALLOONS AS A WINDOW DISPLAY.

But, in many places, when business worries have been put aside for the day, men and women are actually on the lookout for something to claim their interest. It is obvious that a dismal, poorly lighted business street at night repels about as many pleasure seekers and strollers in search of recreation as a brightly lighted thoroughfare attracts.

The advertising value of well-illuminated store windows during the evening hours, after business has ceased, is not a theory but a substantiated fact, which any up-to-date merchant will appreciate and be eager to take advantage of just as soon as the lighting company meets him half way with a reasonable proposition. The merchant has the incentive, but awaits the inducement. Meanwhile, he continues to throw off his window switch at closing time.

The central-station manager no doubt appreciates the value of the long-hour customer, and goes after every drug store, saloon or restaurant in sight. The owner of show windows is no less desirable as a customer, and it is to the lighting company's advantage to make a rate for window lighting during the evening hours which will be attractive to the progressive merchant.

Window-lighting service is needed continuously during a definite period of each day. It is more or less isolated and free from interference, and is much the same as electric-sign service. Consequently the flat-rate system of charging is especially applicable and has its strong advocates. In any case, whether the meter or flat rate be employed, the problem of shutting off the light at midnight, or earlier if desired, is easily solved by the use of an automatic time switch, which may be sold or rented to the customer.

In a window-lighting campaign the central-station company should not only establish an attractive charging rate, but it should lend its influence toward the more intelligent use of electric light as a means to an end, thereby bringing to the attention of prospective customers the advantages of electric service, while at the same time winning the confidence and respect of its patrons.

As in all other forms of lighting, except sign work, in the installation of window lamps it is too often forgotten that illumination, and not mere light, is the object in view. Many a fine window display is greatly weakened by the harsh, spectacular, and even blinding effect of unshielded border lamps, and possibly one-third the amount of energy delivered to the concealed reflector lamps would greatly enhance the value of the illumination.

Another point which demands careful consideration in window illumination is the color or quality of the light provided. Many persons contend that colored goods and wares are only seen in their natural hues when viewed by daylight, and that the various tints are materially altered by the use of artificial light of different qualities, a notable example of this being the effect on colors produced by the mercury-vapor lamp. Since the window space of a store is set apart solely for the purpose of attracting buyers, it is evident that a light of suitable quality is of even greater importance here than it is in the store itself. The incandescent lamp, by virtue of its neat, compact structure in comparison with the arc lamp, and its numerous advantages over the Welsbach lamp, has grown very popular in the field of window lighting; yet the Nernst lamp, with its high efficiency and white light, is favorably regarded for this work and is worth taking into careful consideration.

Apropos of the question of window display, the accompanying cut shows how electricity may be made to play a part in the daytime as well as at night. A merchant in Sixth Avenue, New York, places a dozen or more colored toy balloons in his window and also an electric fan in operation. The balloons are not so buoyant that they cling to the ceiling, but, in response to the current of air from the fan, they bob about in a way that attracts much attention to the window. The cut is reproduced from Printer's Ink.

Arc Lights for Store Interiors.

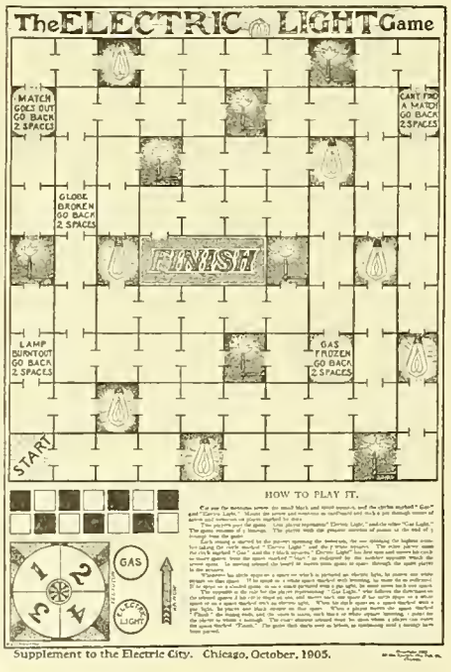
This is the way a Philadelphia company goes after arc-light business on a mailing card:

"The study of light is a mighty interesting matter, particularly when the reproduction of daylight becomes an object. It is interesting to the scientist, but it is of the utmost importance to you. If you need artificial illumination in your store, you should have that light which comes nearest to daylight, because that is the light which shows fabrics and surroundings as they are—a light which does not have too many green, violet, yellow or red rays. By all means, do not have too many red rays—they hurt the eye.

"A white light is what you want, and it is what we have studied to produce and have produced—an electric arc light. It is the successful store light for interior or exterior, and it is the most economical method of artificial illumination. If you don't know our rates, or if you don't know your exact requirements, send us word and we will advise you. You won't be under obligation to use electricity, and you will at least have informed yourself. Being abreast with the times is a big asset nowadays."

The Electric-light Game.

Quite a different type of advertising is "The Electric-light Game," issued as a supplement to the October number of the Electric City and which is reproduced herewith, in miniature, by the courtesy of the Electric City Publishing Company, which has had the game copyrighted. The Electric City is a monthly paper, handsomely printed



FACSIMILE OF THE ELECTRIC-LIGHT GAME DISTRIBUTED IN CHICAGO.

and illustrated, issued in the interest of the Chicago Edison Company and distributed free. It is perhaps the most elaborate of the papers issued by the large electric-light companies, of which there are examples in Boston, New York, Philadelphia, Newark, N. J., and other cities. It has departments for the home and for children, and publishes considerable matter of a general character, of no relation to electricity, to make the paper of more general interest. The supplement shown here is printed on heavy paper and given with the regular issue as an insert. The original game is 8¾ by 13 inches in size and is played something on the parchesi principle. One player represents "Electric Light," the other "Gas Light." In the obstacles encountered, as will be seen, "Electric Light" has rather the advantage. The object seems to be to make electric light a "household word" with old and young—a familiar friend, not an unattainable luxury.

Central-station Advertising.

Herewith is given a reproduction of a recent "ad" of the New York Edison Company in a New York daily newspaper. The original is four columns wide and occupies a space seven inches high by 87/8 inches wide. Note the prominent black line "Electric Lighting" and the grotesque cut to set forth the central idea of the "ad" and catch the eye at once. There is no beating about the bush, no flim-flam. The reader is supposed to be a person of intelligence, whose time is worth something, who will resent clap-trap and who desires to get at the central idea at once. Next in promi-

FACSIMILE OF ADVERTISEMENT IN NEW YORK DAILY NEWSPAPER.

nence of display is the statement that the aforesaid electric lighting is "the cheapest—utility, maintenance and adaptability considered—of all artificial illuminants." Next are given the various classes of service to which the Edison service is adapted, with reasons why it should be used. Last of all are the addresses and telephone numbers of the central-station company. The display type is all of one face, four different sizes being used. This gives symmetry and dignity and makes a pleasing impression. The "ad" is a good one and no doubt had "pulling" power. The electric-light companies in the large cities issue many high-grade examples of advertising, which the smaller companies will do well to study.

The Relation of the Central Station to the Motor-driven Refrigerating Machine.[1]

By G. W. Goddard.

It is probable that no factor of daily commercial life in our towns and cities is of greater importance than is that of necessary controllable temperature as applied to the preservation of food and other products. As the production of this essential element is now under practical mechanical control in size of units to be used by consumers at large, it should be of especial interest to the central stations for the following reasons:

1. The electric drive for the mechanical refrigeration unit is superior from every point of excellence.

2. The motor enters at once under conditions of known operation and easy control by the consumer.

3. The supply and consumption of power is in ratio to demand.

4. It is practically a day load, and heaviest during the summer months.

When those interested in the increase of the central-station power load consider the surprisingly large number of places dependent on controllable temperature, and the importance of the central-station service to them, it is apparent that it is worth being taken seriously and a method established to secure the business which will be substantial and of long term. It will also be found that on the part of the majority of consumers to whom the controllable temperature will be most valuable, a very crude knowledge, and in many instances none at all, exists of the practical application of this apparatus to their needs. By its use they radically change their present method, and, as a conservative and practical class must be intelligently advised by the representative of the electric company, it is necessary for the representative to be reasonably well posted in the principles of its application, and the advantages claimed.

About 18 months ago the Philadelphia Electric Company organized a refrigeration feature of its business, adopting at the start a method of illustrative and descriptive circularization, this being followed by personal calls. It then planned to effect installations of one or more machines in

1. Abstract of a paper read before the Association of Edison Illuminating Companies at Bluff Point, Lake Champlain, N. Y., September 13, 1905. Mr. Goddard is with the Philadelphia Electric Company.

respective lines of trade, and, after such installations to make careful tests of them as to watt consumption, horsepower required, temperatures, cost of operation as compared to ice, etc.

This work has been followed closely, and today, though the load is not large, we have plants installed under continuous and advantageous operation as compared with former cost for ice, and with advantages not to be derived from ice, in the following lines of trade: Dairy, drug store, grocery store, residence, restaurant, saloon, office building, apartment house, etc. The plants are demonstrating their advantages. Some of these places are about to add additional machines, and others are being gradually installed in new places by reason of the results obtained by those in operation.

To the first-named trade, the dairy, the machine offers special advantage. To illustrate: A good-sized and old-established dairy in our city was operating under the usual dairy conditions—cooling its water with ice, and setting the milk (in 40-quart cans) in a large vat of water, cooled with blocks of ice. This vat had long been water-soaked, the floor about it was in a water-soaked condition, and the entire surroundings unsightly and apparently unsanitary. The plant was subject to the daily annoyance of delivery of the ice, which had to be broken into different sizes, with consequent loss of time and labor of the man, and there was a constant rise of temperature in the vat during the day, and the bulk of ice under the consequent melting fell. The owner cleared out his water-soaked vat, constructed a cold-storage room on the same floor, with concrete floor, installed a three-ton machine in the basement, and is driving it with a 7½-horsepower alternating-current motor. He is operating to his entire satisfaction, the temperature to any desired degree being under his control, and the cost being confined to production of temperature, i. e., there are many times during the respective months when the dairy does not need temperature in excess of atmospheric, but as this may at any time rise above the point necessary to keep his product, he must insure against it by ice on hand, where, with the machine, he operates and uses current only as required.

We secured an order for a refrigerating-machine equipment, which was installed on September 17, 1904, in one of the leading grocery stores in the city, centrally located, and after it had been in operation for about two months we made a test, as follows:

Installation, 200-pound machine, driven with a one-half-horsepower direct-current motor, the entire machine equipment being enclosed in one end of the refrigerator, which measured over all seven by six by two feet, the pulley of the machine being back and outside of the refrigerator and driven by pulley of the motor located on back and on top of the refrigerator. The test extended from October 5 to November 2, 1904, inclusive, operating during the day from 5½ to 12½ hours, the average being 7.6 hours per day. The current consumption was from 1,700 watt-hours minimum, to 4,600 watt-hours maximum, per day, the average being 3,675 watt-hours per day, the total watt-hour consumption for the 25 days being 81,900 = 81.9 kilowatt-hours; at a cost of 10 cents per kilowatt = $8.19, or 32.76 per day.

The average daily watt-hour consumption, as per test, may be taken as a constant per annum, the cost for power per annum should not exceed $102.-21, while, as a matter of fact, the meter readings showed the actual use of current to total a considerably lower figure than the above.

On June 1st the location of the store was changed and in the latter place the refrigeration-machine motor was placed in service on a meter registering other power. This machine has given, and is giving, entire satisfaction. The price of the installation, exclusive of the one-half-horsepower motor and wiring, was $350, there having been no cost for repairs or additional charge for condensing water, the rate being (for refrigeration-machine service) $3 per ton of refrigeration per year. The former amount of ice used to effect refrigeration in the same sized refrigerator was 200 pounds per day, the rate for which was 30 cents per 100 pounds, making the total cost of ice for the year $187.20. The comparison therefore would be:

COST OF ICE REFRIGERATION.

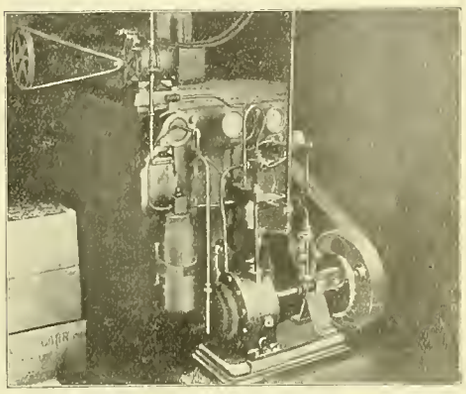
Five per cent on investment of $100 for refrigeration	$ 5.00
Cost for ice, per annum	187.20
	$192.20

COST OF MECHANICAL REFRIGERATION.

Interest on investment $400 at 5%	$ 20.00
Depreciation and repairs (10% on machine part of outfit costing $200)	20.00
Cost of electric power per annum	102.21
	142.21
Difference in favor of electrically driven outfit	$ 49.99

About September 15, 1904, a drug store in the city installed an electrically driven refrigeration plant. This is the largest drug store in the city, centrally located, doing a large soda-fountain business, for which the refrigeration service was principally installed. The conditions were the usual ones, of the ice being brought into the store once or twice a day, broken and placed in the fountain at the top, resting on coiled three-eighths-inch block-tin pipes, through which flows the beverage from cylinders in the basement to the soda-fountain spigots. The dispenser of sodawater desires it as near 32° F. as possible, but is rarely able to maintain a temperature below 40° to 45°, by reason of improper insulation, due to the door in top of fountain, warm air about the cylinders, and the gradual rise of temperature as the atmospheric temperature rises and the bulk of ice falls.

The drug store above mentioned had three large fountains, one of which was out of service, and the refrigeration system installed was what may be called sweet-water circulating. In the basement was installed a 7½-horsepower direct-current motor (belt), driving a three-ton refrigerating machine, directly expanding into an insulated tank filled with sweet water, the suction coil returning directly to the machine. From this tank runs a coil to one of the three fountains on the floor above, where it manifolds at the back and inside of the lower compartment of the fountain, and so continues to the two others where, at the third, it rises and empties into the upper compartment, submerging the beverage coils and overflowing to the second fountain, and from there to the third, from which it returns to the tank, the circulation of the water being effected by a small rotary pump driven by a one-horsepower direct-current motor. There is an additional chilled-water circulation to a cold-storage room, located in the basement, in which the temperature is maintained at 40° to 45° F.



ONE AND ONE-EIGHTH HORSEPOWER REFRIGERATING MACHINE IN SALOON.

The plan of operation of the above is to operate the machine for sufficient length of time to make enough ice on and about the expansion coils in the water tank, with consequent low temperature in the fountain and cold-storage room, during operative and non-operative hours of the machine and to maintain the desired temperature until the next day. This chilled sweet water is circulated, as described, by operation of the one-horsepower motor. The purpose of manifolding the coils in the lower soda-fountain compartments is to refrigerate the bottled goods.

The advantage of this electrically driven refrigeration plant are obvious, prominent among which are avoidance of ice deliveries, with the attending slop and inconvenience, the time necessary to get the ice in condition and in place, constant temperature under control, and furnishing a temperature of 33 degrees as compared to 40 degrees to 45 degrees with ice, securing dry-air refrigeration in lower compartments of fountain, etc.

After the refrigeration plant was installed all of the three fountains were put in service, this being equivalent to an ice consumption representing a cost of $820.86, to which should be charged the time of two employes of the place for two hours each morning throughout the year, amounting to $249.60, making the aggregate amount chargeable to refrigeration $1,070.46. Since installation of the refrigeration plant there has been added a cold-storage room of 724 cubic-feet capacity, which would require half a ton of ice to maintain at desired temperature, representing additional ice charge of $468, making the total cost chargeable to refrigeration of $1,538.46.

The account chargeable to the electrically driven refrigeration plant to furnish refrigeration for the above-named units is as follows:

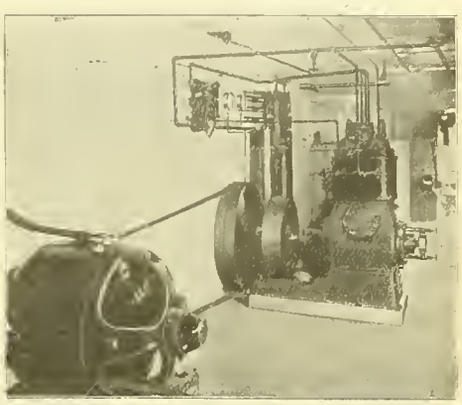
Power for one year (based on average of 11 months)	$579.00
Interest 5% (on entire refrigeration plant $2,100)	105.00
Water for condensing purpose	9.00
Depreciation and repairs, at 10%	210.00
Oil, waste, etc	50.00
Total	$953.00
Difference in favor of electrically driven machine =	585.46

A residence installation made in January of this year was as follows:

A large three-compartment refrigerator 10 by seven feet high by two feet deep, usually full of varied food products, contained a galvanized-iron tank four inches in depth by five feet high by seven feet in length, containing expansion coils submerged in a brine solution. This was placed at the back and inside of the refrigerator, the expansion coils connecting with a 500-pound refrigerating machine, located in the basement and driven by a one-horsepower alternating-current motor, the entire outfit costing $502, installed.

We effected an installation of a refrigeration plant in two saloons in the city, one in the direct-current district, the other in the alternating-current, under the following conditions.

In the direct-current district the saloon was typical of all others in the city; 7½ barrels of beer are delivered to the cellar about 7 a. m. daily, this beer having a temperature of 40 degrees to 70 degrees when received. By means of a water pump (furnishing compressed air into the barrels) the beer is forced up through three-eighths-inch block-tin pipe to the lower compartment of the bar above, where the pipes (from the respective barrels) are coiled and continued to the upper bar compartment, where they are again coiled and ending at the spigots. The cooling of the beer is effected by ice placed on the coils through a removable lid at top of bar, and through the doorway of the lower compartment. This is a crude and wasteful method, as, by reason of the necessarily very poor insulation, the melting is excessive and the saloon is subject to the annoyance of daily ice deliveries. The system adopted for the refrigeration plant was the same as with the drug store, i. e., the machine located in the basement expands directly into an insulated tank filled with sweet water, this water being circulated by means of a small pump driven by an electric motor.



SEVEN AND ONE-HALF HORSEPOWER REFRIGERATING MACHINE IN DRUG STORE.

Though much interested in and desiring the small refrigeration outfit, no electrically driven refrigeration machine has been installed in a butcher shop for reason of prohibitive first cost. We have succeeded, however, in lately arranging with one of the machine builders to make a compact one-ton machine, mounted on one bed plate, suitable for the butchers, at a cost not exceeding $700 installed, and this trade should now become a large user.

By the foregoing tests and conditions it will be noted that the cost of operating the small refrigeration machines by the electric motor at current rates compares favorably with the cost of ice. This must be effected, however, by confining the use of current as nearly as possible to actual required temperature under proper insulated conditions. The advantages by use of the motor-driven machine more than offset the attention required, which, with a good machine, is nominal.

Milan Exposition.

From April to November of next year an exposition of art and industry will be held in Milan, Italy. Foreign nations have been invited to assist, and many have accepted. The city of Milan offered only two sites on which the exhibition could be held—a portion of the park in which is situated the Castello, once a fortified palace, and now a municipal museum, and the parade ground, not far away and corresponding somewhat to the Champs de Mars in Paris. Together these two sites are nearly 200 acres in extent, of which certainly 50 acres will be covered by buildings of elaborate design and of beautiful finish. These buildings are now rapidly approaching completion. The park and the military parade ground will be connected by an electric tramway that will convey visitors from one part of the exhibition to the other, but no further means of transport within the grounds will be necessary, because, although the area will suffice for its purpose, it is not so large as to present disquieting obstacles to visitors in the way of long distances—one of the great difficulties in all the international exhibitions of recent years.

Transportation on land, by road and railway, will receive large attention at the exhibition, both as regards the actual construction of roads and railways, and also the vehicles employed on them. Electric transport will be prominent, for Italy has already taken a lead in electric traction on railways. A monumental exhibit of the Simplon Tunnel, with the machinery employed in its construction, will mark the raison d'être of the exhibition, while the show of automobiles, in the construction of which Italy has also taken a leading position, will be very important, judging from the fact that the large building devoted to this purpose is already overfilled. The work of the postoffice, telephony, telegraphy and space telegraphy will also be included in the land transportation section.

The United States consul at Milan urges American manufacturers to exhibit. He will send exposition literature to interested persons.

Double-joint Desk Fixtures.

A complete line of desk-lamp fixtures is manufactured by McLeod, Ward & Co. of New York. The line of fixtures which is here illustrated is known as the Ward double-joint desk fixture, and, as implied by the word "double-joint," there is a double-joint movement located near the base. There is also a single-joint movement at the socket. This arrangement enables the light to be placed at any point desired within range of the fixture without loosening or tightening the thumb or other screws. The joints are so constructed that they may be moved freely without injuring the flexible cord which is concealed in the tubes.

The fixture shown in Fig. 1 is arranged with two brass clamps, which can be fitted over the roll-top desk, then tightened rigidly in place. A somewhat similar arrangement has a back clamp like that on a Kinsman desk lamp, but with an adjustable front clamp. They are fitted with telescoping or extendable tubes, making them suitable to small or large desks.

Fig. 1. Double-joint Desk Fixture with Clamp for Roll Top.

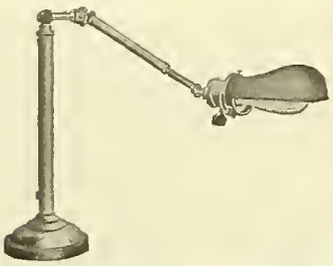


Fig. 2. Double-joint Typewriters' Portable Fixture.

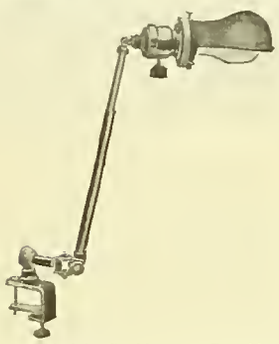


Fig. 3. Double-joint Bookkeepers' Portable Fixture.

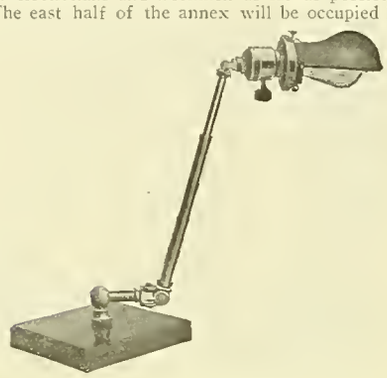


Fig. 4. Double-joint Portable Desk Fixture.

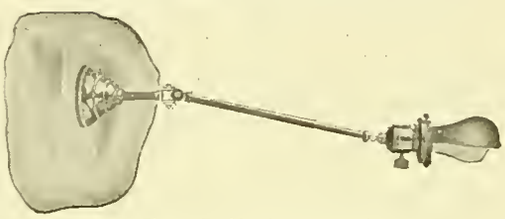


Fig. 5. Double-joint Bracket Fixture.

DOUBLE-JOINT DESK FIXTURES.

Fig. 4 shows a double-joint portable fixture with marbleized base and extendable tubes, which gives the light where wanted on a roll-top desk or wherever the lamp rest is above the work.

For use on bookkeepers' desks, where the fixture is clamped to the edge of the desk, the type shown in Fig. 3 is desirable, as by means of the clamp the fixture may be easily moved from point to point along the desk, making the light adaptable to both the ledger and journal work. Fig. 5 shows a bracket type embodying the double-joint principle.

In Fig. 2 is illustrated a portable double-joint fixture for use on a typewriter's desk.

These fixtures are as well constructed as the Kinsman fixtures made by this company, which are well known, and with the old line are expected to cover the desk-lighting field thoroughly.

Electrical Trades Exposition in Chicago.

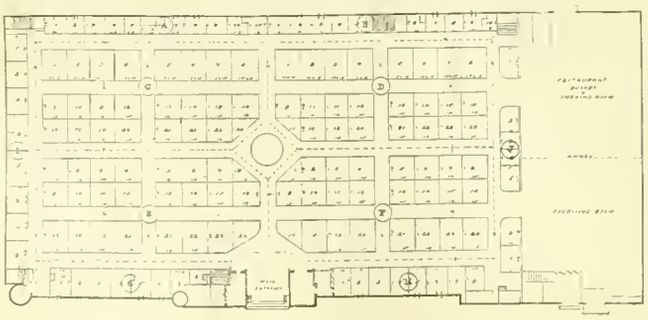
Much interest is manifested in the Chicago Electrical Trades Exposition, which is to be held in the Coliseum on January 15th to 27th inclusive. As already announced in the Western Electrician, this show is being promoted by the Electrical Trades Exposition Company, of which Samuel Insull is president and Thomas R. Mercein general manager. The office of the company is at 464 Monadnock Building.

The accompanying floor plan of the main floor of the Coliseum shows how the space is to be divided up for exhibits. There will also be considerable rental space in the galleries. Charges will be $1 a square foot on the main floor and 50 cents a square foot in the galleries. Exhibitors will not be allowed to sublet their space or show articles not manufactured by themselves.

Electric sign work must conform to the rules of the Chicago Board of Fire Underwriters and the Department of Electricity.

The Coliseum plant will supply 110 and 220-volt direct current for light and power. Alternating current can also be had. Arrangements for this service may be made with C. R. Hall, superintendent of the Coliseum, who will also attend to the hanging of signs and other electrical work if necessary. As an accommodation, however, the management would prefer that exhibitors use their own electricians and workmen as far as possible.

The east half of the annex will be occupied by a restaurant under competent management and with excellent and continuous a-la-carte service at reasonable prices. There will also be a modern and completely stocked buffet and a large and comfortable smoking and rest room, with rugs, lounges and easy chairs, the aim of the management being to make it a pleasant and attractive meeting and resting place for both ladies and gentlemen. A full military band of 30 pieces with soloists will be in attendance afternoons and evenings and render regular and "request" musical programmes.



PLAN OF EXHIBIT SPACES IN COLISEUM FOR CHICAGO ELECTRICAL EXPOSITION.

Air-cooled Electric Drills.

One of the limitations to which electric drills have been subject has been the heating of the motor parts, making it necessary to design the motor of a size and capacity sufficient to allow of sustained operation, rather than with a view to making the drill as a whole compact and easy to handle. To overcome this obstacle it was natural to devise some method of air cooling, which would allow of the motors being made of a size commensurate with the work which they have to perform. This feature is embodied in the Duntley air-cooled electric drills, which are sold by the Chicago Pneumatic Tool Company.

Several sizes and types of the Duntley drill are now on the market, and they have passed through the experimental stage, extending over a period of two years. The drills are now made with one and three-motor drive, while the one shown in the accompanying illustration contains two motors. This last drill is not as yet on the market, but will make its appearance before the first of the year.

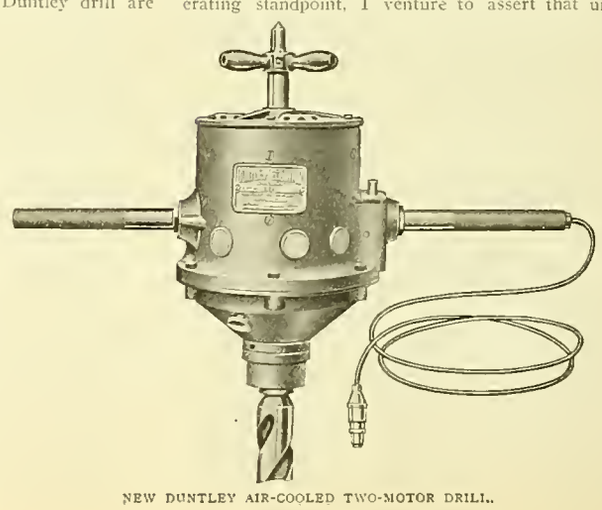
As will be noted in the picture, a casing encloses the motor parts. Through this casing openings are provided, covered by screens, which allow of a free circulation of air around the motor armature and fields, which is accelerated by the rapidly moving parts. This air circulation, by keeping the motors cool, allows of the design of a much lighter and more compact drill.

The amperage consumed by the different sized machines is based upon actual tests made with drills wound for 110 and 220 volts direct current. Two hundred and twenty-volt machines operating from 220-volt direct-current circuits consume only one-half the number of amperes given for the 110-volt drills. The 220-volt drills will operate from 110-volt circuits with full power, but at reduced speed. Neither the 110 or 220-volt drills will operate from a circuit of higher voltage without reducing the pressure by means of a rheostat.

The larger capacity single-motor drills are provided with a friction clutch or collar. When the machines are shipped from the factories, the collars are set to slip at any time the drills may be cutting at a speed requiring amperage in excess of their rating. The collar slipping permits the motors to run at full speed while the drill spindle stops, thus preventing the blowing out of the fuse plug (which has been provided as an additional safeguard against damage by overloading the motors or by allowing the drill to stick), or the heating of the motors. When the drill sticks, allowing the friction collar to slip, a slight turn of the feed screw, to release the pressure on the drill, will cause the friction collar to again take hold and start the drill spindle rotating. This feature alone renders these machines safe in the hands of inexperienced operators, without the slightest knowledge of electrical machinery, as there is no possibility of damage occurring through too rapidly feeding the drill, or by allowing the drill to stick from any cause.

The three-motor drills are constructed along entirely new lines, having three small motors in one casing, arranged in a clover-leaf form and meshing with an annular gear which drives the drill. A new method of field winding insures uniformity of speed of the three motors. They consume from six to nine amperes (110 volts, or half the above when wound for 220 volts) at maximum rating.

The two-motor drills of the pattern here shown are similar in external appearance to the three-motor type, and are designed along practically the same lines, with the exception that only two motors are used.



NEW DUNTLEY AIR-COOLED TWO-MOTOR DRILL.

Mr. Sprague Makes a Protest.

Frank J. Sprague raises his voice in protest against the employment of alternating-current locomotive equipment by the New York, New Haven and Hartford railroad, which has placed an order for 25 78-ton alternating-current locomotives, to be used for trains running out of New York city, as announced in the Western Electrician of September 30th. Mr. Sprague does not object so much to the alternating-current apparatus itself, as to its employment in this particular case. For about 13½ miles the New Haven road uses the New York Central tracks to come into the Grand Central station in New York city. As is well known, the Central is making a very extensive terminal electrification of its lines, and it is using direct current. Under these circumstances, and referring to the decision of the New Haven road to use the alternating-current locomotives, Mr. Sprague says: "Speaking in my individual capacity as an engineer, and also from a railroad-equipment and operating standpoint, I venture to assert that under

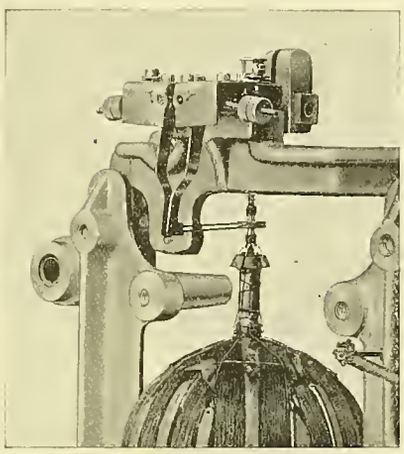
the existing circumstances, and in view of certain special limiting conditions, this decision is an error of more than ordinary magnitude." And again: "Every specific condition surrounding this proposed equipment seems, therefore, to militate against that directness and simplicity of equipment essential to the claim of alternating-current operation, and which under more favorable auspices would have a fair chance of being demonstrated." Mr. Sprague makes an extended argument in support of his position in the Street Railway Journal of October 21st under the heading, "An Unprecedented Railway Situation."

New Recording Wattmeter.

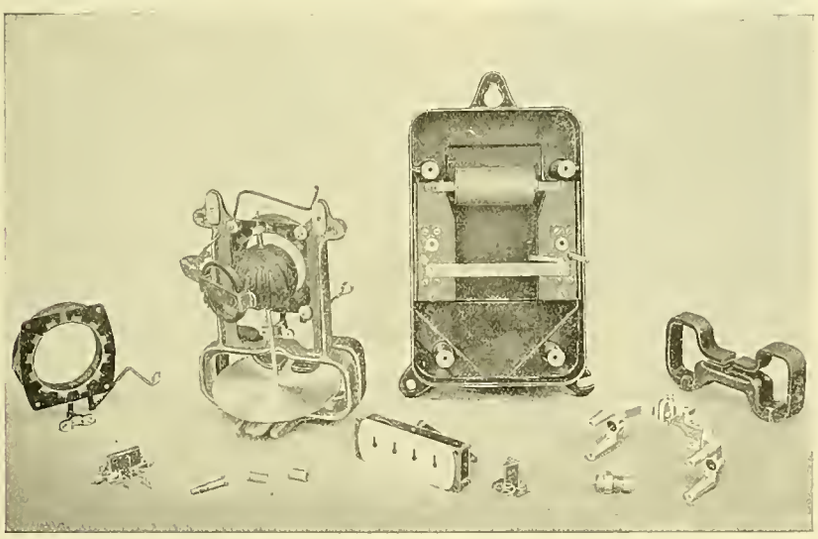
Some new ideas in the construction of recording wattmeters have been developed by the General Electric Company, which has recently placed on the market a new type of recording wattmeter identical in principle with the earlier forms of Thomson recording wattmeters, but differing widely in structural details. This new meter is known as the Thomson recording wattmeter, type C, shown in the accompanying pictures.

The cover is fastened with studs and wing nuts,

EXTERIOR OF NEW RECORDING WATTMETER.



COMMUTATOR AND GRAVITY BRUSHES IN NEW RECORDING WATTMETER.



ELEMENTARY PARTS OF NEW RECORDING WATTMETER.

and may be moved directly toward the front, permitting the installation of a large number of meters where space is limited. The sealing wire is passed through the wing nuts, their respective studs necessitating the use of but one wire. This positively prevents tampering without detection. A felt-lined groove surrounds the edge of the cover, and the leading-in holes for the wires are covered with the same material, excluding both dust and insects.

In the meter proper a number of improvements have been made. The lower bearing is made of carefully selected sapphire; or, in capacities above 50 kilowatts, of diamond. The General Electric Company has recently perfected a method of grinding diamonds in a concave form, obtaining a polish fully equal to that of the sapphire jewel. The shaft is tipped with a brass pivot fitted with a very finely polished steel point which, with the jewel cup, forms an excellent bearing surface. On the upper end of the shaft, and very carefully insulated from it, is the commutator. This is but one-tenth of an inch in diameter, and with the gravity-controlled brushes, reduces the friction at this point to the minimum. The entire mechanism is assembled upon a skeleton casting, which in turn is fastened within the meter casing. By removing four screws and disconnecting the windings from the terminals the mechanism may be removed for inspection and repair.

The armature is spherical, and revolves within circular field coils. This most nearly fulfills the conditions of lowest possible watt loss with highest torque. This armature is wound from very fine wire, upon a paper shell, and the field windings are of copper ribbon. The damping magnets are subjected to a rigid process of magnetization and aging, to insure absolute permanence. The peculiar design of the field coils and armature of the type C meter gives the greatest possible torque, combined with minimum losses and weight of moving element.

Although designed primarily for use upon direct-current circuits, this meter may, like its immediate predecessor, be used with entire satisfaction on alternating-current circuits, regardless of frequency or wave-form, and if properly lagged it may be used upon inductive circuits without recalibration or adjustment.

Having no iron in its construction, the type C meter is not subject to hysteresis action. It is manufactured in capacities ranging from five to 600 amperes, inclusive, two wire; five to 300 amperes, inclusive, three wire, and for potentials from 100 to 600 volts.

Tunnel Under the Detroit River.

Consul Conant of Windsor, Ont., writes that the proposed tunnel under the Detroit River between Windsor, Ont., and Detroit, Mich., is to be about 7,400 feet long, but from the points on both sides where the gradations downward begin, about 2⅛ miles. "As the United States government requires a depth of 40 feet in the channel over the tunnel, the top of the latter will not come higher than 45 feet under the surface, thus allowing for five feet of gravel on its crest. The methods of construction are to be the most modern in tunnel building, both in excavating and constructing the tunnel itself. The safety of the workmen will be looked after from the day the first shovelful of dirt is dug down to the day on which the first train passes over the tunnel rails or the first foot passenger passes from one side to the other."

This undoubtedly refers to the Michigan Central Tunnel under the Detroit River, which, with the "electrification" thereof, is in charge of an advisory board of engineers consisting of William J. Wilgus, vice-president of the New York Central railroad, Howard Carson and W. S. Kinnear.

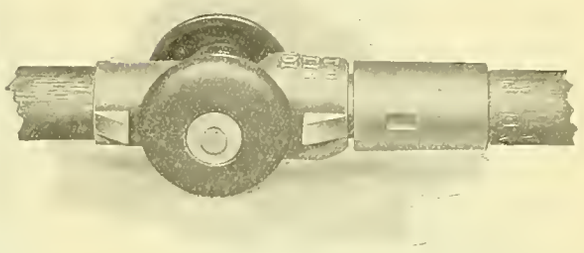
Copper Situation.

Demand for copper has been manifest to a large degree of late, the metal going rapidly into consumption. Exports have also been large, these conditions diminishing the available supply almost to a scarcity. Both electrolytic and Lake copper were held last week at 16.62 cents a pound. This rise in price, from all indications, has been on account of a healthy demand and not from a speculative movement. The great improvement in business has warranted a higher price in raw materials, and copper has naturally shared in the benefits of this improvement. Though there has been talk of 20-cent copper, under the most favorable selling conditions this price is too far in the future to cause anxiety among consumers. But the situation is one which is capable of furnishing surprises, and the position of the metal is worthy of study.

New Wheel Conduit Rod.

A new conduit rod provided with a wheel attachment to facilitate its movement through the conduit is shown herewith. The rods are supplied with a special coupling which may be coupled and uncoupled almost instantly. The rods are said to be flexible and easily pulled through the conduit, though not buckling seriously when they are pushed. Since the sections of a rod must be placed at an angle of 45 degrees to uncouple, it is impossible for them to come apart in the conduit.

The wheels on the rods, as shown in the picture, prevent the rods from coming in contact with the walls of the duct and also serve as a duct cleaner, as they insure a 2½-inch opening throughout the entire length. The wheels are shaped to pass easily through.



NEW WHEEL CONDUIT ROD.

Couplings are made of bronze or malleable iron, the wheels of chilled cast iron and the rods of the best hickory. A record of 20,915 feet by two men in eight hours is said to have been made by using these rods. The rod is made by the Diamond Expansion Bolt Company of New York city.

The Electrical Fire Hazard.

The most recent bulletin issued by H. D. Davis, Ohio state fire marshal, relates to the installation of electric-light wires, the dangers attending careless work and poor insulation. During the last year, he said, 70 fires are known to have occurred in Ohio from electric circuits, in comparison with 117 in 1903. Most of the electrical fires occur in locations where there is a conflagration hazard, he said, and for this reason wiring should receive particular attention. Mr. Davis added:

"Speaking generally, fires from electricity depend upon defective installation or deterioration of the wires and upon accidental contact of the wires carrying currents of different strength. So, accidents result from short-circuits, arcs and grounds. While the chief source of danger is from defective wiring, many fires are chargeable to improper handling of lamps on flexible cords. In these cords the wires are separated only by a coat of insulating material, which is easily worn off and which loses its insulating power when wet. Long cords should not be used, because of the temptation to hang them over nails, hooks and wooden projections which may wear through the insulation. They should never be looped, knotted or put in contact with gas fixtures, or used to hang office tools on. Portable lamps should have cables especially designed for them, and the bulb should be covered by a wire guard."

Waterside Station in New York.

The steel work for the second section of the Waterside station of the New York Edison Company is well advanced toward completion. Section 1 of this station is complete and constitutes what is asserted to be the largest lighting and power station in the world. The new section will soon be in partial operation and is of still greater capacity. The two combined will excel anything in size and completeness yet conceived for the purpose of generating electric power. The combined capacity of both plants will exceed 250,000 horsepower.

Small Bipolar Motors.

For increasing the day load, central-station operators realize that the motor of small power is destined to play an important part, and they are pushing this department of their business energetically. This brings the manufacturer to a realization of the fact that a line of small motors to fill the requirements of dentists, office managers, jewelers, etc., will be bound to sell in the future even more than at present, for the campaign for this class of trade is only fairly on. One of the companies which is offering an attractive line of small motors is the Fort Wayne Electric Works of Fort Wayne, Ind. One type of this company's motor is here shown together with illustrations of two applications of the motor. The motor referred to is known as the type S P D (Fig. 1):

The frame of this motor is rigid in construction and neat in appearance. It is cast in two pieces from a very high grade of iron, uniform in density and free from blow holes. The two sections of the frame are hemispherical in form and are supplied with two openings near either end of the shaft by means of which the commutator and brushes may be examined. These openings also permit free circulation of air within the motor, guaranteeing cool operation. The motor is for direct-current operation.

FIG. 1. TYPE OF SMALL MOTOR.

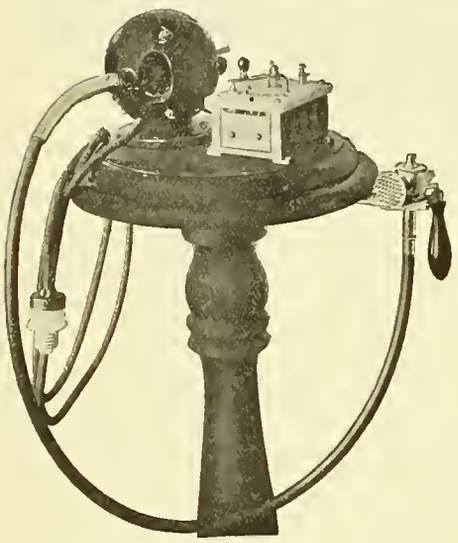


FIG. 2. SMALL MOTOR DRIVING VIBRATOR.

When assembled the two parts of the frame form a nearly perfect hollow sphere enclosing both armature and field in a compact manner. The frame is supported upon a separate cast-iron standard permitting the motor to be located upon either floor, wall or ceiling, the whole presenting such an unbroken outline as to insure neat appearance and prevent accumulation of dust.

The field core is carefully assembled by stacking together laminations of the best quality sheet steel, each being furnished with sufficient insulation upon its surface to prevent the formation of eddy currents and their consequent losses within the core.

The field is bipolar in design, the laminations being stamped in such form as to make the magnetic circuit, poles and pole-tips entirely separate from the cast-iron frame.

The two field coils are wound and insulated in separate units, being made sufficiently flexible to slip over the pole-tips. They are finally fitted tightly about the pole and securely fastened in such a manner as to prevent all vibration and consequent chafing.

The armature core is made up of laminations of high-grade sheet steel stamped in such form that when stacked upon the shaft, with the laminations slightly staggered, a complete cylindrical core is formed with slots in its surface, of constant depth, located at a slight angle with the shaft. By this method of construction all humming in the motor is prevented.

The armature coils are form wound, being forced into the insulated slots of the core in the usual manner and firmly secured in place by means of fiber wedges.

In order to form a suitable support for the brush-holders, lugs have been cast inside the frame of the motor.

Another type known as type S P A has been designed for use where small amounts of power are desired upon alternating-current single-phase systems. It is similar in appearance to the direct-current motor just described, having a spherical cast-iron frame with dimensions corresponding to the direct-current motor.

Fig. 3 shows the application of the S P D motor to a copying machine, the whole when installed making a neat piece of office furniture. Fig. 2 shows the motor operating a vibrator outfit.

The direct-current motor is made in sizes up to and including one-thirtieth horsepower. The alternating-current motors are of the same capacities. A third type offered, known as type D, is similar to the others and is built of direct-current sizes from one-tenth to 1½ horsepower.

Important Telephone Transfer in Indianapolis.

The control of the Indianapolis Telephone Company and the New Long-distance Telephone Company, the two largest Independent telephone properties in Indiana, has passed into the hands of interests outside of Indianapolis, thereby making one of the most important telephone deals that has taken place in that state for some time.

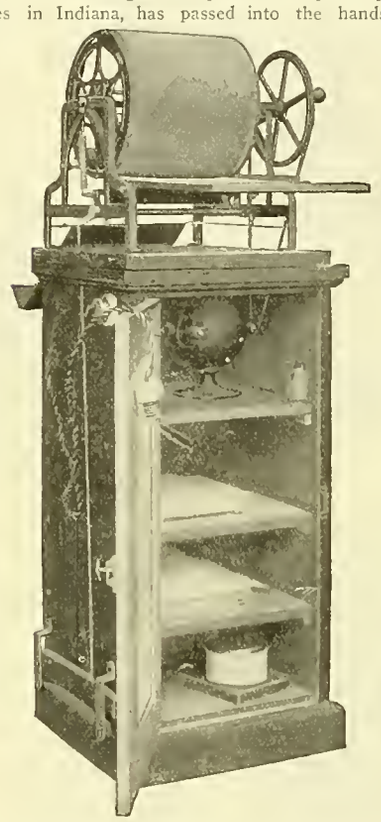


FIG. 3. SMALL MOTOR DRIVING COPYING MACHINE.

Writing on this subject on October 21st the Indianapolis correspondent of the Western Electrician says: "When it was learned that a possible controlling interest in these properties could be secured the strenuous efforts of Messrs. Brailey, Stifel and Bauer of Toledo on the one hand and Col. Breckenridge Jones of St. Louis on the other made the Indianapolis stock market the most active during the last week in its history. So anxious were the respective factions to secure a controlling amount of the stock that it jumped from below 50 to 55 and ran even higher, as it is known that 60 was paid for some of the stock. There is a difference of opinion as to which faction has secured the controlling share of the stock, but that matters little, since the two have combined and entered into a definite agreement whereby the four men interested have pooled their stock and will henceforth control the two important Independent telephone properties in Indiana.

"It is expected that the reorganization of the company will be brought about within a week or such a matter. Mr. Louis Hollweg, president of the two companies, having sold all his holdings, will retire from the presidency. The New Long-distance Company and the Indianapolis Telephone Company, it is said, have not only passed into the hands of men who have resources enough at their command to fight all opposition within the limits of Indiana, but an aggressive policy will be adopted quite different from the conservative policy followed ever since the death of Mr. Sheerin. While the new stockholders from Toledo and St. Louis would not admit that a giant merger was contemplated, but declared that the companies would be operated independently of the companies in Toledo and St. Louis, with which they are connected, it was said that the St. Louis company has lines reaching to Terre Haute from the south, while the Toledo company has lines reaching to Fort Wayne on the north. Evidently it will be an easy matter to connect up the three systems for a more extended and better service. The deal is regarded as important and strengthening to the Independent movement in the state, as it closes up all the loopholes exposed to the inroads now being made by the Bell Telephone Company upon the smaller Independent plants."

In reference to this deal the correspondent of the Western Electrician at Cleveland, which is of course an important Independent telephone center, gives the Ohio view as follows: "Quite a little interest has been taken by telephone men throughout the state in the purchase of the Indianapolis Telephone Company and the New Long-distance Telephone Company of Indiana by James S. Brailey, Jr., and a syndicate organized by him. Mr. Brailey is one of the foremost telephone men in the state, and besides being an important factor in the construction business has developed great strength in formulating and financing deals both large and small. The last is one of the largest purchases he has negotiated."

Telephone News from the Northwest.

The Northwestern Telephone Exchange Company has removed the toll charge at the Prior Exchange in the Midway district between Minneapolis and St. Paul. This enables about 300 connections to connect with either city without paying a toll charge to one or the other.

A telephone line will be constructed from Parkers' Prairie, Minn., to Urbank.

The Eldorado Mutual Telephone Company of Custer, S. D., has been incorporated with $25,000 capital.

The Tri-state Telephone Company has applied for a franchise at Sauk Rapids, Minn., and is said to have St. Cloud, but three miles distant, as an objective point.

The Tri-county Telephone Company of New Prague, Minn., has been incorporated with $10,000 capital stock.

S. W. Smith has resigned as manager of the Fairfax Telephone Company, Fairfax, Minn. Roy Stevens succeeds him.

The Minnesota Central Telephone Company will construct a central-energy system at Redwood Falls, Minn., replacing the old exchange now in use.

The telephone fight at Foley, Minn., has resulted in the removal of the switchboard of the local company on a claim that it is owned by the Northwestern Telephone Exchange Company. The Twin City at once replaced the board. The local representative declared she would not allow the removal of the board without instruction, and it is reported that it was taken by force.

A meeting of all the telephone companies of Southwestern Iowa is to be held in Council Bluffs for the purpose of providing for the installation of a telephone clearing house.

The Earling Telephone and Telegraph Company of Earling, Iowa, has been incorporated with a capital of $3,000. P. J. Korth is president and N. V. Kuhl secretary.

The Nebraska Telephone Company will expend about $15,000 in rebuilding its lines at Central City, Neb. R.

Ohio Telephone Notes.

The Cuyahoga Telephone Company and the Bell people are having a merry time at Chagrin Falls and cast of that place, and it is said that people who take the Bell service are getting their service two months for nothing. After the formation of the Chagrin Falls Telephone Company a system of lines was built by George B. Stafford, connecting many of the small towns. Then plants were installed at Burton and Chardon. All of these were later brought into a combination known as the Geauga County Telephone Company. A few months ago the Bell Telephone Company endeavored to purchase the Chagrin Falls plant, but failed and it went into the hands of the Cuyahoga Telephone Company. The Bell people did secure the plant at Burton, however, and since then have been making many improvements in the lines and endeavoring to build up a service at Chagrin Falls. The Cuyahoga company is building an additional line through Solon and Orange townships and is making other extensions. It is said that Bell lines are being built all over the little town of Chagrin Falls.

The meeting of the ninth district of the Ohio Independent Telephone Association was held at Mansfield, October 18th. Several prominent telephone men were present and a number of important

subjects were discussed, among them the formation of new companies to break into the eastern business.

The Central Union Telephone Company has been making some extended improvements in its plant at Springfield and in the lines throughout Clark County. The conduit system in the city has been extended and a number of new cables have been placed upon the pole lines. In all about 25 miles of cable are going up. Additions are also being made to the switchboard, and when they are completed the capacity will be about 10,000. In the city there are 3,500 subscribers and in the country 1,000 connected with the city exchange. It requires more than 80 operators to take care of the business.

The capital stock of the People's Telephone Company of Mt. Blanchard has been increased from $50,000 to $100,000. F. E. Palmer is the president.

It is announced that J. S. Brailey, Jr., of Toledo has purchased the holdings of M. J. Dreyfus and others in the Independent telephone properties in Tuscarawas County, Ohio, thus securing a controlling interest.

The case of the Queen City Telephone Company against the city of Cincinnati will come up in the Supreme Court for hearing on November 1st. In the Common Pleas Court and Circuit Court the decision was against the company. The trouble grows out of the refusal of the City Council to grant the company a franchise for the use of the streets and alleys for its conduits and wires. The council said that the ground under the streets is now filled with such a network of conduits and water and gas pipes and that the manholes are so numerous at the points of intersection that it would be dangerous to increase them. Another point is that where there are two telephone systems, business houses, professional men and others are compelled to use both and, thus instead of decreasing the cost as in other competitive lines of business, they increase it. It is the belief of the council committee that no company can give good service at less than half the present cost, which would be required, it said, in order to make the service cheaper than it now is. C.

Indiana Telephone Items.

The Citizens' Telephone Company of Columbus is reaching out for the small exchanges operating in the adjacent territory. During the past week the Hope Independent telephone exchange was purchased by the Citizens' company for the sum of $28,000. The Citizens' company is negotiating for several other Independent exchanges in the country.

The Lafayette Telephone Company has purchased a large three-story stone building on the corner of Fourth and South streets for a new exchange. The company will spend a large sum in remodeling the building and establishing therein modern apparatus. The Central Union Telephone Company in Lafayette has also recently leased a new building in Main Street and will likewise make improvements to better and extend the service.

A new telephone company has been formed at Marion, which includes members of the Delaware and Madison County Telephone Company, the Winchester, Fort Wayne and other Independent companies. The company is said to be backed by large capital and will install one of the best plants in Marion that can be produced. Long-distance lines will be built to all surrounding cities and towns, and Marion will again be placed in Independent telephone communication with the outside world. The new exchange to be installed will be an automatic system. A franchise has been prepared to be presented to the City Council at its next meeting. Engineers and electricians have made a careful survey and plans for the system and estimate that the cost will reach about $300,000. This movement means another telephone war, the last one recently closed resulting in the Central Union Company and the Independent company consolidating. The consolidation of the two companies practically cut off all long-distance connections with Independent companies in surrounding towns and cities. This, it is said, has worked much disadvantage to business men and citizens of Marion generally, who have urged the formation of a new company and the granting of a franchise for its service.

The directors of the South Bend Home Telephone Company have declared a semi-annual dividend of one per cent. on the stock.

The Leiter's Ford Telephone Company of Leiter's Ford, Ind., has been incorporated with a capital stock of $2,000. The company proposes to establish and operate a telephone exchange and system in Leiter's Ford and throughout Fulton County. B. F. Overmeyer, J. B. Campbell and C. E. Anderson are the directors.

The first meeting of the Indiana Independent Telephone Association of the Eight district, composed of Rush, Henry, Fayette, Franklin, Wayne and Union counties, was held in Rushville on October 20th. Vice-president A. C. Lindermuth of Richmond presiding. "Operating Conditions" was the principal subject discussed. Representatives from 35 companies in the district were present and brought good reports from their respective localities. A resolution was passed pledging the Independent telephone companies in the Eight district to refrain from any further joint service with any company that has a connection, direct or indirect, with any sub-licensee of the Bell Telephone Company. Charles S. Norton, secretary of the association, was present and stated that the plan of organizing the districts is working harmoniously and that within another year Indiana will have the strongest Independent telephone association in the country. S.

Michigan Telephone Matters.

A. E. Huntly, manager for the Michigan Telephone Company at Muskegon, has left to accept charge of the Ludington district, with an office in Ludington. He is succeeded by John Wrather. Several improvements are being made in the Muskegon exchange, including new switchboards.

The Detroit telephone girls were given an outing on the steamer Kirby to Toledo on Sunday, October 15th, by the Kirby line. Lunch was served to them on the boat.

The strike of the linemen, inside helpers and construction crew of the Citizens' Telephone Company of Jackson has been settled. All have returned to work.

The Union Telephone Company of Perry, Mich., has purchased its rival, the Farmers' Telephone Company. The latter company was started about two years ago as a competitor by Messrs. Cudworth and Hall and became affiliated with the Bell company.

The Pontiac exchange of the Michigan Telephone Company is to be improved to the extent of $35,000. New and up-to-date equipment will be provided. W.

Bell Telephone Output for September.

The telephone output statement of the American Telephone and Telegraph Company for September shows great gains by comparison with the corresponding periods in previous years. The figures for the month and first three-quarters of the year follow:

September:	1905.	1904.	1903.	1902.
Gross output	160,613	106,305	79,406	75,011
Returned	51,494	38,353	43,438	43,334
Net output	109,119	67,952	35,968	31,677
January 1 to September 30:				
Gross output	1,301,058	876,609	812,229	808,334
Returned	457,405	374,925	358,831	346,689
Net output	843,653	501,684	453,398	461,645
Total outstanding	5,324,217	4,281,201	3,603,718	2,987,251

TELEPHONE MEN.

Fred DeLand is writing a series of articles on the "Evolution of the Subscriber's Telephone" for the Enterprise of Belle Vernon, Fayette County, Pennsylvania.

William D. Barnard of Philadelphia, Pa., died of Bright's disease on October 16th. Mr. Barnard was a pioneer in the Independent telephone movement. He was a member of the executive committee of the Pennsylvania association and of the executive council of the National-Interstate association. Besides being president of the Eastern Telephone Manufacturing Company, he was vice-president of the United Telephone and Telegraph Company, the Cumberland Valley Telephone Company and the Eastern Electrical Construction Company. He was also a director in a number of other companies and took an active part in the construction of a large number of exchanges. He took great interest in the progress of Independent telephony and offered practical ideas for its development.

GENERAL TELEPHONE NEWS.

Telephone rates in Jersey City, N. J., will be reduced on November 1st from 10 to five cents per message within the city limits.

At the meeting of the Texas Independent Telephone Association in Dallas on November 6th, 7th and 8th the organization of the Independent Telephone Clearing House Association will be taken up. One of the needs of the telephone business is the arrangement of a system by which the lines in operation may be connected up and may share equitably in the tolls for messages. The clearing-house association has applied for a charter, with headquarters in Dallas, and proposes to work out such a system and to apply it to all lines which become members of it.

MANUFACTURERS AND DEALERS.

The Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y., reports having closed contracts for switchboards for Roxboro, N. C.; Onaga, Kan.; Rochester, N. Y.; Ellicottville, N. Y.; Eldorado, Ark.; Wabash, Ind.; Newark Valley, N. Y., and Camden, N. J.

The Dean Electric Company of Elyria, Ohio, has issued a bulletin which contains as a prominent feature a reprinted article by W. W. Dean "Concerning Harmonic Party-line Systems." Part of the bulletin is given up to a description of the parts of the Dean harmonic party-line system.

CORRESPONDENCE.

Great Britain.

London, October 13.—The township of Tunbridge Wells made itself famous a few years ago by being the first municipality to install a telephone system. Within 18 months it had become notorious in that its telephone undertaking was sold to the National Telephone Company—a public admission of incapacity. Within the last week an effort was made by one of the members of the council to move a resolution that the municipal electricity undertaking should be sold to an outside company, but the attempt was defeated. As a matter of fact, this department at Tunbridge Wells is well managed, but such proceedings as these are fast reducing the number of advocates of municipal trading here, and faith in municipal ability and capacity to carry on such undertakings is weaker than it has been probably for many years.

Several interesting sequels to the hard fight in Parliament in connection with the big electric power bill are now coming to light. First of all, and probably the most important, is the expense which the borough councils were put to in opposing it. The Hammersmith Borough Council has reported that the total costs amount to $25,000. Then there were certain municipalities' works which the company had agreed to take over—local authorities more or less in a state of bankruptcy; and more than one of these is bewailing its fate and trusts that the bill will be introduced next session, when the agreements will be revived. Last but not least is the fact that the London County Council has the whole question under serious consideration, and it is hinted that it intends to promote a bill of this character next session. For many years a section of the council has held the view that it should be the electric supply authority for London and that the borough councils shall take a supply in bulk from them. It is not too much to say that any such proposal is not likely to materialize while a conservative government remains in authority.

Another has been added to the list of electric power companies in operation in Great Britain by the opening of the Lancashire Power Company's first power house. These works have been designed by the same consulting engineers that designed the Yorkshire Power Company's works, recently opened, and they may be designated twins. Both have Curtis steam turbines and the arrangements generally are identical. There are now electric power companies in operation in Wales, Scotland and London in addition to three in the Midland districts of England.

Several of the London electric supply companies have advertised the fact that at the end of this year electrical energy will be supplied for power purposes, including cooking and heating, at two cents per unit (kilowatt-hour). This is probably a little well-reasoned foresight in view of a probable reintroduction of the big electric power bill in connection with which the two-cents-a-unit electricity became quite notorious.

During recent years it has become quite the custom for certain sections of municipal bodies to create dissatisfaction with certain of the public officials. In more than one case, for instance, the electrical engineers have resigned, owing to what might almost be called persecution. In others, the individuals in question have fought the dissatisfied councilors and courted full inquiry from which they have emerged victorious. The latest case of this character has occurred at Bradford, where the electric tramway manager has been subject to much criticism of this nature. He, however, did not submit quietly to such treatment and frankly asked that a special sub-committee should be appointed to investigate. The result of this committee's visits to other large towns owning tramway systems has been a complete exoneration of the Bradford tramway manager.

The London County Council, by virtue of a somewhat foolish action in 1900, when it gave all the borough councils a veto on the question of the system of traction to be employed in their districts, is still being delayed in the conversion of the horse tramways on the north of the river. The Stepney council is obdurate and will sanction no other system than the conduit, while the neighboring body, the Poplar council, has agreed to the overhead trolley system. There are engineering reasons as well as economic why the trolley system should be used in these districts, and the old cry that the tramway companies have retarded progress in London will soon have to be discarded. G.

New York.

New York city, October 21.—The work of improving the terminal facilities at the Manhattan end of the Brooklyn Bridge is proceeding satisfactorily. Extension platforms are being built out on brackets on each side of the elevated tracks, and when finished there will be enough platform space for present needs pending the final solution of the problem, which probably will not come about until the bridge is rebuilt. Meanwhile the board of estimate has reported upon the subject of providing adequate terminal facilities for the Manhattan Bridge, but the presence of the Second Avenue Elevated tracks

on Division Street appears to be an unsurmountable obstacle to a thoroughgoing scheme.

Every effort is being made to complete the work of completing the electrical equipment of the Long Island railroad so the cars can be run through to Far Rockaway by November 1st. At exposed places the power rail is to be protected by fencing. It is expected that the time to and from the city and Far Rockaway will be 20 minutes shorter than by the steam operation.

The Allis-Chalmers Company recently imported some models of turbine machinery, but the New York customs officials declined to classify them as "patterns," but assessed them with duty as "manufactures of metals," chargeable at 45 per cent. ad valorem. The Allis-Chalmers Company is appealing against this decision.

The New England National Automatic Fire Alarm Company of 260 West Broadway, is asking for the appointment of a referee for a voluntary dissolution of the corporation. The company was incorporated in October, 1902, with a stock capital of $300,000. Last March a receiver was appointed, when the liabilities were given as $915 and the assets $496.

Schedules in the assignment of the Switchboard Manufacturing Company of 661 West Fifty-eighth Street show liabilities amounting to $26,668 and nominal assets $16,365. The actual assets are said to be valued at $8,228.

The Hutchison Electric Horn Company of Ossining, N. Y., has been incorporated with a capital of $20,000. M. R. Hutchison, one of the directors of this concern, is the inventor of the "acousticon," recently described in the Western Electrician.

The men employed in the printing shop of the General Electric Company at Schenectady, N. Y., went on strike recently for an eight-hour day, which was granted. Then the printers refused to accept the local rate of wages, which was $16, and wanted the old rate of $18 restored. Today the company announces that the dispute has been settled.

The Hudson Street Railway Company, a New Jersey incorporation, has filed plans for 50 miles of trolley connections as feeders for the McAdoo Tunnel now being constructed under the Hudson River. It was thought at first that the Public Service Corporation of Newark, N. J., would bring business to the McAdoo Tunnel, but that company started on plans to build a tunnel of its own. The new trolley lines threaten active competition with existing lines over a wide stretch of suburban territory. D. W. W.

Ohio.

Cleveland, October 21.—A public hearing will be given some time next week on the surface-loop plan which the Chamber of Commerce at Cleveland has recommended for doing away with the congested condition of the tracks about the Public Square.

John G. Webb, president of the Columbus, Delaware and Marion, is quoted as saying that the gap between Marion and Bucyrus will be closed within a year and that the only other link to form a connection between the big systems of Ohio, Indiana and Michigan will be the 18-mile stretch between Plymouth and Shelby Junction. The interurban roads of the northern part of the state are rapidly closing up the gaps, so that in a short time travel to almost any point will be possible.

The Cincinnati Traction Company is negotiating for a tract of land adjacent to the Eighth Street car barns. If the property is secured immense barns will probably be erected on it.

The Scioto Valley Traction Company has received eight freight cars that will be put into service as soon as the new depot at Third and Rich streets is completed. It will enter competition with the Hocking Valley and Norfolk and Western railroads and will take freight in carload lots or by the small piece.

W. Caryl Ely of Buffalo, who is said to have secured control of the electric lines at East Liverpool, Steubenville, Toronto and Wellsville, is having plans made for a line from East Liverpool and Wellsville to Lisbon, the county seat. A gap between Empire, three miles up the river from Toronto, and the Jefferson-Columbiana county line, will be built. This will give a continuous road from Brilliant, Ohio, to Smith's Ferry, Pa., and from there east to Vanport, 15 miles, a road is to be built that will connect with the Beaver Valley railway, which is under the control of the Pittsburg Railways Company. The electric-light franchises at East Liverpool and Wellsville are also under the control of Mr. Ely.

The report that the Lake Shore Electric has purchased or has in contemplation the purchase of the Cleveland and Southwestern property has been denied by the officers of the former. They say propositions have been made in the past to that end, but that they have never received serious consideration.

Improvements amounting to $100,000 will be made in the power plant of the Northern Ohio Traction and Light Company. A new unit to be placed in the plant will increase its capacity about 1,000 horsepower. The machinery will be so arranged that it may be either used for the railroad or lighting departments. The business of the company is increasing in both departments to such an extent that the addition is necessary.

The City Council of Alliance has selected Silas J. Williams and the Alliance Gas and Electric Company has named Robert Lidsey, superintendent of the Cleveland Electric Illuminating Company, as arbitrators to fix the rate of electric and gas lighting for the city. These men will choose a third. There has been much litigation over the matter and this sensible plan has been taken to settle it.

The first fall meeting of the Ohio Interurban Railway Association will be held at the Chittenden Hotel, Columbus, on Thursday, October 26th. The questions to be discussed are as follows: "What should be the proper width of interurban cars in order to give passengers the same comforts which they receive on steam roads? What should be the space between the seats and width of aisle?" "What should be the width of the strip between tracks on city lines and on interurban lines?" and "What is the best track construction on paved city streets?" Secretary F. W. Coen has issued a letter urging all members to take up the work with enthusiasm this fall and push it. He says that the association is recognized as one of the strongest in the country.

A local journal in Cleveland has printed an item saying that Warren Bicknell will within a short time present his resignation as president of the Lake Shore Electric in order to accept an important position with another system of electric roads. Further, it says that it is not in position to say who his successor will be, but one either of three men—H. A. Everett, E. W. Moore or Barney Mahler—would be logical candidates for the place. What there is in the item remains to be seen, as it has not been confirmed at this time.

In the reorganization of the Columbus, Buckeye Lake and Newark and the Columbus, Newark and Zanesville traction companies the following-named officers were chosen at a meeting held in Columbus a few days ago: President, W. Kelsey Schoepf; vice-president, Hugh J. McGowan; secretary and treasurer, F. A. Deverall. O. M. C.

Indiana.

Indianapolis, October 21.—A contract has been let to the American Engineering Company of Indianapolis to finance and construct a traction line from Huntington to Indianapolis, by the way of Marion. The capital stock of the company has been increased to $50,000. The road will be known as the Indianapolis, Huntington, Columbia City Northwestern Traction Company. N. E. Weist, Jr., is general manager.

Another step toward the completion of the merger of the interurban electric lines in this state was taken on the 17th at Indianapolis, when Hugh J. McGowan, president of the Indianapolis Traction and Terminal Company, was elected president of the Indianapolis and Northwestern and the Indianapolis and Western Traction companies. Those present at the meeting and participating in the election were W. Kelsey Schoepf, president of the Cincinnati Street Railway Company, and western representative of the Elkins-Widener-Morgan syndicate; C. C. Reynolds, general manager of the Indianapolis and Northwestern; F. D. Norveil, traffic manager, and the directors. The proposed merger has for its object the consolidation of many Indiana and Ohio electric lines. Mr. McGowan will be the head of the Indiana company and Mr. Schoepf manager of the Ohio company. Something over 400 miles of electric roads in each state will be taken into the merger. (See Western Electrician of October 21st, page 317.)

Despite notice not to construct a crossing over the Cincinnati, Bluffton and Chicago railroad tracks in Portland, the construction gang of the Muncie and Portland Traction Company stole a march on the steam road during the night and put in the crossing. The Circuit Court then issued an injunction to prohibit the steam line from in any way interfering with the construction of a crossing in Main Street. It is now thought that the traction company will proceed with its construction work without further interference upon the part of the steam lines.

Superintendent of Transportation C. F. Shelton of the Fort Wayne and Wabash Valley Traction Company has decided upon a service distinction. To each employe who has been in the service for more than one year the company will furnish a gold service stripe, to be worn upon the sleeve of the coat. For each year's service, until five years, a quarter-inch braid stripe will be worn. For each five years a gold star will be worn above the bars. This distinction, it is thought, will stimulate the employes to faithful and long service.

The Marion, Bluffton and Eastern Traction Company has begun construction work at a point near Van Buren, nine miles east of Marion. J. Wood Wilson, president of the construction company, says that the road will be completed and cars will be running between Marion and Van Buren by January 1st.

The Circuit Court has granted the petition of the Fort Wayne and Wabash Valley Traction Company to condemn the bed of the old canal in Carroll and Cass counties for a right-of-way for a trolley line between Logansport and Delphi. The damages are fixed at $25,000. It is said the towpath for the entire distance is in good condition, and little grading will be required for the contemplated road.

Two thousand people gathered on the Tippecanoe battlefield, eight miles north of Lafayette, on the 18th and participated in the barbecue and celebration which marked the completion of the electric railway from Lafayette to the battleground. Col. J. Levering Jones of Philadelphia, who is largely interested in the traction line, spoke words of commendation for the efforts of James Murdock in securing the extension of the traction line.

Articles of incorporation have been filed with the secretary of state by the Marion, Hartford and Eastern Railway Company. The capital stock is $25,000. The object of the company is to promote, finance, construct and equip, in the state of Indiana and elsewhere, street and interurban railways, and plants for the creation and distribution of electric and other heat, light and power. The first road to be constructed and operated by this company will run through Grant, Blackford and Jay counties, connecting the city of Marion, Gas City, Upland, Hartford City, Millgrove, Dunkirk and Redkey. J. L. Thompson, W. B. Dodds and others are directors.

The Kokomo Railway and Light Company and the Kokomo, Marion and Western Traction Company have consolidated and merged their interests and stock under one stock company, under the name of the Kokomo, Marion and Western Light and Traction Company. The capital stock is $1,000,000. The combination unites all lines of street and interurban railroads and electric-light, heat and power plants constructed, and in the course of construction, belonging to each of the companies, or authorized to be constructed. S. S.

Michigan.

Detroit, October 20.—The Monroe Common Council has ordered a special election to be held on November 6th to give the taxpayers a chance to vote on a proposition to bond the city for $16,000 to rebuild or remodel the present municipal lighting plant. The plant is in such shape that unless the taxpayers vote favorably on this proposition private interests will have to take up the city lighting.

John Bougie and six other farmers of Alpena have started suit against the Alpena Power Company and others interested in damming Hubbard Lake and ask for $24,000 damages for ruining crops by the overflowing of their lands.

It is said that the Toledo Traction Company is back of a plan for a second electric line between Toledo and Detroit. Detroit contractors have been asked to bid on constructing a roadbed through the marshes along the shore of Lake Erie. It is proposed to follow the shore line closely and then the Detroit River, connecting with the Detroit United railway at Trenton. The rapid growth of business on the Detroit, Monroe and Toledo Short Line road, recently completed between these cities, is the reason for building a second line. Bonds are now being sold for the project.

The Onaway Light and Power Company proposes to enlarge its business and supply light and power to neighboring towns in Cheboygan County. W. W. Vaughn of West Branch is president of the company and H. H. Vaughn is secretary-treasurer and general manager.

The town of L'Anse has just issued bonds for $10,000 for the purpose of erecting a municipal electric-lighting plant. The plant is expected to be in operation by December 1st.

The Murphy Power Company of Detroit, engaged in the heating and power business, has increased its capital stock from $300,000 to $750,000.

The American Electromobile Company has decided to move to Detroit in the spring. Frank E. Rae, a well-known electrical engineer, is its engineer. It is asserted that the company's touring car, operated with an improved storage battery, will have a radius of from 80 to 125 miles.

Detroit's aldermen are still talking of a "trackless trolley" for the crossing of Belle Isle Bridge. The only way large crowds can now be handled is by boat. The city's street-car system does not cross the bridge and the horse-drawn carryalls are inadequate to handle the people. There is no doubt that if a trackless trolley line is put in use across the bridge it will also be extended to the Casino and then to the head of the island, and finally a complete system established on the island itself.

The Detroit United railway shows an increase in interurban business for the first week in October over the same period last year of over $3,000 and on city lines over $12,000. C. G. W.

Rocky Mountain States.

Salt Lake City, October 18.—Work has been commenced at Boise, Ida., on the interurban railroad to be constructed between that city and Caldwell, and in a few days all necessary equipment will be purchased. All of the $100,000, which is the estimated cost of the road, has been subscribed, with the exception of $6,000.

A contract for the construction of an electric-light plant has been awarded to Thomas L. Allen by the City Council of Coalville, Utah.

About $10,000 is being expended in improvements of the electric power plant of the Dillon Electric Light and Power Company at Dillon, Mont. The

company's property is at present in the hands of a receiver, H. W. Turner, general manager of the Butte Electric Light and Power Company.

It is possible that the plant of the Reno Power, Light and Water Company will pass into the ownership of the municipality. The City Council has opened negotiations with that end in view. G.

Northwestern States.

Minneapolis, October 21.—The contract has been let to Foley Bros. of St. Paul for grading and ballasting necessary for the complete double-tracking of the Twin City Rapid Transit Company's new line from Minneapolis to Lake Minnetonka. This portion of the work will be carried on throughout the winter and by spring will be completed, and track-laying can begin as soon as the ground is dry. The work on the new terminals at Excelsior is rapidly approaching completion.

A new 300-kilowatt Parson steam turbine is being installed in the electric-light plant at Moorhead Minn. The machine was purchased at a cost of $20,000.

C. C. King of Scotland, S. D., has purchased a controlling interest in the electric-light plant at Mitchell, S. D.

It is reported that the Chicago American Electric Railway Company will build electric lines from St. Paul to Hudson, Eau Claire, Chippewa Falls and Mondovi, Wis., and to Wabasha and Red Wing, Minn.

The Mason City (Iowa) and Clear Lake Railway Company has purchased a site at Mason City, on which to build car barns, the power plant to be moved to that place from Emery.

T. R. Watts has been appointed receiver for the Grand Junction (Iowa) Light Company.

The Menominee (Mich.) Electric Manufacturing Company will begin work at once on the erection of a new plant.

Capitalists are figuring on building a dam and power plant near Black River Falls, Wis., and transmitting power to La Crosse, Wis. The project includes the purchase of the three large public-service concerns at La Crosse.

A syndicate of local capitalists at Eau Claire, Wis., headed by O. H. Ingram, has purchased a controlling interest in the Chippewa Valley Electric Railroad Company from President A. E. Appleyard of Boston. O. H. Ingram was elected president and George B. Wheeler secretary and manager. The new owners are considering extensive improvements in the system.

The completion of the third interurban line between Minneapolis and St. Paul has been delayed by the failure to complete the work on the Lake Street Bridge in Minneapolis, and it is doubtful if the new line will be placed in operation before the middle of the winter. The work of strengthening the bridge was to have been finished by September 1st, but it is still far from completion. R.

Pacific Slope.

San Francisco, October 20.—Plans are now under way for a considerable extension to the electric lines of the San Francisco, Oakland and San Jose Railway Company. The directors of the company have issued a call for a stockholders' meeting to be held on December 21st, for the purpose of creating an additional bonded indebtedness of $1,500,000. The proceeds of the new bond issue are to be used in the construction of additional lines and in the buying of new equipment. The company has asked for a franchise for a line along Twenty-second Street, from Yerba Buena Avenue, near Hollis Street, to Broadway, at which point a passenger depot will be built. Rapid progress is being made with the company's Fifty-sixth Street line, which will be completed shortly.

Another railroad company was incorporated in San Francisco this week for the purpose of building a line into the Yosemite Valley. This makes three railroads, at least two of which are to be electric lines, which are now headed for Yosemite. The new company, the incorporators of which are officials of the Southern Pacific and Santa Fe railroads, has not yet announced whether its line will be operated by steam or electricity.

A syndicate composed of E. W. Park & Co. of Philadelphia, J. & W. Seligman of New York and D. O. Mills of New York, has taken over the control of the Portland Consolidated Railway Company of Portland, Ore., and is negotiating for the control of other electric lines in Oregon. It is understood that the electric systems of Salem, Eugene and Albany will hereafter be controlled by the same people. A. Welch, of Salem, representative of the syndicate, is now conducting negotiations for the purchase of the plant of the Albany Electric Light and Power Company at Albany.

The Fallon River Company has been incorporated to construct a standard-gauge railroad from Hazen to Fallon, Nev. The articles of incorporation of the company permit of the use of electricity, compressed air or steam. The road is supposed to be intended as a feeder for the Southern Pacific.

The Clear Lake and Southern Railway Company of San Francisco is now making surveys for its proposed line from Lakeport in Lake County south to San Francisco Bay. The company plans to operate a ferry system between its bay terminus in Marin County and San Francisco. Branch lines will connect its main line with the larger towns of Marin, Napa and Sonoma counties. This week the company commenced condemnation suits against a number of property owners in Napa County, in order to secure rights-of-way.

The Pacific Electric Railway Company of Los Angeles is experimenting with the building of electric-railway cars. Ten cars are now being built at the company's shops, and if the experiment proves economical it is said that practically all of the rolling stock required by the company in future will be constructed in its own shops. The cars now being built are 29 feet long, will seat 44 passengers and are to be equipped with two 50-horsepower motors each.

The negotiations for the transfer of the San Jose, Santa Clara and Alum Rock electric railway to its new owners were completed on October 13th. Under the new management the road will be converted into a standard-gauge line throughout and new rolling stock and other equipment will be installed. The new owners are represented by Lewis Hanchett.

The Merced Falls Gas and Electric Company, with headquarters at Merced, Cal., has secured a site for an electric power plant in Mariposa County, about 70 miles from Merced. Officials of the company say that a power plant will be put in at the new location capable of developing 5,000 horsepower. This will be transmitted to Merced and vicinity for lighting and power purposes.

The American Goldfield Company, a mining concern of Grants Pass, Ore., has closed a contract with the Conder Water and Power Company for 600 horsepower, and will put in a transmission line to conduct the current to the American Goldfield Company's Granite Hill mines, where it will be used for pumping and other purposes.

George W. Bush of Redding, Cal., has filed claims on 18,000 inches of water in Battle Creek. The water will be taken out below the mouth of Baldwin Creek and will be conducted a distance of six miles to Horseshoe Bend, where Mr. Bush and his associates will erect their power plant.

The City Council of Oakland, Cal., has now taken final action in the matter of advertising the telephone franchise asked for by the Home Telephone Company. Bids for the franchise are to be opened on December 4th, and the Home Telephone Company has pledged itself to offer not less than $20,000 for the franchise.

The City Council of Gilroy, Cal., is advertising for bids for the construction of an electric-lighting plant and for the supplying of the necessary material for distributing lines. The estimated cost of the lighting plant and distributing system is $14,500.

The Los Angeles Gas and Electric Company was the only bidder for furnishing street lights to the city of Los Angeles, and though the contract has not yet been awarded it is expected that the company will secure it. Its bid offered to furnish street lights at $6.60 per month each on a one-year contract, at $6.30 each on a three-year contract, and at $6 each on a five-year contract.

The Dillon Electric Light and Power Company of Dillon, Mont., is reconstructing its power plant and distributing system in that city. The expenditures at the power house will amount to $6,000. A.

PERSONAL

John Absher of Olney, Ill., president of the Fairfield and Olney Traction Company, has been in Chicago for a few days. Mr. Absher's company will build a single-phase road and will begin operations shortly.

At the installation of President James at the University of Illinois last week a number of honorary degrees were conferred, among them the degree of doctor of engineering on Octave Chanute, president of the Chicago Tie Preserving Company, and F. E. Turneaure, dean of the College of Engineering, University of Wisconsin.

J. R. Curtiss has succeeded C. B. Green as superintendent of the Cleveland, Painesville and Ashtabula electric railway. Mr. Green has gone with the Philadelphia, Lancaster and Christiana Electric Railway Company, which is largely owned by Cleveland people. Mr. Green is a thoroughly experienced railroad man and is well equipped for the new place.

W. H. Blood, Jr., of Seattle, Wash., president of the National Electric Light Association, paid a visit to New York city last week on business of the association. Mr. Blood has appointed as committee on public policy Arthur Williams of New York (chairman), Samuel Scovil of Cleveland, Ernest H. Davis of Williamsport, Pa., and Guy E. Tripp of Dallas, Texas.

James S. Dickinson, formerly storekeeper for the Western Union Telegraph Company in Chicago, died recently at the age of 67 years. At the close of the Civil War, in which he was a soldier, he entered the telegraph supply house of Bliss & Tillotson in Chicago, and two years later entered the employment of the Western Union, being promoted to storekeeper in 1881, which position he held until failing health caused him to retire eight years ago.

The Manila Electric Railway and Lighting Company of Manila, P. I., has secured the services of T. K. Wells as superintendent of transportation. Mr. Wells has had a wide experience in railroad work, having been with the Wabash Railroad and the St. Louis, Iron Mountain and Southern Railroad for 14 years and with the Syracuse Rapid Transit Company for eight years.

ELECTRIC LIGHTING

Warsaw, Mo., has voted $6,000 bonds for the construction of a municipal lighting plant.

William T. Martin has sold his electric-light plant at Hooper, Neb., to William A. Hough.

The business of the Weatherford (Texas) Electric Company has been advertised for sale.

The Atoka (I. T.) Light and Power Company will spend about $10,000 in improvements.

By a close vote Paola, Kan., voted $25,000 in bonds for the building of a municipal electric-light plant.

S. E. Whiteside and G. West have applied for a franchise for an electric-light plant at Texarkana, Texas.

Martin & Dodd have purchased the electric-light plant at Charles City, Iowa, and will put in a heating plant.

The Home Electric Light and Power Company of Greeley, Colo., has increased its capital stock to $50,000.

The Geary Electric Light and Power Company of Geary, Okla., has been incorporated with a capital of $3,000.

The Suns Rays Electrical Company of Mineral, Kan., has asked for a franchise to install an electric-light plant.

The Lawrence (Kan.) Electric Light Company has been granted a franchise to furnish electricity throughout the city for purposes of light and power.

The city of Argenta, Ark., will install an electric-light plant and waterworks at a cost of $65,000, and is believed to be open for the services of a consulting engineer.

M. W. Cave and M. J. Loyd of Wichita, Kan., have purchased the plant of the Bay City (Texas) Ice, Light and Power Company and will organize a stock company to operate it.

Charles A. Freauff of New York has bought the plant of the Shawnee (Okla.) Light and Power Company for $108,000. The street railway will be sold by the court next month.

The town of Rockvale, Colo., has granted a 25-year franchise to the Arkansas Valley Electric Light Company to put up poles and operate lights within the corporate limits of the town.

Harvey Myers, James H. Young and B. Bramlage have incorporated the Municipal Light, Power and Fuel Company with $200,000 capital stock to operate electric-light and power plant; also gas plant in Newport, Ky.

The Warren Water Company of Warren, Ohio, has been consolidated with the Warren Electric Light and Power Company to form the Warren Water and Light Company, under which title all business will be transacted in the future.

The Illinois Light and Traction Company of Streator, Ill., has been incorporated with a capital stock of $400,000 to operate electric-railway, light, heat and power plants. The incorporators are I. H. Sherwood, A. T. Denton and others.

In a recent popular lecture at the Olympia Electrical Exhibtion in London James Swinburne, past president of the British Institution of Electrical Engineers, made the interesting statement that, "taking everything into consideration, the electric light would be cheaper than gas for lighting purposes, even if the gas companies would supply their gas for nothing." Mr. Swinburne laid stress on the increased cost of redecorating rooms in houses where gas lighting is used.

W. V. Coons of Cleveland, Ohio, I. H. Sherwood and A. T. Denton of Streator have filed papers for permission to incorporate an electric-railway, lighting and heating plant for the city of Streator, Ill. The capital is $400,000. Mr. Coons was granted the franchise by the county board a couple of years ago for building an interurban road to Ottawa, but the company failed to carry out the project at that time. Since then matters have been straightened out and it is believed the company is in a position to carry out the work. In addition to the railway project, the company will no doubt enter into competition for lighting the city.

ELECTRIC RAILWAYS

Track laying will soon begin on the new electric street railway at Grand Junction, Colo.

The contract for poles and ties for the Jonesboro and Nettleton (Ark.) interurban line is soon to be let.

The contract has been let for the section of road between Oklahoma City and Norman, for the Oklahoma City-Lexington-Sulphur Springs electric line.

The Hampton Roads (Va.) Railway and Electric Company, sold at auction by order of Federal Judge Waddill a few days ago, was purchased by Horace A. Doan, representing the protective committee of the Philadelphia bondholders, for $250,000, only one bid being offered.

It is said that a new 60-mile electric railway is to be built between Rochester and Depew, N. Y., to be operated by the Buffalo and Rochester Traction Company, which has been incorporated with a capital of $3,500,000. The directors are Henry H. Kingston and Horatio A. Foster of Philadelphia, Pa., and Herbert P. Bissell of Buffalo.

An electric-road project from Winona to Mason City, Iowa, which was once talked of and dropped, has been revived, and new promoters are now interested in the proposed road. About two years ago S. B. Liveremore, then superintendent of the Winona Street Railway Company, was at the head of a syndicate interested in the matter.

The Chippewa Valley (Wis.) electric railway has been purchased by a syndicate of men from Eau Claire, headed by Hon. O. H. Ingram. The sale includes the Interurban line, the street-railway system in Eau Claire and the Eau Claire Lighting Company's plant and all other property formerly controlled by Arthur E. Appleyard as belonging to the railway company.

The preliminary work for building another interurban road into Decatur, Ill., paralleling the Illinois Central, is under way. The line proposed is from Mattoon to Decatur and the plan is to build it with local capital. Business men in Mattoon, Decatur, Sullivan, Dalton City, Bethany, Mt. Zion and other towns through which the road is to pass have agreed to support the venture.

Trouble has occurred on the street railway at Paducah, Ky., the claim being made that the new owners discharged the union motormen and conductors. Cars have been derailed and in some instances egged. The union men are endeavoring to secure auto coaches to compete with the railway company, which provides new men to take the places of the old ones as fast as they quit work.

Articles of incorporation have been filed in Hartford, Conn., by the Trolley Express Company of New Haven, the incorporators being Charles S. Mellen, E. C. Buckland and C. Alvert Townley. The object of the company is the carrying of merchandise over various trolley lines. The capitalization is $100,000. All the incorporators are officers of the New York, New Haven and Hartford Railroad Company.

Reports are current in Will and Du Page counties, Illinois, that plans are being made for the construction of a freight and passenger electric railway connecting Plainfield in the former county with Naperville and Wheaton in the latter. Du Page County has no north and south railway connections at present. The towns to be connected are good ones and are in what is considered the best farming community in the country.

Thomas P. Hopley writes from Enid, Okla., to a Chicago daily paper saying that Enid, which has a population of 12,000, will grant a 50-year franchise for street railways to the first set of capitalists who will guarantee to commence work within a reasonable time and then lay from six to eight miles of line. The city, he says, has railroads extending in 10 different directions and regular trains running on all these lines. Eight lines have been built in the last six years.

The board of park commissioners of the city of Louisville, Ky., has sold 1,000 shares of Louisville Traction stock for $118,250 at private sale. The stock was a gift to the park board from Major Alex. Davis, the largest shareholder in the street-railway company, and was made shortly after the origination of the Louisville Traction Company as a holding company for the Louisville Railway Company. At the time of the gift the stock was worth about 70 on the market, but the recent sale was at 118¾.

An official compilation of the financial condition of the Consolidated Railway Company, which is the electric holding company of the New York, New Haven and Hartford railroad, shows that it now has 26 lines, of which 15 are constituent companies, five are leased lines and six are controlled lines. The outstanding capital stock of the various companies is $3,049,829, the funded debt $24,020,900, and the floating debt $78,000, making the total stock and debt $27,199,220. To this is to be added the $10,000,000 stock of the Consolidated Railway Company itself, all of which is owned by the New Haven company, bringing the total investments of all kinds in the Consolidated company up to $37,199,220. Including recent purchases and extensions the total mileage of the Consolidated is now 588.

In the course of an article in an eastern magazine on the Chicago street-railway situation, Clarence Darrow, special counsel for Mayor Dunne and a pronounced municipal-ownership advocate, says: "But after due credit is given to all the advocates of municipal ownership and the influence coming from social agitators at home and abroad, the fact remains that the street-car companies are chiefly responsible for the stern determination of the citizens of Chicago to take charge of this business for themselves." Many other persons hold this view.

The financial statement of the Aurora, Elgin and Chicago electric road for September shows a very large increase in traffic, due largely to the arrangement with the Metropolitan Elevated road by which the interurban brings its passengers down town to the Fifth Avenue station instead of changing cars at Fifty-second Avenue. In gross receipts the September statement shows a gain of $17,000, and net earnings a gain of $8,225. The new arrangement has also brought the Metropolitan Elevated a large new traffic originating between Fifty-second Avenue and the Desplaines River, where a promising territory is being built up.

POWER TRANSMISSION.

The Cable Cove Power Company of Sumpter, Ore., has been incorporated with a capital stock of $100,000 by O. C. Wright, T. C. Gray and E. Ray Jones.

The Waukegan (Ill.) Gazette says that it has reliable information that the Chicago and Milwaukee Electric Railroad Company has decided to build its proposed $270,000 power plant in Waukegan. Three or four cities were trying to locate the plant.

Robert R. Zell of Birmingham, Ala., and his associates are furthering a plan to develop water-power property near Anniston, Ala. Surveys for a large dam have been made and a company to be known as the Coosa River Power Company will be organized to carry out the project. It is proposed to build the dam in such a way as to allow a roadway underneath the dam proper.

People of Kilbourn, Wis., at which point the famous Dells of the Wisconsin River are located, are again much excited over the possible development of the large waterpower which is there, now going to waste. A public meeting was held recently to consider the proposition of Philip Spooner, who is a brother of Senator John C. Spooner, relating to this waterpower, of which he is owner. The sentiment of the community toward permitting him to construct a dam at Kilbourn in accordance with a charter recently granted by the Legislature is favorable, although it is well known that it would greatly impair the beauties of the Dells. In return for the support and approval of the people Mr. Spooner agreed to give a bond of $5,000 to construct the dam in two years if he is not obliged to put in locks. One thing which has heretofore discouraged capitalists from looking favorably on the proposition has been uncertainty in regard to the laws concerning navigation, the Wisconsin River being considered a navigable stream, though of late years its utility for this purpose has almost ceased to exist.

The commissioners of Victoria Park, on the Canadian side at Niagara Falls, recently refused a permit to the International Railway Company, owner of the Niagara Falls Park and River Railway on the Canadian side of the Niagara Gorge, to allow it to build a power conduit through Victoria Park. The supposition is that, as the Niagara Falls Park and River Railway has its own power house in Victoria Park, where about 4,000 horsepower is developed, and of which only about 2,000 horsepower is used in the operation of the road, the commissioners feared that the excess power was to be transmitted to the New York side for use on the lines of the controlling company on that side of the river. It was because of this action that it was assumed that the park commissioners had refused the railway company the right to export electric power from Canada to the United States. While, in substance, this may be the effect of their action, it is plain that the park commissioners have no such authority, that being a question for the Federal or Dominion government to decide. However, another feature that actuated the park commissioners was the fact that the Niagara Falls Park and River railway and the city of Niagara Falls, Ont., get their water supply from a joint intake, and if power was transmitted it might cause trouble with the city in case of low water.

PUBLICATIONS.

Special circular No. 52, sent out by the Chicago Pneumatic Tool Company, illustrates and describes its line of Duntley electric air-cooled drills, and gives besides a table of tests which will be of interest to those using this class of machinery.

The new Westinghouse storage batteries for railway signal service are described in a small preliminary folder issued by the Westinghouse Machine Company. These batteries mark the advent of the Westinghouse company into the storage-battery field. The folder is principally pictorial and will be followed later by a more complete publication.

A storage battery of the unit-accumulator type for car lighting, as manufactured by the National Battery Company of Buffalo, N. Y., is briefly described in bulletin No. 3. Electric lighting of railroad trains is, for various reasons, a difficult problem, and the company has put much time and labor on this battery to make its operation as nearly perfect as the exacting conditions of railway service will permit.

A handsomely bound volume of 120 pages has been sent out by the Gold Car Heating and Lighting Company of New York. Several methods of heating cars by electricity are fully explained and illustrated in this book. Some forms of these heaters are made to give three variations of temperature and others are made to be adapted to awkward corners. A special regulating switch with indicator completes the equipment.

The automatic engine-stop and speed-limit system of the Locke Regulator Company of Salem, Mass., is described in a recent catalogue which it has issued. This system permits the immediate stopping of the engine from any part of the plant, and by the speed-limit device the bursting of the flywheel is impossible. The apparatus by which these results are obtained is described clearly in the catalogue, which is amplified by numerous illustrations.

The Emerson Electric Manufacturing Company of St. Louis advertises in two recent bulletins a line of small single-phase induction motors and some small laboratory motor lathes for alternating current. The single-phase motors are of one-tenth to one-sixth horsepower and are known as class 32DA. They differ from former Emerson types of equal horsepower in that they are equipped with solid end housings, and are adapted for use in dusty places. The laboratory motor lathe was designed especially for dentists' purposes, but has been found satisfactory for all light polishing. The motor is compact, the body measuring only 6½ by six inches.

Characteristics and construction of rotary converters manufactured by the Westinghouse Electric and Manufacturing Company of Pittsburg are described in a special publication which is being distributed. This little book is well worthy of attention, as it embodies a great deal of information of practical value concerning not only the construction of rotary converters as manufactured by this company, but also much concerning their practical operation. Diagrams of connections for two and three-phase circuits are included among other things. Bulletins and catalogues of this nature are always welcomed by operating men especially, who gain many ideas from reading them.

A variety of the products of the Allis-Chalmers Company of Milwaukee are described in a number of bulletins just received. Two of the bulletins relate to pumping machinery, one describing and illustrating a motor-driven centrifugal pump and the other a high-duty-type engine-driven pump. Three other bulletins take up, respectively, steam shovels, the McDougall roasting furnace of the enclosed-firebox type for roasting heavy sulphide ores, and the Hancock jig, a machine for separating certain low-grade ores. The last on the list is a quite elaborate catalogue upon the subject of saw-mill carriages and accessory machinery. All of these publications are neat in appearance, well printed and skilfully prepared to show up to advantage the products which they describe.

Locomotives for mining operations are made the subject of a tastefully prepared bulletin issued by the Jeffrey Manufacturing Company of Columbus, Ohio. This company has on its list of locomotives a large variety of equipment to suit the ideas of its various customers. The machines are electrically operated, and the bulletin contains a large number of fine half-tone illustrations showing the locomotives and their various parts. It is divided into three sections, one describing mine locomotive, one gathering locomotives and the third, storage-battery locomotives. The second of these types is adapted for gathering loaded cars from the working faces of mine rooms and distributing empty cars. The last-mentioned type is more adapted for industrial plants than for mine purposes, although in some instances it has been used in mines.

The making of telephone cables of the lead-armored type is a process much more interesting than most people are aware of. Indeed the majority of passers-by never stop to consider what is contained inside the big reels of lead-covered cable they see on the street. If they reflect further, they may wonder how these lead casings are put upon the wires with unbroken continuity for hundreds of feet. The process embodies many distinct operations from the time the wires are taken and separately insulated and wound to form a non-inductive core until the lead sheath is placed about them. This last operation is perhaps the most in-

teresting of all, and depends upon the peculiar physical quality of lead by virtue of which it will, when heated to within 75° or 100° F. of its melting point, and subjected to enormous pressure, assume a plastic state, and will become solid again when the pressure is removed. By reading the booklet sent out by th Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y., upon cable making the intricacies of the process will be made clear.

The General Electric Company has issued a mass of new advertising literature which, as usual, is creditable to the company. The most important of these new publications is a handsome large catalogue of railway line materials and rail bonds. The list contains many recent improvements in General Electric products. Almost every part and device necessary in line constructions and track building, as manufactured by this company, is listed in the catalogue, which is finely illustrated. A porcelain receptacle for molding wiring is made the subject of a small leaflet. The luminous electric radiator for 95 to 250 volts, 750 to 1,500 watts, is described in a small pamphlet. This heater consists of an ornamental cast-iron frame with oxidized copper reflector, in front of which are placed large cylindrical incandescent heating lamps. Results of the test of a 2,000-kilowatt Curtis steam turbine made by Messrs. Louis A. Ferguson and F. Sargent of Chicago last July are contained in a pamphlet specially devoted to the subject. Supply catalogue No. 7591 describes the parts of the General Electric edgewise parallel-rod 110-volt direct-current multiple enclosed arc lamp. The paper by P. D. Wagoner upon "Mercury-arc Rectifiers" read at the Denver convention of the National Electric Light Association has also been printed in pamphlet form and is being distributed.

MISCELLANEOUS.

Owing to the numerous electric-light and power stations erected in South Africa within late years, various appliances and apparatus for domestic use, handicrafts, refrigerating purposes for dairies, meat storage, etc., could be profitably introduced.

Building A, first of the group of seven structures that form the new Carnegie Technical Schools, was opened in Pittsburg a few days ago with a class of 120 selected out of more than 600 applicants from all parts of the world. The classes will be increased as other buildings are opened.

The De Forest Wireless Telegraph Company reports that its stations in operation in the United States, also in Canada, Central America, Cuba and Brazil foot up to the total of 497½ kilowatts of total amount of energy which is being used. The list of stations to be erected in 1906 shows a total of 297 kilowatts.

The Mexican government has ordered the construction of about 1,953 kilometers of telegraph lines between the City of Mexico and Puebla. The wires will be placed upon iron posts, 3,000 of which will be required for the purpose. The work will be done under the direction of Engineer Camilo Gonzalez, director general of Federal telegraphs.

Stockyards experts in Chicago should be able to answer the question of a correspondent of a London daily paper, who asks whether it would be feasible to substitute killing by electricity for the present system of slaughtering animals for food. Probably the answer would be in the negative, for present methods are humane, and electricity would introduce needless complications.

At the fifty-fourth annual meeting of the stockholders of the Illinois Central railroad in Chicago President Stuyvesant Fish made it clear that no change from steam to electric power for the suburban business in Chicago is in prospect for some time to come. No change in routing of express trains is under consideration and a five-cent fare to Hyde Park may be a possibility of the dim future.

The Powell Dyffryn Steam Coal Company is completing the installation of about a 4,000-horsepower plant at a central station near its Aberaman coal mines in Wales. The plant consists of slow-speed engines, direct-coupled to flywhel alternators, generating three-phase current, 3,000 volts, 50 cycles. Steam is supplied from a battery of multi-tubular boilers, and the electric power is transmitted from the central station over a network of bare copper wire overhead mains to all the various collieries belonging to the company in the neighborhood of Aberaman, for driving the machinery above and below ground. Up to the present, over 30 large main and tail haulage gears have been equipped, as well as several large fans and practically all the surface machinery. Some electrically driven winding engines will also be running shortly, and the whole installation, when finished, will probably be about the most complete and extensive of its kind in Great Britain.

A dispatch from Ottawa, Ont., says that J. C. R. Laflame, formerly rector of Laval University and president of the Royal Society of Canada, has been appointed by the International Waterways Commission as geological expert to make a report upon the recession of the Canadian side of Niagara Falls. It is said that the Canadian side has receded 300 feet during the last 80 years. Members of the waterways commission have left Ottawa for Niagara Falls to begin this investigation.

New York papers tell of an instance in which space telegraphy rendered invaluable service in saving property and life during an all-day storm at sea a few days ago. By means of De Forest space-telegraph apparatus on board the steamship Lucas and the steamer City of Everett the latter was discovered to be badly damaged and calling for help. The operator on the Lucas heard the wireless calls and that ship was able to give assistance which permitted the damaged boat to be temporarily repaired and thus able to withstand the storm.

In a report of experts in relation to electrically driven pumps Col. Ward, commissioner of public works in Buffalo, N. Y., recommends that electricity should not be the main factor of power in the new Buffalo pumping station, where it was proposed to install electrically driven turbine pumps, the power to be furnished by some of the Niagara Falls power companies. He thinks it unsafe to depend on this power on account of the liability of shutdown due to accidents to the plants and physical injuries to the transmission lines. He says: "The turbine pumps are very low-duty machines, requiring from 50 to 100 per cent. more power for an equal amount of work accomplished than high-grade, high-duty, triple-expansion, vertical plunger pumps." He says the city should develop its own electrical power either by steam turbines or gas or oil engines and then let the electrically driven pumps act as the reserve instead of the main factor at the pumping station.

A Washington (D. C.) dispatch says that the new customs tariffs of Germany hit American exports severely in many particulars, amounting almost to discrimination against this country. These new tariffs, says the dispatch, will be the subject of serious negotiations between this country and Germany, and the matter probably will be taken up soon after the return to America of Baron Speck von Sternburg, the German ambassador. A statement has been prepared for this purpose by the Department of Commerce and Labor showing the difference between the old and new rates in ad valorem terms, based on the German estimates of the import value of the articles in 1903, the latest year for which figures are available. As regards manufactures, the old rates are for the most part moderate. The rates of duty on steam engines and motors of all kinds which were hitherto the same as that on agricultural machinery, and averaged four per cent. ad valorem, are advanced all the way from 40 per cent. to 1,150 per cent. Motive machinery coming from countries not enjoying the conventional rates will be subject to duties as high as 50 per cent. ad valorem, while that coming from favored nations will pay duties ranging from 5½ per cent. to 35 per cent. ad valorem.

TRADE NEWS.

E. A. Wilson has been succeeded in the electrical supply business at Santa Monica, Cal., by E. A. Wilson & Co.

The H. T. Paiste Company of Philadelphia has opened an office in Boston at No. 7 Otis Street, Winthrop Square. This is in charge of Frank Booth, who will have charge both of the sales of the H. T. Paiste Company and the New York Insulated Wire Company.

The firm of Ross & McLaren, general electrical contractors at Sault Ste. Marie, Mich., has been dissolved, A. M. McLaren retiring, to make his home in California. Mr. Ross will continue the business, taking his own son Wilfred into partnership, under the firm name of Alex. Ross & Son.

Reports from Salerno, Italy, say the imports of electrical supplies into that district are likely to assume large proportions, as the electrical works at Tusciano have been completed, and are distributing electric current to the great benefit of the public. Many Italian macaroni works are operated by electricity.

Carter & Gillespie of Atlanta, Ga., have purchased the Southern Supply and Electric Company's plant in Atlanta, which will enable them to expand their large business throughout the South. Pioneers in the electrical business in Atlanta, Carter & Gillespie have kept pace with new developments and inventions and are able to give advice along all electrical lines as well as furnish all kinds of electrical appliances and supplies.

It may not be generally known that Thomas P. Benton & Son, La Crosse, Wis., have been manufacturing multipolar generators, motors and generating sets since 1888. This firm makes a specialty of complete lighting equipments for isolated plants, and has made installations all over the United States. It has done considerable work for the United States government. Some of the Benton machines are said to have run for years without requiring any attention for repairs. The firm also manufactures searchlights of various sizes, and has equipped many vessels with its types.

Quoting from the Western Electrician, the recent complaint of an American traveling abroad that some foreign manufacturers imitate American products and sell them as "American made," the London Times (Engineering Supplement) says: "There is a curious absence of detail about this allegation. It is unquestionably true that on the Continent, and particularly in Germany, machinery of native manufacture has been placed on the market as of British origin, and various examples of this practice were quoted a few years ago, from his own observation, by Lord Charles Beresford. British manufacturers, however, have no inducement, even if it could be supposed that any were inclined to a practice directly opposed to the straightforward spirit of business customary in this country, to ascribe their manufactures to any other origin than their own."

BUSINESS.

The Duncan Electric Manufacturing Company of Lafayette, Ind., says that its meter is a good all-round device built to conform to common-sense and present-day practice—not one built by some theorizing expert who never saw the inside of a central station. The Duncan direct-current watt-meter is a practical meter and is in use today in nearly 1,000 central stations, which the company believes is the best proof of its quality and popularity.

One of the specialties of Pass & Seymour to which they are devoting considerable attention is an improved receptacle. Upon each side of this receptacle is a porcelain extension to carry the supporting screws. There is a substantial porcelain backing under the brass lugs, and the whole is made in accordance with the latest National Code rules. Weatherproof sockets constitute another specialty. Heavy copper shells, the best rubber-covered wire and P. & S. porcelain are the materials used in the construction of these sockets.

The Public Lighting Commission of the city of Detroit, Mich., has just placed an order with the Westinghouse Machine Company of East Pittsburg, Pa., for a 2,000-kilowatt turbine-type generating unit, following this order shortly afterward with a second order for a machine of the same size. In the equipment of its power house on the river front, in the center of the business district of Detroit, the commission has heretofore used vertical engines of the compound marine type. The early generator equipment was of the direct-current series type, the generators being rope-driven from the vertical engines. Later the system was gradually replaced by the more modern alternating-current series arc system, with generators of the direct-connected type. The new turbine equipment thus represents another step in advance with respect to the compactness and modernization of the power equipment. The two new units will be installed in the original building, replacing some of the rope-driven machinery. Turbines will be of the standard Westinghouse-Parsons type, operating at a boiler pressure of 160 pounds without superheat and at a normal vacuum of 28 inches. The generators will also be of standard Westinghouse design, of the revolving-field type and with the enclosed-generator-frame construction.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) October 17, 1905.

801,850. Electrical Distributer for Gas Engines. Lee S. Chadwick, Ridley Park, Pa. Application filed March 26, 1903.

An electrical distributer for gas engines has a periphery consisting of a contact segment in electrical connection with one pole of the circuit. A long segment is disposed substantially diametrically opposite the contact segment, and a short segment is between each end of the long segment and the contact segment. The last three segments are out of circuit and all of the segments are insulated from each other.

801,851. Portable Telephone. Walter N. Clark, Warren, Ohio. Application filed October 1, 1904.

A portable telephone is provided with a bracket for holding the receiver in a position near the ear.

801,864. Telephone System. Edward J. Hall, New York, N. Y. Application filed February 8, 1905.

Telephones at the stations having hook switches with upper and lower contacts are connected to the upper contacts and one of the line wires. The hook

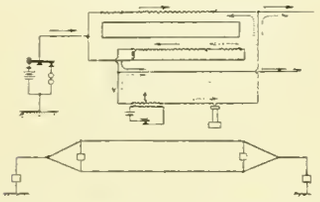
switches are connected to the other line wire. A signaling device at the central station is connected to the lower contact thereat and the line wire to which the telephones are connected. A battery in the line circuit and means at each sub-station for closing the line circuit to actuate the signaling device complete the apparatus.

801,879. Method of Separating Pyrrhotite from Chalcopyrite and Gangue. John N. Judson, South Strafford, Vt. Application filed July 22, 1905.

A method of treating ores containing nonmagnetic or weakly magnetic varieties of pyrrhotite is described where the pyrrhotite is associated with chalcopyrite and gangue minerals. The method consists in heating the ore to a degree sufficient to make the pyrrhotite more magnetic than the chalcopyrite and without considerable loss of sulphur, and subsequently removing the pyrrhotite from the other minerals by magnetic attraction.

801,888. Alternating-current Motor. Robert Lundell, New York, N. Y. Application filed January 9, 1905.

This single-phase alternating-current motor has the coils of its armature connected to a commutator and also means for causing local or short-circuited currents to flow through certain groups of armature coils. Means are provided for causing the other currents from an outside source of alternating-current supply to flow through other groups of armature coils and for short-cuiting all of the armature coils.



NO. 801,936.—SIMULTANEOUS TELEPHONY AND TELEGRAPHY.

801,895. Junction Box. Thomas J. Murphy, New York, N. Y. Application filed September 12, 1902.

In junction boxes there is combined with a casing having side and end members made of sheet metal and corner brackets to which the side and end members are secured an insulating interior box within the casing containing the connections.

801,898. Electric Power Transmission Device. Herbert McNulta, Anaconda, Mont. Application filed December 10, 1904.

In a motor vehicle there is an alternating-current generator, one element of which is driven by the prime mover in the vehicle. The generator operates an alternating-current motor. The transformer is electrically connected between the generator and the motor for varying the electromotive force supplied by the generator to the motor.

801,902. Incandescent-lamp Attaching Implement. Svert Olafson, Seattle, Wash. Application filed January 30, 1905.

An implement for setting and removing electric incandescent lamps in inaccessible places is the object of the patent.

801,922. Automatic Sprinkler System. William C. Shaffer, Milwaukee, Wis. Application filed June 5, 1902.

An expansible diaphragm situated between two balanced water chambers is adapted to close an electric circuit upon expansion, giving an alarm when the sprinklers are put in operation.

801,932. Contact Device for Electrical Perforating Machines, Etc. Daniel Stockman, Newark, N. J., assignor to G Howlett Davis, West Orange, N. J. Application filed December 10, 1904.

A support of insulating material constitutes a bed for a stencil and a pair of co-operating contacts between which the stencil is adapted to a certain range of travel. Means establish an air space between a face of the stencil and one of the contacts.

801,936. Apparatus for the Simultaneous Transmission of Telephonic and Telegraphic Currents Over the Same Line. Carlo Turchi, Ferrara, Italy. Application filed July 13, 1904.

In a superimposed telegraph and telephone system are a double metallic telephone line and its telephone apparatus, a separator coil bridged across the two lines and comprising a movable core and two branches wound together and separately about the core, and a telegraphic branch leading from a point between the two branches. (See cut.)

801,947. Magnetic Separator. John P. Wetherill, South Bethlehem, Pa., and Henry A. J. Wilkens, New York, N. Y., assignors to Wetherill Separating Company. Application filed December 18, 1897.

A magnetic separator for materials of low magnetic susceptibility comprises a series of magnets having highly concentrated magnetic fields, a series of feed belts for the several magnets, the feed belts discharging one upon the other, a receiver for heads in proximity to the concentrated field of each magnet, and a cleaner belt running past the magnets in the same general direction as the feed belts.

801,967. Multiplex System of Telegraphy. George A. Cardwell, New York, N. Y., assignor to Joseph E. Heimerdinger, trustee, New York, N. Y. Application filed February 3, 1900. Renewed February 29, 1904.

Improvements in telegraphy consist in transmitting over a line to different receivers or receiving stations electrical impulses in sets or groups, to each of which sets or groups is given a number of meanings. These are translated at each receiver or receiving station so that a number of messages may be transmitted and received simultaneously at different stations.

801,999. Trolley Wheel. George Loffi, Norwalk, Ohio. Application filed January 7, 1905.

Details are described.

802,015. Device for Attaching Telephone and Other Wires to Insulators. Esek McDaniel and Michael Barr, Paris, Ill. Application filed March 23, 1905.

A band adapted to be bent around the insulator and hold the conducting wire is described in the patent.

802,020. Fog Distance-signaling Method. John Patten, New York, N. Y. Application filed May 22, 1903.

A method of determining the distance between two points consists in simultaneously producing by means of an ethereal wave explosions or loud noises at the two points, and then noting at either point the interval elapsing between the time of explosion and the arrival at that point of a sound wave produced by the explosion at the other point.

802,052. Electric Coupling. Norman Marshall, Newton, Mass. Application filed October 26, 1903.

A receptacle for making temporary electrical couplings is described.

802,074. Elevator Mechanism. John Dillon, Milwaukee, Wis. Application filed December 19, 1904.

An elevator mechanism embodies a brake, an electromagnet, brake-controlling mechanism in connection with the magnet that is normally energized to maintain a release of the brake, means for predetermined de-energization of the magnet to apply the brake and means for automatically increasing pressure of the applied brake.

802,080. Cable Hanger. Gustav Lambert, Charlottenburg, Germany, assignor to Aktiengesellschaft Mix & Genest Telephon und Telegraphen-Werke, Berlin, Germany. Application filed June 8, 1900. Renewed February 24, 1904.

Cable hangers for multiple switchboards or similar apparatus consist of a series of endless strips of flexible material, each strip forming a single loop and each loop carrying one cable, the loops being of such length that each subsequent loop is longer than the preceding one.

802,093. System of Overhead Electric Conduction for Vehicles. Ettore Bauco, Rome, Italy. Application filed August 20, 1902.

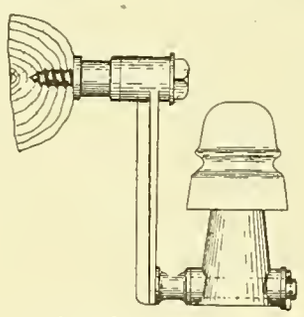
A system of overhead conduction for vehicles propelled electrically has three acrial wires suitably stretched, two of which are on the same level and the third one arranged a little above and in the vertical middle plane of the other two. A trolley provided with five sheaves which act as means of contact and derivation of current moves on the wires.

802,096. Tree Insulator. Charles W. Dunton, Boston, Mass., assignor of one-half to Frank D. Field, Cambridge, Mass. Application filed March 24, 1905.

In a tree insulator are a swinging arm, means for attaching it to a tree, a support pivoted at its lower end to the extremity of the arm bearing an insulator and means for holding the electric wire. (See cut.)

802,130. Electric Measuring Instrument. Montraville M. Wood, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed May 29, 1902.

A circuit interrupter consists of a grooved metallic wheel having a notched periphery and insulating material in the notches.



NO. 802,096.—TREE INSULATOR.

802,160. Trolley Base. Charles E. Gierding, Newark, N. J., assignor to the Sterling-Meker Company, Newark, N. J. Application filed January 30, 1904.

A trolley base comprises a pivoted pole-carrying fork having inturned lower extremities forming stop projections. The base proper has a pivotal standard, a low-down spring device immediately above the base interacting with the fork to elevate the pole.

802,170. Magnetic Ore Separator. Richard R. Moffatt, Brooklyn, N. Y., assignor to the Imperial Ore Separator Company. Application filed July 13, 1904.

Two rotating drums disposed so as to converge in a curvilinear direction have their axes of rotation in the same horizontal plane. A battery of stationary electromagnets is arranged within each drum. Pole-pieces on the magnets extend circumferentially above and below the magnets and a magnetic bridge is interposed in the field of force between the two drums above the axial line for reducing the magnetic resistance. (See cut.)

802,172. Fire-alarm Operating Device. Osman K. Nestor and Emil Moch, Jersey City, N. J. Application filed May 31, 1905.

Two parallel members are connected by two parallel devices which pass therethrough and from which one of the members is insulated. A spring is placed between the members and is adapted to bear on each, and from which one of the members is insulated by fusible material.

802,173. Trolley Harp. Edward D. Rockwell, Bristol, Conn., assignor to the Liberty Bell Company, Bristol, Conn. Application filed March 11, 1905.

Mechanical parts are described.

802,201. Electric Sign. John L. Dawes, Pittsburg, Pa. Application filed December 1, 1904.

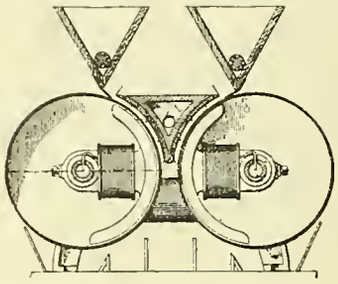
The electric sign described in this patent has an enclosure with top and bottom holes and is provided with a front plate of glass or similar material to receive a sign pattern. An internal rotary cylinder having a fan wheel at its upper end, has intermediate the ends a lamp, the cylinder and lamp being in alignment with the top and bottom holes.

802,205. Process of Producing Chlorates and Bichromates. Arthur E. Gibbs, Niagara Falls, N. Y. Application filed March 1, 1904.

The method consists in electrolyzing a solution containing a chloride and a chromate, and isolating the cathode products, thereby simultaneously producing bichromate and chlorate.

802,246. Electrical Fuse Plug. George B. Thomas, Bridgeport, Conn., assignor to the Bryant Electric Company, Bridgeport, Conn. Application filed March 17, 1905.

Associated with an insulating casing and an insulating ring carrying an external ring terminal is a separate clip piece secured in the inner end of the insulating casing, the clip piece being mechanically and electrically connected to the external ring terminal.



NO. 802,170.—MAGNETIC SEPARATOR.

802,266. Fire Alarm or Signal. John A. Chase, Denver, Colo. Application filed December 16, 1904.

In a fire-alarm or signal device are a suitable frame, a tubular circuit closer having a tendency to assume the circuit-closing position, a post upon which the circuit closer is slidably mounted, and a combustible device normally preventing the circuit closer from assuming the position.

802,291. Magneto-electric Ignition Apparatus for Explosion Engines. Gottlob Honold, Stuttgart, Germany, assignor to Robert Bosch, Stuttgart, Germany. Application filed April 30, 1902.

A magneto generator adapted to produce the spark for a gas engine is described.

802,305. Automatic Block-signal System. James McIlwain, Okawville, Ill. Application filed February 21, 1905.

Block-signal apparatus includes a circuit, means for energizing the circuit by a movable vehicle, a hand switch located upon the movable vehicle, another hand switch located at a stationary point adjacent to the track and alarm mechanisms connected with the circuit to be energized and de-energized by movements of the switches.

802,328. Quantity Meter. Richard Schmidt, Munich, Germany. Application filed May 13, 1903.

In combination with a balance spindle are a balance wheel and a balance spring connected to the spindle. A regulator lever controls the spring. A regulator block is yieldingly mounted on the regulator lever and arranged to bear against the balance spring. Electrically operated means operate the regulator lever.

802,337. Moisture-proof Case Covering for the Terminals or Lead-armored Insulated Wires, Etc. Charles H. Teush and Luther Hargis, Evansville, Ind., assignor of one-third to Charles M. Katterjohn, Evansville, Ind. Application filed March 27, 1905.

Moisture-proof covering for splices, etc., consists of a casing having one end completely closed, an externally screw-threaded crown sweated to the other end and an internally screw-threaded cap screwed upon the crown.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on October 23, 1905:

391,437. Electric Potential Differentiator. E. Thompson, Lynn, Mass.
391,446. Clock Synchronizer. A. G. Wiseman, Webster Groves, Mo.
391,447. Electric Railway. P. Wright, Denver, Colo.
391,468. Automatic Circuit Changer for Secondary Batteries. W. W. Criscom, Haverford College, Pa.
391,505. Galvanic Battery. H. J. Brewer, New York, N. Y.
391,512. Electric Switch. W. B. Cleveland, Cleveland, O.
391,517. Electric Cable Joint. J. E. Cuff, Denver, Colo.
391,542. Machine for Making Battery Plates. A. F. Madden, Newark, N. J.
391,547. Electrical Continuity Vibrator. G. F. Milliken, Boston, Mass.
391,587. Conduit for Electric Wires. M. Dallas, New Orleans, La.
391,590. Electric Motor. J. Doyle, Hoboken, N. J.
391,592. Electric Measuring Instrument. A. H. Eddy, Hartford, Conn.
391,593. Automatic Commutator for Alternating Electric Currents. A. H. Eddy, Hartford, Conn.
391,594. Arc Extinguishers for Electric Switches or Cut-outs. A. H. Eddy, Hartford, Conn.
391,595. System of Electric Lighting. T. A. Edison, Menlo Park, N. J.
391,596. Incandescent Electric Lamp. T. A. Edison, Menlo Park, N. J.
391,720. Electric Plaster. H. P. Pratt, Chicago, Ill.
391,761. Electric Arc Lamp. S. E. Nutting, Chicago, Ill.
391,762. Telephone-exchange System. C. E. Scribner, Chicago, Ill.

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LIBRARY OF ELECTRICAL ENGINEERING

Work of the Underwriters' Laboratories in Chicago.

More than 10 years ago there was established in Chicago by the Western Insurance Union and the Chicago Underwriters' Association a small room for testing electrical fittings. This room was located on the second floor of one of the insurance patrol houses. The scope of the work that could be carried out in this small room was limited, and it became necessary to move to larger quarters at 67 East Twenty-first Street. But as the work for the laboratories increased and the working force became larger the facilities again became overtaxed, and it was decided to build and equip a laboratory expressly for the purpose. This was done and the Underwriters' Laboratories, which are controlled by the Laboratories Corporation, are now located in a commodious new building at 382 Ohio Street.

The Underwriters' Laboratories are under the direction of the National Board of Fire Underwriters and are supported by the stock or "old-line" fire-insurance companies doing business in the United States. The work carried out is exclusively along the lines of experimental work in fire-protection engineering and testing of devices and materials having a bearing on the fire hazard.

The Underwriters' Laboratories, which have grown from such a small beginning, constitutes the only establishment of its kind in the world. Here complete tests of nearly every device having a bearing on the fire hazard are made, the general construction of such devices is noted and the facilities of the manufactures for turning out a uniform product are ascertained. Drawings of the device, or photographs, a complete description and the data and results of the tests made upon it are filed in a convenient manner and the files catalogued so that it is possible at a moment's notice for the secretary to lay his hand upon the complete record of every device tested in the laboratories. This record is all there in black and white, to the comfort of the manufacturer whose product measures up to the standard and the corresponding dismay of him who fails in the tests.

The new building used for the laboratories is shown in Fig. 3. It was designed by Argyle E. Robinson of Chicago and constructed under his direction and with the co-operation of the Laboratory engineers. It is of fireproof construction throughout. The walls are of solid brick, the columns of cast-iron protected by tile, the beams of steel, the floors of reinforced tile (Johnson system), with top flooring of cement and endurite, the window frames of hollow metal, the sash glazed with wired glass, and the partitions are of reinforced tile in steel frames. There is absolutely no wood used in any part of the building or its fixtures with the exception of a 10,000-gallon wooden reservoir in the basement, and this is kept filled with water.

The walls and floors are all solid, no concealed spaces being used in the interior finish. The plant will be equipped throughout with most modern forms of automatic and manual extinguishing apparatus. In fact, the building and its appurtenances as a whole are asserted, and no doubt with good reason, to be the best constructed in the city, with regard to small fire hazard, and they may be looked upon as a model to follow in fireproof construction work.

In ground dimensions the site of the plant measures 100 by 100 feet, one-half of it being covered by the building and the remaining space, 50 by 100 feet, being reserved for yard purposes and for the erection of ovens for testing fire doors and shutters, floors, partitions and large subjects of this character. This 10,000 square feet of land has been leased by the Laboratories Corporation for a period of 99 years. It covers 100 feet street frontage on Ohio Street and extends 100 feet in depth to a shipping alley between Ohio and Superior streets. The location is north of the main branch of the Chicago River, within walking distance of the City Hall. This central location was judged necessary not only for easy access from the business district but to secure connections of large capacity for supplies of electric current, gas and water essential in the laboratory work. It also insures prompt delivery of shipments by express and freight from manufacturing plants in all sections of the country.

Fig. 1. Corner in the Electrical Testing Room.

Fig. 2. View in Hydraulic Testing Room.
THE NEW UNDERWRITERS' LABORATORIES IN CHICAGO.

Owing to the fact that the officers and staff of the Laboratories have but recently moved into the new building (although testing work is now being done), the equipment has not all been installed and things have a more or less unfinished appearance. It was possible, however, to take some photographs which represent fairly well some parts of the interior where work is being carried on at the present time.

Fig. 1 is a view in the corner of the electrical laboratory, which is located on the third floor. At the left in this picture is shown the board at which fuses, cut-outs, etc., are tested. The back of this board consists of a lamp-bank for furnishing the requisite load in the various tests. The groups of lamps are controlled by the snap switches shown on front of the board. At the time the picture was taken a number of fuses were being tested. These were first tried on a 10 per cent. overload and operated thus till the temperature became constant, as shown by the thermometer, whose bulbs were placed against the fuses and held in position by a bit of putty. In this case the temperature became constant in about one hour. Next the current was raised to 25 per cent. overload, when the fuse is supposed to open. If the fuse fails to open at this load it is condemned. But even after being condemned it is still operated at 25 per cent. overload till the temperature becomes constant, after which the current is run up till the

fuse blows. These things are all noted and recorded, the records being filed as above described.

Another testing apparatus which is shown in the picture is for testing push-button switches, snap switches, etc. It consists of a small motor which drives a shaft upon which are mounted two eccentrics. The eccentrics periodically push forward and draw back rods which operate the opening and closing buttons of a push-button switch. Such switches are operated 6,000 times at rated capacity, the load being furnished by a row of incandescent lamps. Snap switches are operated by mounting the switch so that the button fits in a slot in the end of the shaft driven by the motor, and as the shaft turns the switch is snapped on and off.

Some insight into the work of the electrical department of the Laboratories is given by the two examples cited. But there are many other tests to be made on the different types of electrical appartus. Other apparatus now installed in the electrical laboratory, but not shown in the picture, includes a specially designed transformer giving 40,000 volts for breakdown tests. The secondary of this transformer is divided into 10 steps, and these, together with variation of the primary voltage, enable almost any high tension up to 40,000 volts to be obtained.

An alternator of 10 kilowatts capacity furnishes current for the transformer and is a special machine originally built at Armour Institute, Chicago. This alternator is driven by a motor which also drives a 600-ampere direct-current dynamo, which delivers current at seven volts for testing high-current fuses.

Fig. 4 is a plan of the third floor of the building, on which is located the electrical laboratory. Upon this floor are also the chemical department, draughting room, photographing department and instrument vault, the last being a fireproof vault of the most approved design, in which are stored the portable instruments used on this floor.

Fig. 5 is a plan of the second or office floor. Here are the offices of the organization, and the same precautionary measures have here been taken against possible fire as elsewhere in the building. The office furniture even is of steel, and there is absolutely nothing to burn but the records themselves.

Down on the first floor of the building is located the hydraulic laboratory, where fire-fighting devices such as hose, nozzles, etc., are tested. Fig. 2 is a view of a portion of the interior of this room. As in the other departments, everything has not been completed here, although tests are being carried on. There are a number of temporary devices installed, as shown in the picture, which are being utilized by students of Armour Institute, who are carrying on some experiments under the direction of their instructor, Prof. Fitzhugh Taylor, who is also connected with the Underwriters' Laboratories as a member of the engineering staff.

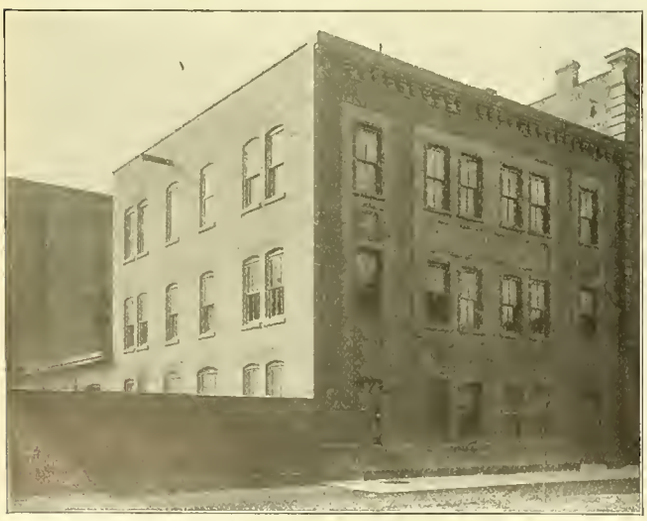


FIG. 3. THE NEW UNDERWRITERS' LABORATORIES IN CHICAGO.

Located in this department is a 500-gallon screw pump, which is shown in the picture. This pump is operated by a 50-horsepower motor of the accumulative compound-wound enclosed type. The casing of the motor is provided with a fan which draws in air through one duct and discharges it through another. When the details have been completed the intake will be run to the outside of the building to obtain a supply of cool air.

The pump, which is driven directly from the motor shaft, is, as before stated, of the screw type. The motor shaft drives by a herring-bone gear a second shaft parallel and close to the main shaft. Inside the pump these two shafts are provided with screws which intermesh with each other inside a casing, the cross-section of which is of a figure 8 shape. The shafts operate in opposite directions and the screws, being one a left-hand and the other a right-hand, force the water from the intake at one end of the casing into the discharge pipe at the other end of the casing, and the pressure obtainable is 125 pounds to the square inch. The pump is a Quimby 500-gallon machine.

In addition to the large pump there is a smaller one of 50 gallons capacity driven by a three-horsepower motor for pumping into the pressure tank or for other purposes. There is also a Christensen automatic three-horsepower motor-driven air compressor. These last two machines are located next the wall and beyond the large pump shown in the picture.

The pumps derive their supply from the 10,000-gallon tank in the basement, which is filled from the city mains. In most of the experiments the water is used over and over again, so that the expense for this part of the work is comparatively small.

The pumps discharge into a 4,500-gallon pressure tank, and from this the water is taken at constant pressure for the tests. To maintain the pressure constant the air compressor delivers air into the upper part of the tank, and the water is

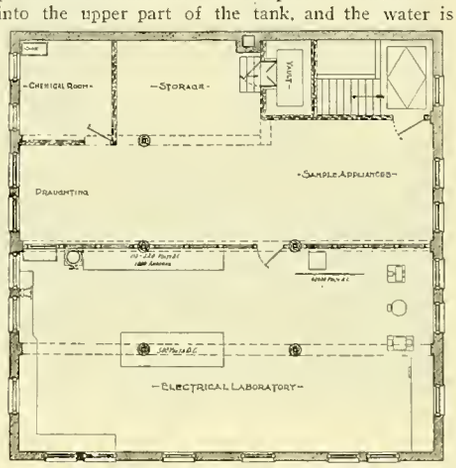


FIG. 4. THIRD-FLOOR PLAN OF UNDERWRITERS' LABORATORIES.

then pumped in against the air. The air compressor, being fitted with the usual automatic control, pumps in air as fast as the water is taken out for the tests, keeping the pressure at a normal value.

In the basement are located five dry-pipe valves, these valves being of the type used in the dry-pipe sprinkler system for fire protection. This system is only installed in places where there would be danger of freezing with the ordinary system. In the dry-pipe system the sprinkler pipes are normally filled with compressed air, which holds back the water from entering through the valves located in the basement of the building. When the sprinkler heads are melted out the air is allowed to escape and the water then flows into the sprinkler pipes through the valves.

The above account in a general way describes the nature of the work and the facilities provided for the Underwriteres' Laboratories. The organization which has this work in charge is a very complete and efficient one. The president of the Laboratories Corporation is Henry Clay Eddy of Chicago, who is resident secretary of the Commercial Union and Palatine insurance companies. The secretary is W. H. Merrill, Jr., of Chicago, who devotes his whole time to the work and is one of the leading authorities in the country on electrical insurance matters. There is a board of directors composed of the president and 10 other men from the different parts of the country who are prominently connected with the large fire-insurance companies and the National Board of Fire Underwriters. The head of the engineering staff is William C. Robinson, who has a number of assistants for the various departments. There is also a committee passing upon laboratory reports, an electrical committee and a committee on gases and oils.

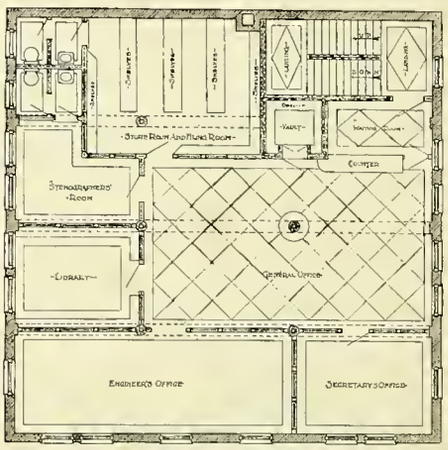


FIG. 5. SECOND-FLOOR PLAN OF UNDERWRITERS' LABORATORIES.

F. E. Cabot of Boston is chairman of the electrical committee.

This organization, upon the efficiency of which the insurance interests largely depend for correct estimates of the value of fire-extinguishing appliances and fire-resistive materials and methods of construction as well as for correct methods of safeguarding as far as practicable lighting and heating devices, has enjoyed up to the present time the cordial support and co-operation of the manufacturing companies interested in the construction of wares of this character. Since it retains in its new home the staff and governing boards which have been principally responsible in its upbuilding, it is expected to continue its progress and to become in the future even more of an important factor for the general good of legitimate manufacturing enterprises, insurance companies and the insuring public.

Contracts Awarded for Chicago Drainage Canal Power Plant.

Contracts aggregating nearly $200,000 were awarded on October 30th for equipping the hydro-electric power plant of the Chicago Drainage Canal to be located at Lockport, Ill., and also for the transmission line to Chicago. In the Western Electrician of September 2d there was given a synopsis of the specifications for this part of the work. The contracts which have just been awarded are distributed among a number of the large manufacturing and contracting firms. The following is a list of the successful bidders and the amounts for which the various contracts were let:

Stanley-G. I. Electric Manufacturing Company, switchboards and transformers, $3,546, rheostats for the four main generators, and two direct-current machines, $1,515; Arthur Frantzen Company of Chicago, oil circuit-breakers and switches, $13,836, bus-bar compartments, $8,629; Brennan Electric Construction Company, conduits and wiring connections, $6,285.87, erecting 180 miles of aluminum conductors, $4,357.80; General Electric Company, transformers and lightning arresters, $74,888; Western Electric Company, aluminum conductors, $423 per mile; Porter & Berg, high-tension insulators (about 4,000), $5,920; Whiting Foundry Equipment Company, electric crane, $5,800.

Private Capital Necessary.

Speaking before the Commercial League of New York city, Mayor McClellan of that city touched on the subject of municipal ownership of public utilities as follows: "No municipality may, under the Constitution, borrow more than 10 per cent. of the assessed value of its taxable property, and this leaves the city a margin of only $40,000,000 at this time. With that all the needs of the government must be met. If we cannot have the aid of private enterprise and private capital, and are permitted to use only the municipal capital, it is a legal, physical and financial impossibility to undertake the great rapid-transit constructions which are so necessary for the comfort and convenience of the people."

A Year's Operation of the New York Subway.

At midnight on October 26th the New York subway had been open for passenger service for a completed year. The line from Brooklyn Bridge to One-hundred-and-thirty-fifth Street and Broadway was the first operated; then, after some months, extensions were opened from Ninety-sixth Street to One-hundred-and-forty-fifth Street and Lenox Avenue, from One-hundred-and-thirty-fifth Street on Lenox Avenue to West Farms, part of the latter line being under the Harlem River and part in the open air through the Bronx, and then at the other end stations from Brooklyn Bridge down to South Ferry were progressively opened as completed.

Much official satisfaction is expressed at the first year's working. There has been a handsome revenue, amounting to $5,300,000 in five-cent fares, representing 106,000,000 passengers, or about 300,000 a day. There have been no serious accidents, although quite a number of minor mishaps, and one or two deaths. In the early spring there was a strike of motormen and conductors, but this matter was satisfactorily adjusted.

New Yorkers have now a large measure of real rapid transit. Express trains run every two or three minutes during the busy hours from Brooklyn Bridge to Ninety-sixth Street, but there is a demand for more expresses. There is also a demand for longer local trains, and to this end plans are being prepared for lengthening the local platforms to accommodate seven cars instead of five. The express trip from Brooklyn Bridge to Ninety-sixth Street occupies 16 minutes, or a little less, and the schedule time is generally maintained.

General Manager Frank Hedley admits that the present service is not the maximum that will be ultimately attained. The proper operation is still hampered by incomplete terminals, especially at South Ferry, where there is a loop, as at City Hall. Mr. Hedley prophesies that conditions will be greatly improved when the tunnel between South Ferry and Brooklyn is in operation, which will be about the summer of 1906. Mr. W. B. Parsons, who as chief engineer of the Rapid Transit Commission, was responsible for the planning of the subway, asserts that the full utility of the system cannot be realized until his original designs for extensions on the East Side above Forty-second Street and on the West Side below it are carried out. So far these lines have not been authorized, and although the Interborough Rapid Transit Company says that it is logically entitled to them, the present temper of the commission is against these extensions.

Of the 106,000,000 passengers carried, there were, in round figures, 18,000,000 starting at Brooklyn Bridge, 10,000,000 at the Grand Central Station, 7,000,000 at Fulton Street, and 5,00,000 at Times Square. The estimated number of passengers on the elevated lines during the same year was 261,500,000, so that a fair estimate of the total daily average of Interborough passengers is 1,000,000 a day.

Besides the insufficiency of service, from the public point of view, and the almost intolerable overcrowding of the cars at certain hours, there has been much complaint as to deficient ventilation. It was found, when the hot weather set in, that the temperature at the subway stations often exceeded that of the street level, and the air seemed to be wanting in the proper proportion of oxygen. The company, however, did not face the problem energetically, but by the adoption of insufficient devices, such as the installation of office fans at the stations, quieted public criticism for a time. Then, at one or two points, large exhaust fans were installed, but these do not appear to have solved the difficulty, and it is announced that the company's engineers are now considering the problem anew. The official view is that the air is good but overheated, owing to the heat given off by the motors, and confidence is expressed that the temperature can be lowered by suitable devices. With regard to the ventilation of all new subways, it is certain that the up and down tracks will be partitioned off, so that the trains will create their own air currents.

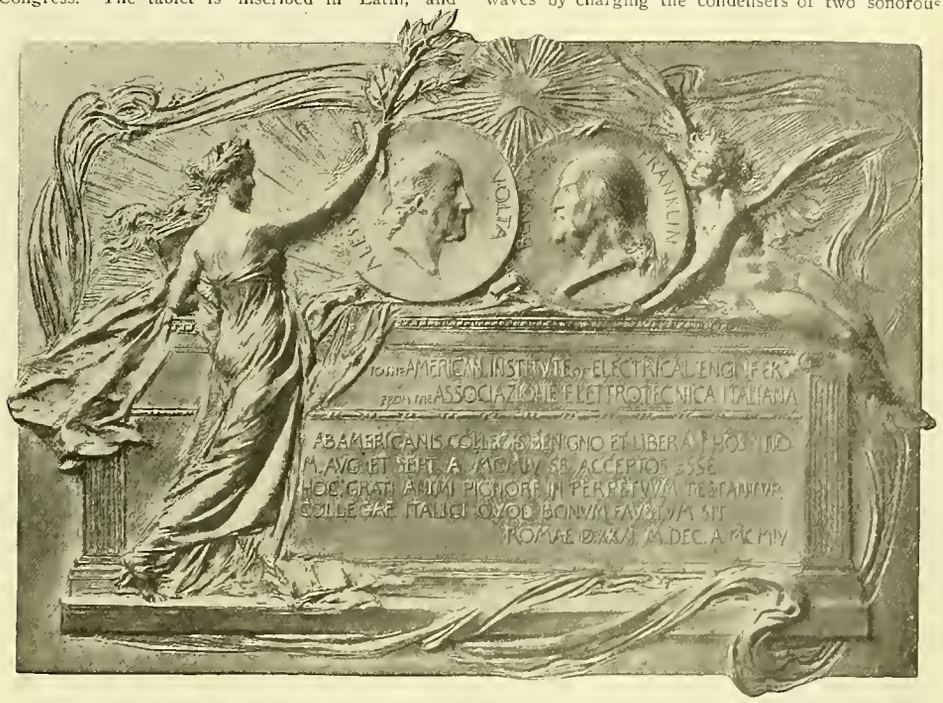
The only outstanding portion of the present subway will be opened for traffic on January 1st. This is from One-hundred-and-thirty-fifth Street under Fort George, and by viaduct to the Ship Canal. Unforeseen engineering difficulties have retarded the completion of this branch. When it is ready there will be an extra track available for express trains above One-hundred-and-thirty-fifth Street in one direction during the busy hours.

Within a few weeks from now it is anticipated that contracts will be advertised for new subways, the routes tentatively selected being along the general lines of Third, Sixth, Seventh and Eighth avenues. The Third and Eighth avenue schemes will probably be started first. D. W. W.

Institute Receives a Silver Tablet from Italy.

At the two hundredth meeting of the American Institute of Electrical Engineers held at the assembly room of the New York Edison Company on October 27th President S. S. Wheeler presided. Secretary Pope announced that 43 associates had been elected at a meeting of the board of directors, held earlier in the day, while nine associates had been transferred to full membership.

Dr. Wheeler announced that the Institute had received from the Italian Society of Electrical Engineers a handsome silver tablet, which was on the platform, in token of appreciation of entertainment by the Institute when the Italian delegates were in this country to attend the International Electrical Congress. The tablet is inscribed in Latin, and



SILVER TABLET PRESENTED BY ASSOCIAZIONE ELETTROTECNICA ITALIANA TO AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

photographs of it will be sent to the chairmen of the various local entertainment committees which assisted in entertaining the foreign delegates when they were in this country.

John W. Lieb, Jr., who was active in the entertainment of the Italian delegates, said that the tablet was designed and executed as a silver casting by one of the most famous of Italian sculptors, Prof. Proliaghi. The translation of the Latin inscription, made by C. O. Mailloux, is as follows: "By this testimonial the Italian colleagues place on record, for all time, their reception in gracious and generous hospitality by their American colleagues during the months of August and September in the year 1904. May it be of good augury. Rome, 31st day of month of December, in the year 1904."

The silver tablet is 17 inches wide and 13 inches high. It is mounted on a marble slab and is embellished with medallion portraits of Volta and Franklin. It will be placed in a prominent position in the Institute headquarters in the new Union Engineering Building now in process of construction.

The subject of the evening's discussion was "Lightning Protective Apparatus," and papers prepared by N. J. Neall, Julian C. Smith and Philip Torchio on this subject were read. Messrs. Neall and Torchio read their own papers, and Gano S. Dunn read that of Mr. Smith. An ample discussion followed the reading. The subject is referred to at some length elsewhere in this issue.

Electrification of Ore-carrying Road.

The Duluth, Missabe and Northern Railway will, it is said, discard steam as the motive power on its road as soon as possible, and electric locomotives will be used instead. The third-rail system is contemplated. The plans are also said to include the use of electrical apparatus for unloading the big steel ore cars at the docks. The road is 72 miles long, connecting Duluth and Mount Iron, Minn., through Iron Junction and Wolf, with 37 miles of branches.

Improvements in the Stone Space-telegraph System.

John S. Stone of Cambridge, Mass., inventor of the Stone system of space telegraphy, has recently patented a number of new ideas relative to the various parts of his system, there being issued to him on October 24th 16 United States patents, Nos. 802,417 to 802,432, inclusive, which were assigned to William Swan of Boston, Mass.

First on the list of these patents is one embodying specifications for an attuned receiving circuit. The mutual energy of the resonant circuit with respect to the elevated conductor is made small in comparison with self-induced energy of the resonant circuit.

Devices for increasing the amplitude and persistency of electrical oscillations in the conductor are described in the second patent, the third being devoted to a method of developing electromagnetic waves by charging the condensers of two sonorous circuits and discharging them across a common spark gap.

The next device described is for preventing a tuned or resonant circuit from receiving extraneous impulses, and is covered in the fourth, fifth and sixth patents. No. 7 relates to a resonant receiver.

Described in the eighth patent is an electrical system connected to the lower end of the aerial, the system consisting of a number of coils and condensers having for varying wave lengths the same capacity and inductance as the aerial for corresponding frequencies.

Means are described in the ninth and tenth patents for producing pronounced vibrations at certain definite frequencies.

Sonorous circuits adapted to develop simple harmonic electrical oscillations of definite frequency, with means common to the circuits for simultaneously disturbing the electrical equilibrium, are the basis of the eleventh patent.

Methods for bringing the electrical center of an oscillator to a point where the receiver may be associated, and for giving an elevated conductor a number of rates of vibration for persistent trains of electrical oscillations of different definite frequencies, are described in the twelfth and thirteenth of the series.

Preventing a space-telegraph receiving system from responding to abrupt or impulsive electric waves, and making it responsive to suitably tuned persistent trains of waves, is accomplished by devices described in patent No. 14 of the series, while the fifteenth describes an improvement in the art of developing simple harmonic signal waves.

Last of all there is described a sonorous circuit adapted to develop simple harmonic electrical oscillations of a definite frequency, a resonant circuit being attuned to the frequency of and inductively connected to the sonorous circuit.

Various street-railway lines in Peru are to be changed from horse to electric traction, and a new electric railway is projected to run between Chorillos and Lima.

Possible Applications of "Telemechanics."

By C. D. Kubicki.

After the success obtained by Professor d'Arsonval in a lecture organized by the French newspaper Le Matin, and in which the distinguished French scientist showed to the audience the most interesting applications of liquefied air, the same journal offered to its subscribers on June 30th last a second scientific "festival," at which 5,000 people gathered in the magnificent Palace of Trocadero in Paris to listen to Dr. Branly's lecture on space telegraphy and on telemechanics, as the author calls it.

As in many other inventions of any considerable importance, there is already some controversy as to whom belongs the greatest part in the invention of wireless telegraphy. Before I start to give an account of Dr. Branly's last experiments in telemechanics, and without wishing to show any partiality toward the scientists who contributed to that important discovery, I will try to draw a short historical sketch of the invention of space telegraphy.

Starting with Maxwell's theories on electromagnetism, which are justly considered as opening a new era in the study of physics, Hertz in 1887 undertook a series of experiments, by which he showed means of obtaining a circuit of short electric waves, although a similar attempt had been made already by Federsen and by Schiller. Hertz obtained an amplitude of vibration of one-millionth part of a second, while his successors, Lodge, Righi, Bose, Lebedef and Lampa, succeeded in obtaining these waves 10,000 times shorter.

Hertz was first to find means of transmitting electromagnetic waves at a considerable distance and of receiving them in a very sensitive resonator. Hence the origin of space telegraphy, brought into practice by Dr. Branly's discovery of cohering, in 1890.

In 1896, A. S. Popoff used an antenna at the receiving station, while Marconi applied the antenna at both stations. Slaby invented means of tuning these stations, and Braun, until 1903, utilized the properties of a closed circuit in order to strengthen the vibrations in the antennæ.

At the beginning of his lecture, Dr. Branly, whose modesty is well known, was presented to the audience by Professor d'Arsonval, who emphasized Dr. Branly's contribution to the industrial applications of Hertz's waves by discovering the properties of the coherer. This Professor d'Arsonval calls the electric eye, and by means of it space telegraphy and telemechanics were brought to realization.

In a series of very interesting experiments Dr. Branly showed to the audience the apparatus which he used while first experimenting with the coherer, and which at the present time serve his further investigations in telemechanics, to which he devotes a great deal of his time in the laboratory of the Catholic Institute, where he teaches physics and chemistry.

Dr. Branly started his first experiments in 1890, employing a glass tube, enclosing steel filings between two pistons, in which everyone recognizes the prototype of the coherer. The coherer and a galvanometer were placed in the circuit of an electric cell. Under these circumstances the electric current passes through the circuit, and the galvanometer is deviated until the current is interrupted by a stroke on the tube. The electromagnetic waves started by the production of a spark in an induction coil pass through the filings at a speed equal to the velocity of light. The remarkable feature of these waves is that, while they pass through a stone wall one meter thick, they are intercepted by a metallic screen or by salt water. If a metallic antenna be used at both of the stations, the waves are magnified.

The production of an electric spark is accompanied by vibrations, some of which act upon our sense of hearing, some others on the sight; but some of these vibrations are silent and invisible and consequently cannot be perceived. Nature here has supplied, through experimental science, the coherer, which Professor d'Arsonval aptly compares with an electric eye, and which is sensitive to these vibrations. The primitive tube containing filings was replaced in Dr. Branly's recent experiments by a tripod supported by a plane steel surface carefully polished.

Should an electric spark be started at one end of a large room, the galvanometer placed in a circuit, as above, will deviate, showing the passage of the current, which acts upon a small iron rod or armature, one end of which is attracted by the electromagnet, while the other, armed with a pencil, marks a dot on a band of paper. In a model of a receiver, invented by Dr. Branly, the iron rod, while retracting toward its initial position, interrupts the current automatically.

But space telegraphy is not the only industrial application of the phenomenon of cohering. If several circuits be properly arranged, it can contribute to the production of many other effects resulting from the passage of an electric current, viz., the lighting of incandescent lamps, the phosphorescence of Geisler's tubes, starting fireworks or exploding a mine, etc. If compared with these new industrial possibilities, space telegraphy seems to belong already to the past century. It may be easily seen that all these industrial applications, as well as many others, depend on means by which the electromagnetic waves could act upon the coherer automatically at the receiving station, bringing the circuit to a proper arrangement after each impulse. Otherwise, all the circuits being necessarily prepared in advance, they would act spontaneously, without any possibility of controlling them, under the influence of a single spark occurring at the transmitting station.

DOTS AND DASHES IN SIGNALING TAPE.

This automatic action is obtained by Dr. Branly's telemechanical controller, by which an operator at the transmitting station can produce the desired effect in the order he wishes at a distance of 50, 100, 200 and more kilometers. Moreover, he is at every moment kept informed, by means of the same apparatus, at what time a given effect commences and what is the time of its duration.

After a signal was given from the lecturer, the audience was startled by the noise of a spark produced at the transmitting station, and a motor, placed in series with other apparatus on the opposite end of the edifice, was set in motion, while a second longer spark appeared and persisted in the receiver. During the interval between the sparks, all sent from the transmitting station, there occurred on the stage an automatic firing of a pistol, a row of incandescent lamps were lighted, an electric fan was started and an iron sphere weighing 15 kilograms was lifted by an electromagnet. After a short pause the motor stopped and everything came to rest.

The series of the above experiments were divided into three groups, as follows:

First Experiment.—Without this, space telegraphy would not exist.

Second Experiment.—First application to space telegraphy.

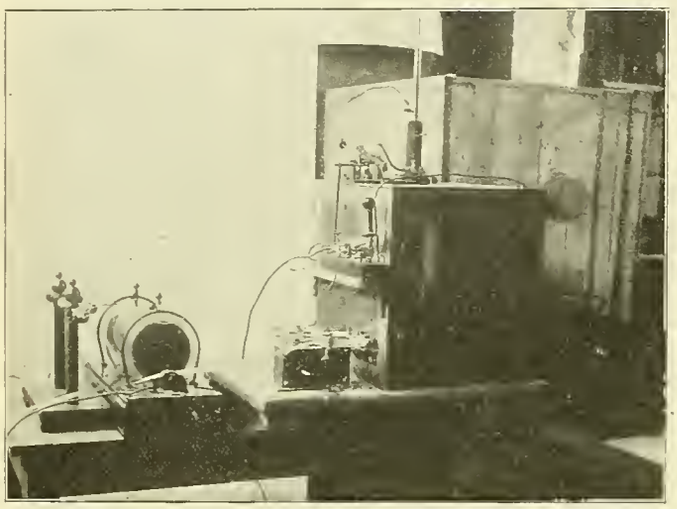
Third Experiment.—Application to telemechanics.

In experiment one a coherer composed of a tube which contained steel filings, or of a steel tripod, and a galvanometer were placed in series in circuit of an electric battery. The current did not pass the circuit, being interrupted by the tube or by the tripod. But an electric spark produced in an induction coil at a great distance from the receiving station gave rise to a series of waves in the ether by which the circuit was closed through the filings or through the contact of the tripod with the surface which supported it. A feeble stroke against the tube or against the surface of the tripod sufficed to interrupt the circuit again. A new spark then caused the circuit to be closed, and so on. The waves were propagated in all directions at a rate of 300,000 kilometers a second, which is the velocity of light.

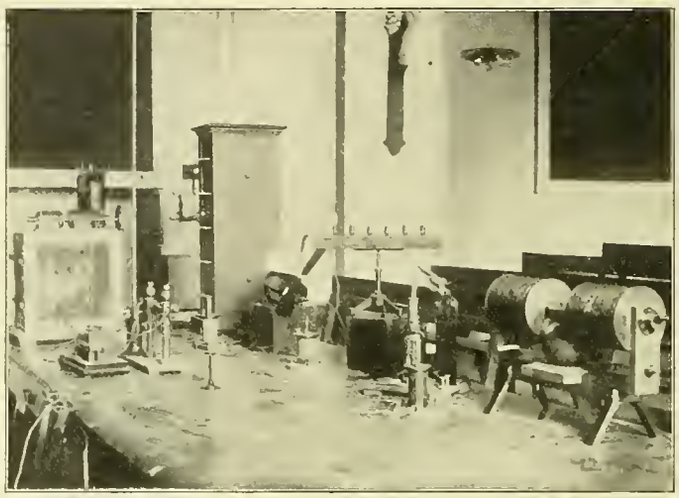
If the apparatus of either of the stations were placed in a wooden box, or in an enclosure built up of masonry, the action of the waves would not cease, as would be the case if the enclosure were made of a metallic net. If in the latter case the inner circuit were connected with an outside antenna, the action of the waves upon the coherer would again be brought into existence.

Experiment two required the use of an ordinary telegraphic Morse receiver, or telephone receiver, placed in the circuit. This made an inscription or allowed the hearing of the dots and dashes, which correspond to the passage of the current for a shorter or a longer time.

In experiment three the phenomenon of telemechanics was illustrated by the automatic starting of a small motor at the receiving station. Then followed a series of sparks at equal intervals. These sparks were signals sent out by an automatic telegraph, which was started at the same time as the motor. The signals were recorded on the paper band of a Morse receiver and read by the operator at the transmitting station. The separate processes included in the experiments in telemechanics took place in the intervals between the consecutive sparks in a succession, which was determined in advance. Then followed another series of sparks. At first only single sparks, then groups of two, then of three, of four and of five, each spark following its predecessor at a very short interval of time, while 12 seconds elapsed between separate groups, each of which was started by one long spark. The long spark announced to the operator the beginning of a process. If it was necessary to stop any of the processes, the operator sent out sparks in the intervals which corresponded to each process. A special spark brought the motors to rest. The controlling of the separate processes, their starting, their duration, as



TRANSMITTING STATION OF TELEMECHANICAL SYSTEM.



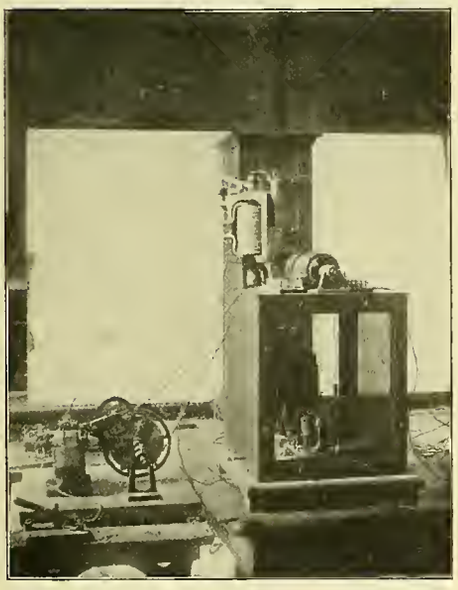
APPARATUS FOR DEMONSTRATING TELEMECHANICS AT LECTURE.

well as the stoppage, depended entirely on the transmitting station. This was obtained by means of a special apparatus, placed at the receiving station.

The controlling apparatus consisted of an axis, containing a series of circular disks, insulated one from the other; each of these disks controlled a separate circuit, and to that end was provided on its circumference with an eccentrical segment, which, during a certain fraction of the revolution of the axis, came in contact with a spring and closed the circuit on which depended the production of a given process. Let us follow, for example, the process of lighting of the lamps. During eight seconds the corresponding disk closed the circuit which contained the coherer and the lamps. That interval of time corresponded evidently to the duration of the contact of the spring with the eccentrical segment of the disk. If in the same interval a spark was started at the transmitting station the waves acted upon the coherer, the circuit was closed, and the lamps were lighted. After one or any number of revolutions of the disk-controlling axis, the lamps would be extinguished at the moment when the corresponding segment came again in contact with the spring. During the interval of time in which the lamps were lighted and extinguished no other process could take place, since all the other circuits were disconnected, due to a relay. But the time at which a given process might be started was announced by means of a Morse sounder placed at the transmitting station.

The transmission of the automatic radio-telegrams depends on a special disk, placed on the same controlling axis. This disk contained five series of teeth, which came in contact with suitable springs and produced another series of sparks at equal intervals of time. During each of these intervals the band of paper in the Morse receiver advanced a length of one centimeter. During the interval between the single and the double spark the firing of the pistol took place; between the double and the treble spark the fan was started; between the treble and the quadruple sparks the lamps were lighted, and between the quadruple and the quintuple the electromagnet lifted up the iron sphere. During the intervals the operator started a process by producing a spark by means of an induction coil.

The coherer, the relay and accessories were contained in a metallic cage made of gratings, which protected the circuit against the influence of the signaling spark of the automatic telegraph. At the



RECEIVING STATION, SHOWING METALLIC CAGE AND DISTRIBUTING AXIS.

receiving station the Morse apparatus was protected by a separate cage against the working spark. An antenna placed at each station had a twofold action, due to the play of the controlling axis. The antenna of the receiving station, which sent out the autotelegrams, became a receiving antenna during the time of commutation of the segments with the springs. At the transmitting station the antenna which conveyed to the receiving station the vibrations produced by the working spark became, for the time being, a receiving antenna for the Morse apparatus, which received the autotelegram. It is clear that if an operator is needed at the transmitting station, the receiving station operates automatically and may therefore be situated at any distance and at a point, access to which is very difficult.

The controlling axis of the first apparatus devised by Dr. Branly was put in motion by clockwork, while at the present time it is set up to work by a separate motor, which is started by a spark from the transmitting station. The interval of time between the groups of sparks five and one is utilized for bringing the motor to a standstill.

It is of importance that the operator should know whether the effect he intended to produce takes place or not. He is informed as to that by a

DR. BRANLY PREPARING HIS APPARATUS IN TELEMECHANICS.

signaling system. To this end the same controlling axis is provided with another row of disks, each of which contains a tooth. Each process corresponds to a separate disk, one of these disks closing the circuit of an induction coil once at each revolution of the axis during the whole duration of the given process, and each controlling spark is preceded by a signal appearing at the receiving station as a long dash.

The above system of signaling affords means not only to obtain a single process, independent of any other, but also any composite action, such as starting of a railroad train or of a steam engine, the lighting of a lighthouse, etc., without the necessity of employing complicated apparatus. If it should be desired that one of the effects succeed the other, the apparatus sends out signals which announce that a given process is still in operation.

Let us follow, for example, the process of the lighting of a lighthouse, which can be divided into three parts, as follows: First, the lighting at 8 p. m.—A first spark, sent out from the transmitting station, starts at the receiving station a motor, on which depends the controlling axis. As the axis revolves, the sparks of the automatic telegraph act upon the Morse receiver at the transmitting station during the intervals of time. These are to be seen on the band in the illustration. The same station can also send out sparks which start the various processes belonging to the lighting of the lighthouse. While this takes place, new controlling signals are added to the signs of the automatic telegraph which arrive at the transmitting station. After the component processes have been realized, in two or three minutes, the motor is stopped by a spark in a corresponding interval of time.

Verification at midnight.—The operator verifies at the transmitting station the working of the apparatus at the receiving station. By means of a spark he starts a motor placed in this station. The signals of the automatic telegraph are recorded as before at the transmitting station, preceded by signs which show that the process is still in operation. The time of verification does not exceed one or two minutes, after which the operator stops the motor by a spark from the transmitting station, sent out during the interval which corresponds to that purpose.

Extinguishing of the light at 4 a. m.—A new spark from the transmitting station starts the motor of the controlling axis, and the operator reads the signals on the band of paper, showing that the process is still going on. The component processes can then be stopped in a desired succession, after which the main motor is also arrested by a special spark.

It is evident that the controlling apparatus may be arranged for an infinite number of combinations. Let us suppose them to be 25, which means that 25 disks, instead of four, as in the preceding case, may perform 25 various processes, the printing of the letters of an alphabet, for example, by which secrecy in the transmission of telegrams is wholly assured.

If at any moment an unexpected spark, resulting from the atmospheric electricity, for example, should come to stop the motor, a special arrangement of electric bells gives the alarm. Dr. Branly is at present at work finding means of preventing, by another device, the production of such accidents. By his new arrangement the controlling axis will be exclusively dependent on the transmitting station.

Among the numerous applications of telemechanics following may be alreeady suggested: The steering of balloons and of torpedo boats and the exploding of mines. The objection may be raised that the above applications have not as yet come out of the laboratory, but such was also for a long time the case with space telegraphy.

During wartime a powerful vibrator may disturb the waves, and tuning if used might be rendered impossible. We do not think it would afford means of perfect safety. If radio-telegraphy, as well as telemechanics, may serve mankind only in times of peace, let us hope they will find a vast field for industrial applications.

Death of George C. Bailey.

George C. Bailey, general western manager of the John A. Roebling's Sons Company, and secretary and treasurer of the Roebling company in Illinois, died at his home, 5224 Jefferson Avenue, Chicago, on October 27th. Mr. Bailey had not been robust for several years, and in December of last year he went to Southern California in search of better health, but returned six months later but little improved. He again gave some attention to business but grew gradually worse, and six weeks before his death he was at the office for the last time.

GEORGE C. BAILEY.

Mr. Bailey was born in Lambertville, N. J., on March 14, 1843. He began to work at the age of 14 in Princeton, N. J., and two years later moved to Trenton, N. J., where he was for many years associated with Titus Bros., manufacturers of woolens. He became connected with the Roebling establishment in Trenton in 1881 as its western traveling representative. The western business grew rapidly and the company was compelled to open a branch in the West. Consequently Mr. Bailey was sent to Chicago by the company, and in 1886 bought the property at 171 Lake Street. He put in a stock of wire and cables and at this location the western business has since been conducted. Mr. Bailey was made general western manager when the branch was opened and held that position at the time of his death, besides being secretary and treasurer of the John A. Roebling's Sons Company of Illinois.

Mr. Bailey was recognized as a capable business man, and wherever he was known was well liked. Particularly in the Central West, where he came in touch with many different lines of business, he had many friends. The nature of his business brought him in contact with electrical and street-railway men, by whom he was highly esteemed. In the days of the old Chicago Electric Club he was a prominent member of that organization. For a number of years he devoted much thought to the heavy-cable branch of the business.

The funeral was held on October 30th, conducted by Dr. Joseph A. Vance of the Hyde Park Presbyterian Church. The body was taken to the receiving vault at Oakwoods. Many intimate friends and business associates were in attendance. Mr. Bailey is survived by his wife and two children, Ferdinand W. and Miss May. He was a member of the Union League Club.

A company has been organized at Fort Collins, Colo., for the purpose of constructing an electric railway from Eaton, through Fort Collins to Denver. Work will probably be begun this fall.

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DATES AHEAD.

Ohio Society of Mechanical, Electrical and Steam Engineers (annual meeting), Canton, Ohio, November 17th and 18th.

Automobile Club of America (annual exhibition), Sixty-ninth Regiment Armory, New York City, January 13th to 20th.

Chicago electrical exhibition (first annual exhibition of Electrical Trades Exposition Company), Coliseum, Chicago, January 15th to 27th.

A PLEASANT reminder of last year's visit of members of the Associazione Elettrotecnica Italiana to the United States at the time of the International Electrical Congress is the silver tablet which has been presented to the American Institute of Electrical Engineers by the Italian society and which is illustrated in this issue of the Western Electrician. The picture shows the tablet to be a beautiful piece of work, and one can well believe that it was modeled by one of the foremost of Italian sculptors. Medallion portraits of Volta and Franklin embellish the tablet, and there is a fraternal inscription in Latin. The tablet will be placed in a prominent position in the Union Engineering Building now in course of erection, where it will remain, "for all time," let us hope, a witness to the friendship of Italian and American electrical engineers. The gift was graciously conceived and executed. In the felicitous language of the inscription, "May it be of good augury!"

THE ELECTRIC WIND has been defined as a rush of particles of air from a point attached to the surface of a charged insulated conductor. It is believed to be the product of three different factors—the change of form of a fluid conductor under the influence of electrostatic force, the repulsion between similarly charged ions, and the drag exerted by these ions upon the fluid. A recent German writer describes some interesting experiments by which the three effects may be distinguished, and a synopsis is given in the London Electrician. If a positively charged point is held near a flame, and a glass plate is interposed, the yellow part of the flame is repelled, while the blue part is attracted. This is the simple deformation. On substituting an earthed wire gauze for the glass plate, the whole flame is repelled by the air current, the ions being stopped by the gauze. On removing the latter, both effects are superposed, and the ordinary phenomenon of the electric wind is witnessed.

CONSIDERABLE comment has been caused by the recent coal-carrying decision of the Indiana Railroad Commission. This commission was appointed under an act of the last Legislature. It has rendered a decision to the effect that it is right for railroad companies to charge a less freight rate on coal consigned to manufacturing industries of the gas-belt cities than the rate charged traction companies, electric-light companies and domestic consumers. In fact, there are three rates now in effect for transporting the same quantity of coal from the same place to the same destination. The manufacturing industries get the low rate, the traction companies and electric-light companies are charged a slightly higher price, and the maximum rate is charged to domestic consumers. The reason given for the concession to the manufacturing industries is that the carrier is enabled to carry away from the factory the finished product, in many instances, instead of returning the cars empty. The Indiana decision is all the more important at this time, because of the agitation of railroad rates and the receent convention held in Chicago.

ALLEGATIONS to the contrary notwithstanding, exports from this country to the Philippines are gradually on the increase. This may be looked upon as favorable to the ultimate supremacy of American goods in the islands, especially when it is remembered that previous to our acquirement of the Philippines there had been a very limited demand for the products of the United States, while under the new regime the American exporter has not been favored with special privileges to induce him to follow the flag. This growth is particularly marked in the electrical lines of trade. Statistics show that the United States is the leading source of supply in telegraph, telephone and other electrical instruments. For the first 10 months of the last fiscal year this country supplied $31,990 out of a total importation of $48,434, its nearest competitor being Germany, with a value for the same period of $5,180. Under the heading of incandescent lamps, the United States supplied $3,057 out of a total supply value of $5,718. Here again Germany was second, with $867. Under the heading of electrical machinery we supplied $106,446, out of a total of $112,784. This is certainly an encouraging showing.

One of the most important features to be watched in securing the continuance of this trade is the proper packing of the goods. Testimony of wharf officials at Manila is uniformly to the effect that American goods arrive in a worse condition than those from other prominent exporting countries. American shippers should not lost sight of the fact that their products must face a 10,000-mile journey with rough handling in unloading which has no parallel in domestic shipments of freight.

MAYOR DUNNE has been unfortunate, to say the least, in his encounters with the City Council in relation to possible municipal ownership of the street railways of Chicago. When first organized the present Council appointed a local transportation committee with a majority hostile to the mayor's visionary ideas. Clashes were frequent, but within the last month issue has been joined in decisive manner, and on three distinct occasions the mayor has been completely routed in endeavoring to cause the Council to discredit the work of its committee, which has under its consideration franchise ordinances offered by the two operating street-railway companies.

First, the mayor had introduced in the council an order directing the committee to cease further consideration of ordinances proposed by the companies and to report the "contract plan" offered by the mayor himself some time ago. On October 9th the Council referred the proposed order to the committee itself, which was, of course, equivalent to killing it. A motion to suspend the rules so that the proposed order might be acted on directly was defeated by the decisive vote of 18 to 45.

A week later, on October 16th, the mayor came back with an effort to force the committee to "cease all negotiations contemplating the granting of a franchise to any of the present existing street-railway companies and all negotiations with said companies excepting those looking to the purchase of the properties of said companies." This was definite enough, but the Council by a vote of 27 to 37 refused to pass the order requested.

Still the mayor persisted in his effort to "put the aldermen on record" in opposition to the "expressed will of the people," encouraged, perhaps, by the change of a few votes in his favor. He made a third attempt, this being a mandate to the committee to proceed without delay to prepare an ordinance for the purpose of acquiring ownership of the street railways under the Mueller law, this matter to take precedence over all others pending before the committee. This proposed order came to a vote in the Council on October 30th. Alderman Foreman, chairman of the committee, offered a substitute directing the committee to report on a method of making a legal test of the validity of the street-railway certificates authorized by the Mueller law. This substitute was carried, in place of the mayor's order, by a vote of 45 to 21.

Thus the mayor has sustained three successive defeats in the space of four weeks. And to crown all, Alderman Young introduced a resolution at the meeting of October 30th urging the mayor to "divulge the substance of the Dalrymple report, now reposing so securely in his breast," and to transmit the report to the Council. This resolution was ordered deferred and published at its author's request. Mr. James Dalrymple, it is well known, made a pilgrimage to Chicago from Glasgow, where he manages the municipal tramways, at Mayor Dunne's request. But after "sizing up" the Chicago situation he made a written report which is popularly supposed to have been unfavorable to municipal ownership in this city. This report the mayor has never made public.

What will be the next move of the city's chief executive? Perhaps he himself does not know. He is reported to have said, "I have done my duty." But it is always to be remembered that the mayor can veto any street-railway or other ordinance which does not meet his approval. It requires a two-thirds vote to carry an ordinance through the Council over the mayor's veto. With all the aldermen present this means 47 votes—a figure not yet reached by the opponents of the mayor in any of the test votes.

Chicago Street-railway Situation.

By votes of about 2 to 1 the Chicago City Council at its meeting this week three times went on record as unfavorable to the mayor's ideas in the traction problem. The order of Mayor Dunne, which was the special order for the evening, directing the local transportation committee of the council to proceed at once to prepare an ordinance for the purpose of acquiring ownership of the street railways of Chicago under powers conferred by the Mueller law, and that the preparation of such an ordinance take precedence over all other matters and ordinances being now considered by the committee, was set aside and a substitute, offered by Alderman Foreman, was passed by a vote of 45 to 21. The Foreman substitute read: "Resolved, By the City Council, that the committee on local transportation be and it is hereby directed to consider and report to this council at an early date a method of making a legal test of the validity of the street-railway certificates authorized by the so-called Mueller act."

Following this, one of the mayor's supporters wished to attach an amendment to the resolution, requiring the committee to cease all negotiations with the traction companies except with a view to the purchase of the properties, but this was tabled by a vote of 43 to 21.

That the council favors the course being pursued by the local transportation committee became evident when Alderman O'Connell introduced an order which provided that all traction questions be taken out of the hands of that committee and given to a special committee of 13 appointed by the mayor. The order was defeated, 52 to 14.

This was not all in the proceedings which interested the mayor. Alderman Young offered a long resolution which in substance asked Mayor Dunne to make public the report of James Dalrymple, the Glasgow traction manager who visited Chicago at the request of the mayor to advise him in his effort to establish municipal ownership of the street railways. The resolution was made a special order for the next meeting.

Bion J. Arnold has submitted to the local transportation committee of the City Council a plan for through routes and terminal loops in the business district, which is to form the basis for the committee in working out a comprehensive surface street-railway system. The engineers of the Chicago City and Union Traction companies were called into conference by Mr. Arnold and agreed to the plan.

The plan provides 13 through routes and 12 loops. The through routing connects the different parts of the city, through the business district without change of cars, as follows: North to South Side and vice versa; from North Side to the Southwest Side; from the South Side to the Northwest Side; from both the North and South sides directly to the West Side. North Clark, Wells and North State are the principal trunk lines on the North Side; West Madison, West Van Buren and West Harrison on the West Side, and Clark, State and Wabash on the South Side.

Lines from the three sides of the city which are not through routed are provided with loops in the downtown district. The West Side lines have seven loops, the South Side three and the North Side two. All West and North Side cars not through routed are brought as far east as State Street.

To accommodate the companies, which desire to retain the tunnels, Mr. Arnold has used both La Salle and Washington streets in his plan. Personally he favors the elimination of tracks from these streets so they may be used as boulevards and for teaming. The use of these streets, however, makes a more perfect railway system, and later, if the contemplated subways are built in the two streets named the tracks can then be removed.

The report declares that the new plan of routing will enable the companies to carry twice as many people as they are now transporting. Nearly 2,000 cars are planned for during the rush hours, and on some of the busy streets they will be run only a fraction of a minute apart. The loops are so planned, it is declared, that excessive congestion will not occur at any one corner. Franklin and Monroe streets, on which no tracks are now constructed, are brought into use.

Electrical Exports for September.

Electrical exports from the United States for the month of September amounted in value to $852,769, an increase of $10,933 over September, 1904. While the total exports for the month show a slight increase, goods classified as electrical machinery fell off $26,533 from the figures for September, 1904. Electrical appliances, however, show a gain of $37,466. The figures in detail are as follows: Electrical machinery—September, 1905, $465,882; September, 1904, $492,415. Electrical appliances—September, 1905, $386,887; September, 1904, $349,421.

Considering electrical machinery only, the following is a classification of the principal buyers from the United States during September, 1905, and the value of the electrical machinery they bought: British North America, $134,159; United Kingdom, $57,822; Mexico, $54,668; Japan, $51,216; Argentine, $26,339; France, $25,316; Philippine Islands, $17,375; British Australasia, $16,707; British East Indies, $11,287; Brazil, $10,342; British Africa, $8,587; Cuba, $4,608; Germany, $3,057.

Space Telegraphy and Ultra-violet Light for Railway Signaling.

One of the serious drawbacks of space telegraphy as applied to train signaling is the presence of a great number of wires adjacent the railroad tracks which interfere with the transmission or reception of the electric waves unless the aerial be at a sufficient height to clear the wires. At first thought it would appear entirely feasible to mount an aerial on the roof of a car at a sufficient height to be well above the telegraph wires. But this is not so easy as it seems, as there are bridges, tunnels and crossing wires which do not allow of a structure being erected at any considerable height on the car. In a device which he has recently patented Isidor Kitsee of Philadelphia has sought to overcome this difficulty.

The apparatus described by the inventor contemplates the use of a pole or arm on the roof of the car which, like the ordinary trolley pole, may be raised or lowered at will. This pole carries the aerial conductor and is provided with a rope for drawing it down toward the horizontal position. It is not intended, however, that this shall be done by hand, as the invention embodies an ingenious device for performing the operation automatically.

In the roadbed, at the requisite distance from bridges, tunnels and the like, are mounted projecting stubs or contacts which engage a lever arm on the bottom of the car. This lever arm, upon engaging the stub, is pushed over and closes an electric circuit on the car, which is supplied by a battery. The energization of this circuit attracts the armature of an electromagnet therein and releases a spring-driven ratchet wheel, one-half of the periphery of which is of conducting material, and the other half of a non-conducting material. As the wheel revolves the tip of the armature glides over the conducting surface, closing a second circuit, which includes a small motor driving a drum. The drum winds up the rope and draws down the pole to clear the obstruction. When the wheel has completed its half revolution and the drum is turned sufficiently to draw down the pole the projecting arm at the bottom of the car is again moved over by a stub on the other side of the obstruction, momentarily closing the first-mentioned circuit and again raising the armature pawl of the spring-driven wheel. This causes the armature to follow the insulated portion of the wheel and come to rest in the first notch on the periphery, which notch is insulated. The motor circuit is thus opened and a weight on the lower end of the pole draws the latter up to the vertical position. The device is then in the original position, and the circuits are ready to perform the operation again at the next obstruction.

Experiment has proved that rays of light having short wave-lengths, more particularly ultra-violet rays, have the property of reducing the electrical resistance of a spark gap between two induction-coil electrodes. For example, if the two ball electrodes of an induction coil be moved apart until the potential difference ceases to cause the spark to be discharged, ultra-violet rays of light when directed on the gap will instantly cause the discharges to resume. This principle has been embodied in an ingenious train-signaling apparatus patented recently by Karl Scholz of Liebauthal, Austria-Hungary.

Mr. Scholz's idea is to provide on every train, on the front of the locomotive and the rear of the last coach, a sending and receiving set for utilizing the ultra-violet rays. The sender consists of an arc lamp connected to a dynamo on the train. This lamp is provided with a reflector which sends out a beam or pencil of light through a rock-crystal lens which allows the violet rays to pass. The beam of violet light is capable of being projected 300 meters or more.

The receiving device consists of a spark gap which is normally too far open to admit of a discharge, but which upon being struck by the beam of violet light from another train, will have its resistance reduced sufficiently to allow of a discharge taking place, whereby a relay is operated. The relay closes circuits for operating the air brakes of the train and for ringing a signal bell to attract the attention of the engineer.

The receiver is fitted with a device for collecting the rays, so that the latter have an effective area of several square feet. At curves an automatic device turns the lamp so that the pencil of light is always pointed at a portion of the track the desired distance ahead.

The Laying of the Latest Atlantic Cable.

The Commercial Cable Company's fifth Atlantic cable, from Canso, Nova Scotia, to Waterville, Ireland, was completed and put in operation on October 6th, as already noted in the Western Electrician. This makes seven transatlantic cables worked in direct connection with the lines of the Postal Telegraph-cable Company. All of them are duplexed, so that their combined capacity is 14 messages at one time.

The new cable is described as the best and most expensive submarine cable ever laid. It was manufactured by the Telegraph Construction and Maintenance Company of London, having been begun in March, 1905, and finished and shipped on board the construction company's steamer Colonia on August 3, 1905.

Atlantic cables are always laid from west to east, because the prevailing winds in the summer months on the Atlantic are from the west, and ships meet much better weather going eastward; consequently the Colonia sailed direct from England to America, arriving off the coast of Nova Scotia on August 16th, and landed the heavy shore end of the cable on the morning of August 18th. Moving out from the shore it struck a rock and remained fast thereon for four days. The injuries it sustained compelled it to go into drydock at Halifax with 2,300 miles of submarine cable aboard. It was the largest and heaviest ship ever taken on that drydock, exceeding by thousands of tons the United States battleship Indiana of 10,000 tons, which went into drydock there a couple of years ago. Repairs were made, and the Colonia took the sea again.

On September 23d the ship laid its course from Canso, N. S., paying out cable. On September 28th it passed through a hurricane in mid-Atlantic, although on that day the weather on both sides of the Atlantic was reported fine, with gentle winds. On October 3d it arrived without a mishap at a point 187 miles from the coast of Ireland, where the final splice was to be made between the cable that it had paid out from the American side and the 187 miles of cable previously laid westward from the Irish coast by the steamship Cambria in the month of June. The weather was heavy and the Colonia was compelled to heave to for several days awaiting smoother seas to enable it to make the final splice, which was made on October 6th.

At some points the cable was laid at a depth of nearly three miles below the surface of the sea. The quantities of material used in the manufacture of the cable were 1,411,200 pounds of copper; 799,688 pounds of gutta-percha; 1,500,000 pounds of brass tape, jute yarn, iron wire and preservative compound.

The signaling speed of this cable is reported to be 15 per cent. greater than that of any other cable of equal length in the Atlantic. The cost of the cable varied from $1,000 to $6,000 per mile, according to the character of the ocean bed and depth of water, the great variation in cost being due to the different diameters and weights of the sections of the cable, the cable which is laid in the deepest water being lightest for the important reason that it would be impossible to retrieve a heavy cable from the deep water, because of the enormous pressure. Cable in deep water is practically safe from injury, and therefore does not need to be so strong, so that the sections laid in the deepest water are of smaller diameter and lesser cost. The sections laid near shores are of massive construction and very expensive. In the neighborhood of the fishing grounds off the coast of Newfoundland a type of cable midway between the deep water and shore-end cable is used. This intermediate size is made strong, to resist injuries from the anchors of fishing craft, the most prolific source of danger to submarine cables. This intermediate type is made just heavy enough to afford reasonable prospect of retrieving it in the event of its being damaged by the anchor of a fishing vessel.

It is said that a committee of traffic experts and engineers has been appointed by the management of the Pennsylvania Railroad to ascertain the feasibility of adopting electricity for a part or all of the traffic over the West Jersey and Seashore railroad between Philadelphia and Atlantic City.

Practical Operation of Lightning Protective Apparatus.

Lightning protective apparatus was the subject for discussion at the New York meeting of the American Institute of Electrical Engineers on October 27th, the papers and discussion taking up the operating phase of the subject rather than questions of design. Three papers were read as an introduction to discussion as follows: "Some Experiences with Lightning Protective Apparatus," by Julian C. Smith, superintendent of the Shawinigan Water and Power Company of Montreal; "Note on Lightning Arresters on Italian High-tension Transmission Lines," by Philip Torchio, engineer of distribution of the New York Edison Company, and "Performance of Lightning Arresters on Transmission Lines," by N. J. Neall, electrical engineer of the Westinghouse Electric and Manufacturing Company of Pittsburg. The papers all being on the same general subject they were discussed together. The following synopses of the papers together with an abstract of the discussion will be found of interest to those having to do with the operation of transmission lines.

Experiences with Lightning Protective Apparatus.

Mr. Smith in his paper dealt with some experiences with lightning protective apparatus which the operating department of the Shawinigan Water and Power Company has had during the years 1903, 1904 and 1905. This plant has a capacity of 11,250 kilowatts. Referring to the long-distance lines, it is sufficient to note that the energy is delivered through a double set of bus-bars to the low-tension side of the step-up transformers. These transformers are T-connected for transforming from two-phase to three-phase. The ratio of voltage transformation is 2,200 to 50,000. The neutral point of the transformer banks is grounded, giving about 29,000 volts between each wire.

In 1903 a line from the falls to Montreal was installed, which was 85 miles long, the voltage at the power house being normally 50,000 and the terminal 44,000. A sub-station was built at Joliette in 1904 and a branch line constructed from that point to Sorel, 20 miles long. Mr. Smith alludes in his paper to the main line as line No. 1 and the branch line as No. 2. In the fall of 1904 line No. 2 was continued from Joliette to the power plant, paralleling line No. 1.

When the No. 1 line was put into service the lightning apparatus installed was as follows: At each end of the line was a bank of Westinghouse lightning arresters of the low-equivalent type and a bank of static interrupters. The number of gaps in these arresters was decided upon only after a series of tests had been made to determine the lowest practicable break-down voltage. These arresters were set to discharge at about 65,000 volts. In 1904 a bank of General Electric arresters was placed on the 50,000-volt line in the Joliette substation. This bank was also adjusted to discharge at about 65,000 volts. In 1904 three banks of horn arresters were put on the No. 1 Montreal line. These arresters consist of bent copper rods. The horns were spaced 6.25 inches apart at the gap, this distance corresponding to a break-down voltage of 90,000. In 1905, when the No. 2 line was equipped with lightning arresters, three banks of low-equivalent arresters were put in, one at each end and one at Joliette. In addition to these arresters three banks of the 1905 type of horn arresters were put in.

The Montreal lines run in a general northeasterly southwesterly direction, parallel to the St. Lawrence River, and about 20 miles distant from it. The prevailing winds are westerly and the general course of the electrical storms is parallel to the lines. In the territory covered by the lines of the Shawinigan company there occur during each year about 15 thunder storms. As these storms move along in an easterly direction and sometimes take days to cover the 100 miles, it has been found that from June 25th to September 10th a storm is reported nearly every day from some part of the line. During the summer of 1903 several disturbances occurred which may be summarized as follows:

1. Poles splintered by heavy discharges.
2. In a few instances, insulators broken.
3. Flashes across the static-interrupter terminals.
4. Arcs on the transformer terminals.
5. Arcs inside the transformer cases at the top between adjacent leads.
6. Damage to apparatus caused by 3, 4 and 5.
7. Interruption to service, due usually to excessive voltage drop, causing synchronous apparatus to fall out of step.

In view of the above disturbances and damage it was decided to put in a type of horn lightning arrester affording a low-resistance path to ground, to depend on a fuse for the interruption of the short circuit which would occur if the horns did not break the arc, and to set these horns so that only the heavier discharges would break them down. The horns were consequently adjusted to discharge at about 90,000 volts.

At the end of 1903 it was determined that the arresters installed were sufficient to meet the conditions caused by ordinary storms. In 1904, however, there were more than the usual number of storms and considerable damage was done, 25 poles being splintered in one instance.

During 1905 the number of storms was less than usual, but there were two very violent storms, both near Shawinigan. Poles on the No. 1 line were damaged. At various times during the summer the horns of both lines discharged, but it is noteworthy that the horns of the two lines did not discharge at the same time; that is, the two lines, only about 100 feet apart, would not be equally affected by lightning discharges.

The horn arresters on the No. 2 line were designed to take less current than those on the No. 1, as a resistance consisting of a mixture of glycerine and water was put in the ground connection; in parallel with this resistance was a horn-gap. During the first storms it was noticed that the resistance had "an equivalent spark-gap" greater than the horn, although the resistance was about 10,000 ohms and the gap about three inches. The resistance was greatly decreased early in the summer by pushing the terminals closer together, and the gap was slightly increased. After this was done the lightning discharge went through the resistance.

Another factor came into play in 1905. The two long-distance lines are operated in parallel on the low-tension sides at both ends, the neutral point of the transformer banks being grounded at Shawinigan. A series transformer was placed in the ground-wire leading from each bank of transformers and an overload relay was connected to this series transformer so that if any considerable amount of current flowed into the neutral the relay would open up the low-tension side of all of the transformers connected to that line. The operators in the Montreal terminal stations were depended upon to separate the two lines in cases of trouble. By this means a ground or heavy disturbance on one line would cut that line out of service. Experience during the last year shows that this scheme works satisfactorily. To some extent, however, it masks the action of the lightning arresters, as in case of heavy discharges over the horns the relay will cut off the line.

Summing up his experience with reference to the horns, Mr. Smith said that he considered them a valuable addition to the standard equipment. Since the installation of the horn arresters they have had no arcs in the station. No damage has been caused to the apparatus. No interruptions to the service have been caused directly by lightning. On the other hand, each time the horns discharged a more or less severe short circuit occurred, in no case, however, being severe enough to cause trouble or to cause the synchronous apparatus to fall out of step.

Lightning Arresters on Italian Lines.

Mr. Torchio in a recent trip abroad made some observations on the high-tension lines in Italy, which he embodied in his paper. He found American lightning arreseters frequently used, with some Siemens horn arresters at the ends of the lines.

It is asserted by Gola that the shortcomings of the ordinary commercial lightning arresters are due to some deficiency in the choke coils employed and not to any deficiency in the lightning arresters themselves, their function being only to discharge the line. To overcome the shortcomings of such

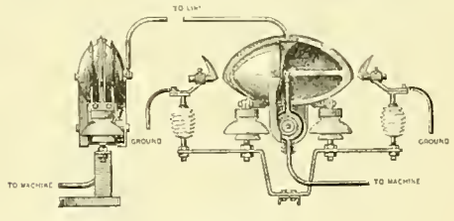


FIG. 1. GOLA APPARATUS TO BE USED IN PLACE OF CHOKE COIL.

choke coils Gola devised an apparatus in the shape of a large shell, consisting of a choke coil and a number of large cast-iron diaphragms and shells connected in series by means of small copper conductors, the whole being placed in series on the line to perform the functions of a choke coil and also to introduce an abrupt and great change in the section, material and shape of the line conductors leading to the station apparatus. The device is illustrated in Fig. 1. In proximity to the sharp-edged ends of the shell are located corresponding air-gap, horn-shaped lightning dischargers which are connected through a resistance to ground, either directly here or in series with ordinary lightning arresters, according to the requirements demanded by the line voltage. The function of the supplementary lightning arresters is to assist the main air-gap in rupturing the arc after the lightning discharge has taken place. It is said that while this device will allow the main line current to pass undisturbed, it will so obstruct the passage of lightning or static-discharge currents as to cause them to be reflected at this point and pass to ground via the dischargers above mentioned.

The "water-resistance static discharger" of Friese and others is connected at each end of the line, one discharger between each conductor and ground, thereby forming a permanent continuous path to ground for a small fraction of the main-line current. A general feeling prevails that this grounding will eliminate a great many troubles from lightning and surges on the line. Several ways of grounding the line are in use in Italy, but the one at the Morbegno station of the Valtellina three-phase railway may be considered as representative of the water-resistance type of grounding device. The device is mounted on an iron frame outside the station. It consists of grounded feed and discharge waterpipes supplying the necessary water to three pairs of glass tubes, each pair being joined at the middle by a metallic union to which are brought the grounding connections from the line conductor; the grounding is made through the two water tubes in parallel. The current to ground in this system, operating at 20,000 volts (11,000 volts to ground), is 0.2 ampere from each line wire to

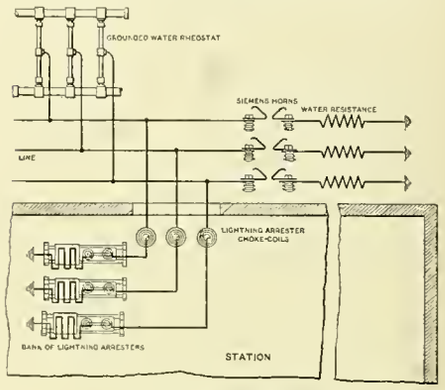


FIG. 2. APPROVED SCHEME OF PROTECTION FOR ITALIAN LINES.

ground. The superintendent of the station was hopeful of the success of the device.

At the Paderno station of the Milan Edison Company a different arrangement of water-resistance static discharger was being installed at the time of Mr. Torchio's visit. It consisted of only three large glass water tubes, but of greater diameter and length than those used in the Morbegno station. In this case it was also expected that the device would give satisfactory results.

Summarizing the observations made by the writer the best practice of today for the protection of Italian transmission lines indicates that the plan illustrated in Fig. 2 should be adopted.

Performance of Lightning Arresters.

The paper by Mr. Neall was an exhaustive one, the author beginning by a description of a method of obtaining, by means of test papers, records of the operation of lightning arresters in service, giving also some results obtained. The method consists in keeping a record of the operation of lightning arresters by inserting special papers between the gaps. Fig. 3 shows the form of test papers and the method of placing them in low-equivalent arresters of the Westinghouse type.

Tests were made upon a number of transmission lines using the record system, those made for the Penn Railways Company, the St. Paul Gas Light Company and the Indiana Union Traction Company being the most complete. The results of these tests showed that all arresters operate more frequently than has been hitherto supposed to be the case.

By comparing the holes made by the dischargers through the older forms of arrester, which have no series resistance, with those made by discharges through the low-equivalent arrester for the same voltage, it was found that no greater difficulty in discharge is encountered, as evidenced by the ragged edges or torn appearance of the holes in the low-equivalent arrester papers. These blister-like holes seem characteristic of free severe static discharges. If a paper is placed in the path of discharge of a high-tension condenser used in the equivalent spark-gap method a blistered hole invariably results. If an element having a high static resistance is inserted in the circuit this hole is reduced to a fine one with smooth edges. If current continues to pass, the hole will be enlarged and badly smoked, but will still have smooth edges. By comparison it is found that the typical static discharge through a carbon-pencil type of resistance is of the smooth-bore character, while free gaps give the blister.

A curious effect observed in the plain-gap papers shows that the original puncture may be very fine and yet the current once having held over will completely burn it away. On the other hand, the low-equivalent lightning arrester gives evidence of a quicker suppression of the short-circuit arc after the discharge has passed.

The most important information given by these papers is that the lightning disturbances on a line are not of the magnitude generally supposed. It is impressive that the small holes made in paper are substantially the same as those made in insulation, and yet these small holes pave the way for very serious breakdowns of apparatus, due to normal current following.

A comparison of lightning-arrester papers punc-

tured in practice with the papers taken from the idle lines leads to the belief that the low-equivalent arrester is discharging these disturbances almost as freely as if the resistances were omitted.

A comparion of results of the tests showed clearly that for freedom of discharge the arresters which are built like the low equivalent with low resistance have freer discharge than the straight gaps and high resistance.

The action takes place through the series gaps and both of the resistances, and nothing occurs in the shunted gaps unless discharges are of high frequency and above a certain severity. When discharges are found in the shunted gaps the papers usually show a clean puncture, indicating that the discharge is chiefly static. It seems that the time element of the disturbances, together with the throttling action of the non-arcing metal multi-gaps, enables the static disturbance to pass before the line current can follow.

Arresters with gaps and resistance capable of carrying considerable current for a short space of time act like high-potential regulators, relieving the line of surges promoted by many causes other than lightning.

The papers show the ability of arresters to discharge automatically and repeatedly without attention. At 55,000 volts the papers show as free discharges as are obtained at lower voltages.

Records to be effective should run along regularly in the same way that any other part of the plant is metered. There is a natural variation from year to year in the severity of lightning storms over any given locality.

The first purpose of this test was to demonstrate its applicability, which is now sufficiently indicated by the facts presented. It is reasonable to expect that the advance in the design and installation of apparatus from now on will in general be such as to reduce to a minimum the inherent disturbances in a plant, limiting these to what might be called uncontrolled forces, such as lightning, wind, etc., the effect of which, however, can be largely cared for by properly installed protective apparatus.

In proposing this method for general investigation of all protective apparatus certain of its features are not lost sight of; these are: First, it requires frequent handling; second, the time interval between the placing and removing of papers covers more than one discharge—refinement on this would call for complicated apparatus; third, the method will not succeed unless pursued by constant determination to obtain results; fourth, lines must be carefully marked and all incidents directly or indirectly related to the operation of arresters in any given case must be carefully traced out; fifth, records require careful filing and summarizing.

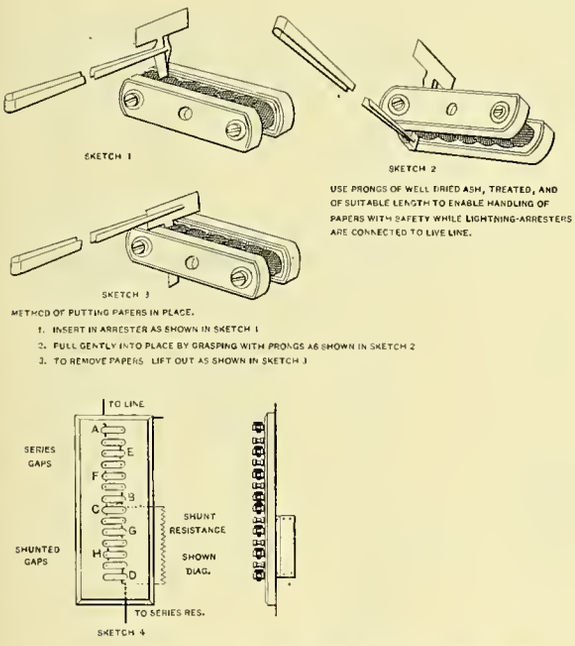


FIG. 3. TEST PAPERS AND METHOD OF PLACING THEM IN LOW-EQUIVALENT LIGHTNING ARRESTER.

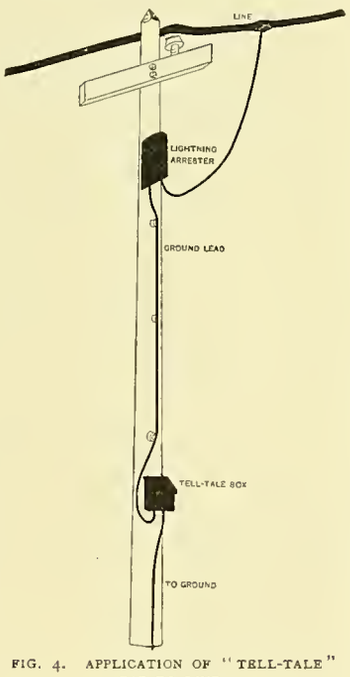


FIG. 4. APPLICATION OF "TELL-TALE" GAP TO LINE.

The method is applicable, however, for all apparatus giving protection to a line by carrying disturbances from line to ground over an air-gap or its equivalent. Where there are a number of gaps in series, like the multi-gap arresters, the papers can easily be installed without impairing the action of the arresters.

In special cases, such as the investigation of an overhead grounded wire, horn lightning arresters, etc., use can be made of a special tell-tale gap placed in the path to ground at some part of the device. This gap is shown in Fig. 5 and consists of two non-arcing metal knurled cylinders between which a test paper can just be placed. By insulating the leads in such a way that any discharge passing to ground must go through this gap, a record can be obtained of the operation of the apparatus in question. An overhead grounded wire, by reason of its great length and frequent grounding, could have a special section cut out for investigations and provided with gaps, as shown in Fig. 4.

Discussion (in Abstract).

Percy H. Thomas, Cooper Hewitt Electric Company, New York: In considering the great variety of forms that arresters take it is probably well to remember that there are only one or two really fundamental points about an arrester—the air-gap present and the chances for the static charge to dissipate itself, and also some means for interrupting the arc. However ingenious we may be as to the arrangement of form, we cannot get away from these facts, and I do not think we can expect any great help from some particularly formed shape, or something of that sort. There is another type, the high-resistance path between line and ground, which will undoubtedly carry off slow accumulations of charge, and how serious a matter this is I do not know; but I do not believe it is a very serious one. It is hard to believe that a high resistance, like a water resistance, will oppose a different character of opposition to the flow of current at 100,000 volts that it offers to the flow of current at 50,000 volts. That means for ordinary discharges a high-water resistance really cannot protect us. I want to speak about the general character of lightning arresters. We have to have air-gaps and we have to have some arc-interrupting devices. The commonest is the multi-gap arrangement. We have there the extension of the arc, like the horn arrester, by the heat generating the primary force; also interruption of the circuit by fusing. These are the only things we have to work with at the present time.

I will first state that the various non-arcing means, except the fuse, to which I have referred, are not effective on very large plants without something to limit the amount of power which follows the discharge. We must have a series resistance, except in the case of a fuse. What we want to know is: Are present resistances too great for free discharge? Is it possible to use less resistances than we now have and still keep our arreters non-arcing? Is it possible to use a less series resistance in the horn type of arrester than in the multi-gap type? Can we arrange any system by which it is feasible to protect lines by the use of fuses to interrupt the discharge, the difficulty being to protect the line after one discharge has occurred before you get a chance to put in another fuse, and to prevent the dropping out of synchronous apparatus? These questions are of importance in the protection of commercial installations, and if we concentrate our attention upon that line and develop ingenious arrangements of one kind or another, I believe we will arrive at the solution more quickly. Personally, I have never missed an opportunity to make a practical test on a commercial line, and I have noted down two or three of the plans in which that has been possible. I know many others have made similar observations, and a good deal of data is before the Institute, and a good deal is not, and it is too bad that there is not more of it.

Mr. Neall's paper pretty nearly enables us to answer the first of the four questions which I have asked, taken in connection with a great deal of corroborative evidence we have seen in one place and another. In a majority of cases, both of lightning and static discharge, and practically in all cases of static discharge, as far as his experience goes, the series resistance or the total resistance embodied in the arrester is sufficient to carry off the accumulated charge without injury to the apparatus. On the other hand, there were a number of cases where he found discharges in the shunted gaps, showing that the resistance series and shunt, taken together, is too great to allow a free discharge, but, as far as his evidence goes, there seemed to be no reason to suppose that the series resistance alone is not sufficient in practice in all cases where there is sufficient insulation in the apparatus.

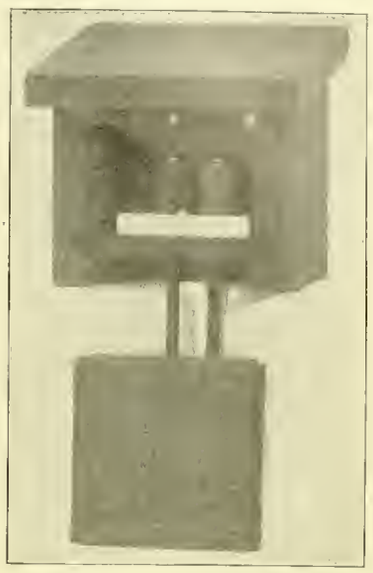


FIG. 5. "TELL-TALE" GAP IN LIGHTNING PROTECTION.

C. F. Scott, consulting engineer, Westinghouse Electric and Manufacturing Company, Pittsburg: I visited not long ago the plant of the Missouri River Power Company, which has been referred to at other Institute meetings, and the engineers gave me an exact account of the performance during the last year. This plant has run continuously for 24 hours a day, and seven days a week, carrying a fairly uniform load all the while. As motors are operated in connection with mining operations and smelters, the interruption of the power is a very serious matter. During the year they had only four or five disturbances on the high-tension system. One of these had been in the station, which was simply a discharge, across a terminal. The station operator said it was a new terminal which they had recently put in themselves, and it perhaps was not properly insulated or taped, and it had been repaired, and no damage resulted. At the time it was simply a discharge across terminals in the station, which went out of its own accord, without interruption to the service. There had been out on the line several discharges which had resulted in short circuits. The only thing which was made necessary was the opening of the switches at the power station, which led to the interruption of the short-circuit, and these switches were closed immediately, and the only interruption, therefore, was the inconvenience of immediately starting such motors as had stopped. The phenomenon of lightning on the line manifests itself in different ways. Sometimes during a windstorm, along in the winter, with a light driving snow, by listening to the little clicks on the telephone, one can note the effect of a storm as it is passing over the line. When the storm first strikes the line, there is one manifestation, and the clicking then continues. When the storm leaves the line, disturbance may be noted.

Prof. W. S. Franklin, Lehigh University, Bethlehem, Pa.: I was interested to note some of the enumerations of the important functions of the lightning arrester as stated by Mr. Thomas. We know that the gap is important. Its importance lies, in my opinion, solely in the necessity of having the line perfectly insulated when the arrester is not operating to carry off the low discharge. After the lightning discharge is passed, the air gap heals and we have a practically complete insulation again. The next important thing is the putting out of the arc. The two important things are the gap and the means for extinguishing the arc. Another matter that Mr. Thomas mentioned was the importance of providing for the steady discharge of the line. I do not know whether my ideas are untenable, but my idea of the static discharge is that which is indicated by the sound produced in a telephone on a line which is grounded. You all know the sound produced in the telephone is a series of sharp little crackles or snaps, showing what we call the ordinary static charge on the line, may be a sudden accumulation of slight discharges from the atmosphere to the line and the sudden rush of the discharges to earth. The static discharge is much of the same character as an ordinary lightning discharge, and no doubt many of the punches indi-

cated by the paper Mr. Neall shows were due to the static charge on the line.

W. H. Patchell, engineer-in-chief of the Charing Cross, West End and City Electricity Supply Company, London: We have had considerable experience with lightning arresters in the rather more general use of them, and it is to that part of the subject I would like to draw your attention. Gentlemen like Mr. Scott and Mr. Thomas, who are connected with large manufacturing concerns, get hold of a new lightning arrester, and they like to try it on the dog. I have the honor to be that dog. The dog is not always alive to say what happened, but upon this occasion he is. We have in operation about 70 miles of 50,000-volt three-phase line work with spark connected with neutral earth. The machines operating the line are steam-driven and vary in size from 800 to 1,600 and 4,000 kilowatts. The whole of the line is underground, sometimes three cables in one trough, sometimes two cables in a trough, and at other times only one. When we started we had some surges. We tried to take care of the service by the Siemens horn arresters, which we found were absolutely useless. When we worked with the small machines, it was rather uncertain whether the arresters were useless or not, but when we worked with the 1,600-kilowatt machines, there was no question about it. The current caused by the surging made a bead on the horn arrester, which at once upset the calibration of it, so that at one moment we had a horn arrester set for 12,000 volts and the next moment, after a surge, we had one that was set below the pressure at which we were working. I can coincide with the views of one of the speakers in regard to the fact that the trouble varies with different lines. On one of our lines the experience is that there is more trouble with the 2,000 volts than with the 50,000 volts. I think, as far as spark-gap arresters are concerned, the less current we have the less trouble we have. The arc forms a path for the current, of lower resistance than the initial path, and so causes an increased flow of current with accumulative effect, so that the remedy may easily be worse than the disease. We went from the Siemens' horn arrester, with the aid of our contractors, Messrs. Lahmeyer, of Frankfort-on-the-Main, to a form of horn arrester which, instead of finishing with a sharp point, as the Siemens did, has an almost parallel part at the lower end, which, of course, is closest at the bottom where the spark first jumps. The horns are enclosed with a glass cover in a small case, so that a chimney action ensues, which carries the arc rapidly up the parallel portion to the horns. One side of the lower portion of the horns is of carbon, and we find in practice that, while beads form between the horns, if both are copper, they keep quite clean if one is of copper while the other is faced with carbon.

C. P. Steinmetz, electrician, General Electric Company, Scheneectady, N. Y.: The discussion of this evening deals only with the class of disturbance entering from the outside, and with the apparatus designed to protect the electrical system mainly in the overhead transmission lines against atmospheric disturbances. In designing such protective appliances we are very seriously limited from the beginning, in that the lightning-protective apparatus must not only promptly and efficiently discharge atmospheric disturbances entering the line, toward the ground, but must do that without producing an internal surging or disturbance. Now, the charge and discharge in electric transmission systems by atmospheric disturbances is sudden and liable to be oscillatory, and is therefore a sudden change of circuit conditions that is of the very same character which predisposes to the production of an internal surging. It is this condition which limits us in designing lightning-protective appliances and which has not always been sufficiently taken into consideration in designing lightning arresters. Furthermore, when you consider lightning-protective apparatus, the great difficulty there is, as I have stated before, that our knowledge of the phenomenon of lightning is not complete yet. If lightning were of a very high frequency oscillation, like the discharge of a Leyden jar, then we could protect the system against it by interposing reactive coils between the station and line, and shunt the discharge by multiple spark gaps to ground. If lightning were a steady, gradual charge and discharge of the line, we could discharge the line by a high-resistance shunt toward ground, with or without a sparker. If it were a low-frequency, high-power surging, we could endeavor to take care of it, but lightning is neither the one nor the other, nor the surging, but may embrace all three of these, or any two of this phenomena at the same time. For instance, occasionally electrostatic disturbances in the lines originate in the atmosphere, consisting of a gradual, steady charge, followed by a very high-frequency local oscillating discharge, accompanied by a low-frequency surging. All three conditions occur at the same time, but the most serious objection is that there may be lightning disturbances different from all these three cases I speak of. There are certain classes of lightning which have not been mentioned, the so-called globular lightning. Globular lightning has been observed occasionally sufficiently by observers, and no question regarding its existence can be raised. At the same time, it has never been sufficiently studied or investigated, so that we know what it is. All that we know is that it probably is not a sudden, instantaneous discharge, but a discharge center, somewhat of the character of an arc discharge, but different therefrom. One characteristic of it is the extreme destructiveness that was observed, but even that may not be essential.

There is one thing that we know regarding atmospheric disturbances. We know that in the interior of a conducting body of perfect conductivity there can be no electric disturbance produced by external disturbance. That is, if we enclose our transmission system in a perfectly conducting shell, as, for instance, by putting it underground, atmospheric disturbances cannot enter it, and, inversely, since we cannot put our transmission line underground, if we bring the ground to the transmission line we will make the transmission line the more complete, the more perfect the ground. A grounded overhead wire appears to me the most perfect protection of a transmission system against atmospheric disturbances. Two wires are more perfect than one wire, and three wires are more perfect still, as a conducting shell. In some cases when barbed wire is used for overhead wire for protection against atmospheric disturbances, it will give a much larger support by its more rapid action. This will be true in certain classes of atmospheric disturbances, but in other classes of such disturbances it has no advantage. But that does not mean that any so-called overhead wire grounded, as grounds are frequently made, means a protection. It is essential, in perfecting a transmission line by overhead ground wire, that the transmission line should be in the protective zone of that wire, that is, in the space enclosed by an angle of 45 or, preferably, 60 degrees from the grounded wire downward. Furthermore, the conductivity of the grounded wire, although coming into consideration, is not very important; it is not material how large a grounded wire is used, where the grounded wire merely brings the ground potential above the transmission line and so lowers the electrostatic potential of the space where the transmission line is from the value which it would have unprotected, to a very much lower value corresponding to its position between the ground wire to the ground. In that case the resistance of the ground wire has no direct effect. But where the line is exposed to a secondary induced current resulting from a lightning discharge, more or less parallel to the line, then the transmission line to the ground wire is in the position of the secondary conductor to the lightning stroke and the ground wire in the position of a short-circuit secondary, which, therefore, by carrying a reversed current, screens the transmission line from electrodynamic induction more or less completely.

Electric Supply from Gas-engine Plant.

Gas power is used in the plant of the Rockland Electric Company of Hillburn, N. Y., which has been in continuous operation during regular working days for nearly a year, supplying current for lighting the surrounding towns, power for adjacent Ramapo Iron Works and fuel gas for a number of heating furnaces. To the Rockland company, it is said, belongs the credit of introducing an interurban electric supply system from a by-product producer-gas fuel in connection with power and fuel-gas supply to adjacent industrial works. The use of gas power arose from the extremely low fuel cost of gas power and from the advantages of fuel gas in furnace work. The present power equipment, totaling about 1,075 brake horsepower in generating capacity, not including an exciter unit, consists of three 19 by 24-inch Westinghouse double-acting gas engines direct connected to 225-kilowatt Westinghouse two-phase generators and a 75-kilowatt Westinghouse vertical three-cylinder unit for operation during light loads upon the plant.

Having found its present equipment inadequate to meet the increasing demands for electricity, the Rockland company has placed an order for two additional 23 by 30-inch two-cylinder double-acting horizontal tandem gas engines of the same make. These engines will be of the four-cycle type, imparting two impulses to the crank shaft at each revolution irrespective of the load. Each will drive a 60-cycle alternating-current generator and will operate on producer gas of approximately 125 effective B. T. U. per cubic foot. The normal rating of each engine will be 470 brake horsepower, and each will be capable of developing 10 per cent. overload for a period of two hours. After the installation of the two engines now on order the total capacity of the equipment will approximate 2,100 brake horsepower.

Improved Construction Work in Joliet.

The committee on fire protection engineering of the Western Insurance Underwriters has received a report from its inspection bureau on electrical conditions at Joliet, which recites that the new city electrician, recently appointed, is gradually raising the standard for inside wiring, and contractors are being required to comply with the requirements of the National Electrical Code. Several installations of electrical wiring were examined and found to compare favorably with the work secured by the average department. Prospects for still further advancement seem good.

Convenient Cable Clamp.

Kearney cable clamps, illustrated herewith, are designed to supplant the extra joints and fastenings necessary in the ordinary methods of cable suspension at angle poles and dead-ends. Two wrought-steel plates with four clamping bolts, as shown in Fig. 1, constitute the device. The two parts of the clamp are designed to fit the surface of the cable, and when the nuts on the four bolts joining the two parts are tightened the clamp grips the cable so that the pull is transmitted through the upper plate to a globe strain or similar insu-

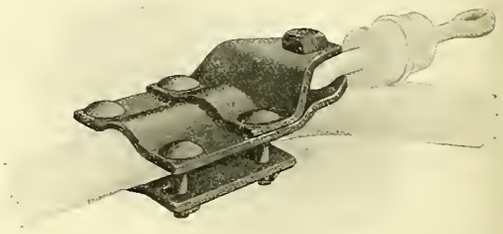


FIG. 1. KEARNEY CABLE CLAMP.

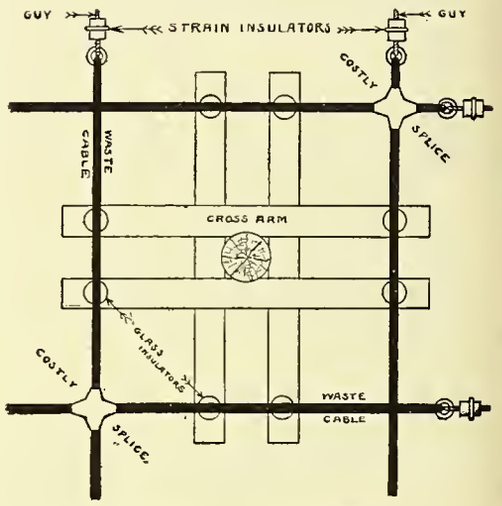


FIG. 2. OLD METHOD OF TURNING CORNER WITH CLAMP.

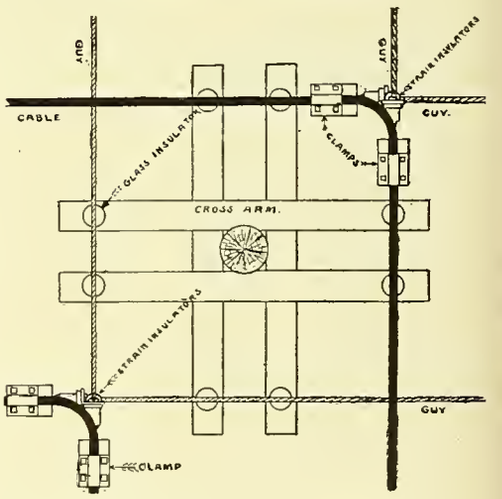


FIG. 3. TURNING CORNER WITH KEARNEY CABLE CLAMP.

lator fastened to the pole at the curve. By the use of two of these clamps, one holding the cable in either direction from an angle pole, the curved portion of the cable between the two clamps may be made short and relieved of any great amount of strain. This method of construction does away with the necessity for serving the heavy cable about an insulator at an angle pole, and then making a joint to continue the cable after it has turned the angle.

The Kearney cable clamp is made in but one size, suitable for cables from No. 0000 to 1,000,000 circular mils cross-section. The manufacturers, W. N. Matthews & Bro., of 203 North Second Street, St. Louis, state that a substantial saving in first cost as well as a more perfect type of line construction can be had by the use of this device. In order to place this clamp upon the market the company offers to prepay the freight on trial orders of 25 or more clamps on condition that they will be paid for if satisfactory; otherwise they are to be returned at the expense of the manufacturer.

Figs. 2 and 3, show respectively the ordinary method of turning a corner without the use of the clamps and turning a corner with the Kearney clamps.

Alternating-current Electrolysis.[1]

By Ernest Wilson.

It is well known that if an alternating current be passed between metal electrodes in an electrolyte, electrolysis may take place. For instance, it has been shown that in the case of lead plates in dilute H_2SO_4 the SO_4 combines with the lead to form $PbSO_4$ and the plates are eaten away. The present paper gives an account of some experiments made to determine what may be the effect upon certain metals of passing alternating currents between them and certain electrolytes under given conditions. Suppose that an alternating current be passed between electrodes in an electrolyte and that the curves of potential difference between the electrolyte and one electrode and the curve of current be observed: Let the curve of potential difference be corrected for the fall of potential due to the conductivity of the electrolyte, thereby giving the electromotive force of electrolysis measurable in volts. Let the current curve be integrated, giving the quantity of electricity measurable in coulombs. We should expect that as the maximum coulombs per half-period increased the electromotive force of electrolysis would also increase until it had the value given by continuous current, and that with further increase of the maximum coulombs per half-period the electromotive force of electrolysis would have a constant amplitude. If the process were truly reversible we should expect to find that the electromotive force of electrolysis and current would have an effective phase displacement of one quarter-period in time.

The plates in a given cell were of like metal and were separated one-eighth inch (0.317 cm.), with their opposing faces parallel. They were held in position by wooden blocks and ebonite distance pieces, bolts and nuts. The wooden pieces covered the back of each plate, with the view of confining the current to the opposing faces. The area of each of the surfaces exposed in the electrolyte was about 150 square centimeters, but not all of each plate was submerged. For the purpose of obtaining the potential difference between the electrolyte and one of the plates an exploring electrode cut from the plate itself was placed in the electrolyte midway between the plates, and by the aid of a revolving contact-maker on the alternator shaft and a quadrant electrometer the curve was obtained. The distance between the exploring electrode and the plate was about one millimeter. Similarly the curve of current was obtained by observing the instantaneous value of the potential difference across a non-inductive resistance placed in the circuit. The curve of current was controlled by inserting a considerable non-inductive resistance in the circuit. The electromotive force of electrolysis is, therefore, a dependant variable as regards wave form. Further research should deal with variation of wave form. Small test pieces were placed in the solution to see if any action took place without the passage of the electric current. It should be noted that during the experiment the solution in a given cell changes, and therefore an average result has been obtained. No special care was taken to keep the temperature of a given cell constant, and the volume of fluid in each cell was about two liters.

Lead. H_2SO_4 dilute.—The electrolysis produced by an alternating current when passed between lead electrodes in dilute H_2SO_4 (100 parts H_2O + 5 parts H_2SO_4 by volume) has already been studied. It was shown that for a given R. M. S. current density [$V\overline{\text{mean current}^2}$] over the plate, less lead per square centimeter per hour was dissolved at a frequency 92.5 than at frequency 21.5. A. R. M. S. density of 0.0236 ampere per square centimeter as the maximum coulombs. Referring to the table, experiments 1 and 2 show that at frequency 21.5, 0.00629 gramme per hour per centimeter were dissolved. This multiplied by the ratio of the frequencies would give 0.00146 gramme per hour per square centimeter as against 0.00344 actually measured. Experiment 3 was undertaken to discover if at 92 frequency and approximately the same maximum coulombs per half-period the weight of dissolved lead would be the same as in experiment 1. We find that five times as much lead is dissolved at the higher R. M. S. current density. The effect may depend upon the current density, since the

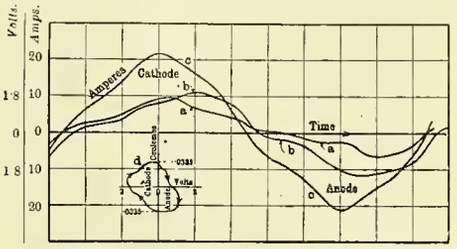


FIG. 1. CURVES OF CURRENT AND POTENTIAL DIFFERENCE.

maximum coulombs per half-period are slightly less in experiment 3 than in experiment 1, whereas the current density is nearly threefold. Also in experiment 3 the density of the electrolyte fell to 1,036 in eight hours, as against 1,049 in 15 hours in experiment 1.

In experiment 3, curve (a), Fig. 1 is the potential difference between the lead-exploring electrode and one plate. This can also be taken to give the electromotive force of electrolysis, since the conductivity drop is sufficiently small. The curve (b) is the potential difference between the plates, and (c) is the curve of current. It will be observed that the electromotive force of electrolysis (a) does not change sign at the moment the plate begins to be an anode; the difference in phase represents the time taken to reverse the electromotive force existing since the coulombs were last a maximum. The work done during this time is returned to the system. This is not the case when the plate begins to be a cathode as the reversal of electromotive force occurs simultaneously with the current. The coulombs have been plotted co-ordinately with the electromotive force of electrolysis, giving the cyclical curve (d). As was previously pointed out, more work is done on the system during the time that the plate is a cathode than when it is an anode. The evolved hydrogen combines with the oxygen of the PbO_2 leading to the formation of $PbSO_4$, the maximum coulombs being sufficiently great to produce the peroxide. The plates are not, however, fully polarized in this experiment, much less so in experiment 2, and it may be that the low result in experiment 2 is attributable to the small value of the maximum coulombs. The electrolysis with lead electrodes at low current density is a subject worthy of further research.

It is conceivable that electrolysis by alternating currents may be influenced by diffusion and certain local conditions. When observing the electromotive force of electrolysis it was noticed that the electrometer deflection became unsteady at certain times of a period, indicating how easily it may be affected. In these experiments the plates were purposely placed near together and did not give such facilities for diffusion as might otherwise have been obtained.

Iron. Ferrous Sulphate (strong).—The iron plates were cut from good transformer plate and cleansed with emery paper, thereby presenting a bright but not perfectly smooth surface. Alternating currents have a marked effect upon iron in this solution. Experiment 4 was made first, and it was found that the plates lost 0.000462 gramme per square centimeter per hour. Without changing the solution, which during the experiment had taken up 2.4 grammes of iron, the plates, after being dried and rubbed with wash leather to remove the surface oxide, were again inserted and experiment 5 made. The frequency was the same in each experiment, but the maximum coulombs were increased from 0.00956 to 0.0346. The result was to dissolve only 0.000457 gramme per square centimeter per hour, as compared with 0.000462 in experiment 4, the solution again going up in density. Experiments 6 and 7 were then made with fresh solutions, but using tap water instead of distilled. A small quantity of H_2SO_4 was added to delay oxidation and to correct the calcium salts in the water. The result shows that 0.00389 and 0.00445 gramme per square centimeter per hour were thrown down, and these are roughly eightfold the weight thrown down in experiment 5, although the frequency and maximum coulombs are the same. The presence of some free acid in experiments 6 and 7 may be accountable for the high figures obtained. A test sample in the solution of experiment 4 lost 0.4 per cent. of its weight in 58 hours, as against 2.5 per cent of the submerged portion in seven hours in the experiment. There is considerable electrolysis. Experiment 8 was then made. In it the solution was made with distilled water acidified to the extent of one cubic centimeter of H_2SO_4 in 2,000 cubic centimeters of water to delay oxidation and nearly saturated with pure $FESO_4$. Comparing experiments 4 and 8 for the relation between grammes dissolved and maximum coulombs per half-period, we find that 0.000229 gramme per square centimeter per hour should be dissolved if the relation held, as against 0.000462 observed at the higher frequency. Similar results were obtained in the cases of lead and zinc in dilute H_2SO_4. Lead and iron give, roughly, the same ratio between the observed and calculated weights. It should be remembered that in these experiments not the whole of the plate is submerged in the solution, and there may be some additional effect at the surface of the liquid where it joins the plate.

Sodium Chloride (strong).—After washing and drying the iron plates in experiment 9 have increased in weight, but in the solution a totally submerged test sample through which no current was passed increased weight nearly to the same percentage, so that there is no conclusive evidence of serious electrolysis. Curve (18), Fig. 2, was obtained between the iron exploring electrode and

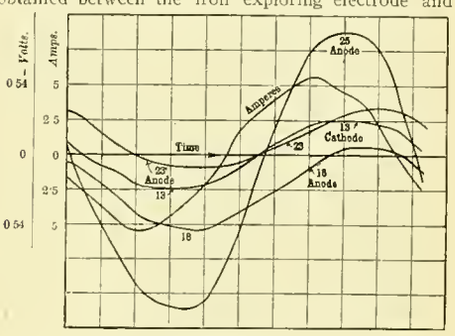


FIG. 2. CURVES OF CURRENT AND POTENTIAL DIFFERENCE.

one plate. It is very much displaced with regard to the axis of time, possibly due to the fact that the plate is easily attacked when it is an anode, thereby requiring less work during that half-period. When passing from the cathode to the anode states a full quarter-period in time is required before the work done on the plate becomes positive. Experiments 10 and 11 show that an increase in the weight of the plates takes place, thereby leading to disintegration.

Copper. Copper Sulphate (strong).—In experiment 12 the copper plates acquire a fairly easily removable copper deposit and show slightly diminished weight. The curve of potential difference between a copper electrode, in the solution between the plates, and one plate is nearly in phase with the current, and has the same wave form. One would expect a little electrolytic action. Comparing experiments 12 and 13, we see that although the maximum coulombs are the same, more copper is dissolved at the higher frequency—i. e., at the higher-current density. The deposited copper in experiment 13 was not so easily removable as in experiment 12.

Sodium Chloride (strong).—In experiment 14 the copper plates were highly discolored and cov-

Experiment.	Metal.	Solution.	Duration of Test in Hours.	Frequency.	Density of Solution. Before.	Density of Solution. After.	Temperature of Electrolyte. Before.	Temperature of Electrolyte. After.	R. M. S. Amperes per Square Centimeter.	Maximum Coulombs per Half-period.	Difference in Weight of Two Plates After Rinsing in Water and Drying.	Difference in Weight After Rubbing with Wash-leather.	Average Grammes per Hour per Square Centimeter After Rinsing in Water and Drying.
1	Lead	H_2SO_4 dil	15	21.5	1,050	1,049	17.0	.....	0.0236	0.0304	—30.2	.....	0.00629
2	Lead	H_2SO_4 dil	15	92.5	1,050	1,049	17.5	.....	0.0236	0.0094	—16.5	.....	0.00344
3	Lead	H_2SO_4 dil	8	92.0	1,050	1,036	21.0	32.0	0.0847	0.0335	—87.9	.....	0.03230
4	Iron	Ferrous sulphate	18	92.0	1,134	1,122	21.5	21.0	0.0273	0.00956	— 2.427	.....	0.000462
5	Iron	Ferrous sulphate	7	92.0	1,122	1,125	19.5	29.0	0.0979	0.0346	— 0.940	—1.101	0.000457
6	Iron	Ferrous sulphate	8	92.0	1,174	1,186	20.6	25.0	0.0929	0.0335	— 9.645	.....	0.00389
7	Iron	Ferrous sulphate	8	92.0	1,174	1,186	20.6	25.5	0.0929	0.0335	—11.046	.....	0.00445
8	Iron	Ferrous sulphate	8	32.0	1,066	1,102	18.5	21.4	0.0340	0.0334	— 1.851	—2.012	0.000787
9	Iron	Sodium chloride	18	92.0	1,138	1,134	22.0	21.0	0.0262	0.00956	+ 0.092	—0.027	+0.000057
10	Iron	Sodium chloride	7	92.0	1,134	1,128	19.5	23.5	0.0929	0.0345	+ 0.262	—0.173	+0.000121
11	Iron	Sodium chloride	8	32.0	1,086	1,090	19.5	21.0	0.0312	0.0334	+ 0.255	.....	+0.000100
12	Copper	Copper sulphate	12½	25.5	.....	1,105	16.25	17.3	0.0265	0.0345	— 0.185	.....	0.000051
13	Copper	Copper sulphate	8	92.0	1,060	1,092	19.0	30.5	0.1000	0.0335	— 0.181	.....	0.000079
14	Copper	Sodium chloride	18	92.0	1,138	1,132	21.5	21.0	0.0241	0.00956	— 0.165	—0.276	0.000028
15	Copper	Sodium chloride	8	32.0	1,066	1,098	18.4	20.3	0.0340	0.0334	— 6.653	.....	0.000278
16	Aluminium	Potash alum solution (sat.)	2	92.0	.....	.....	20.6	98.0	0.1030	0.0335	.....	.....	.....

would eat away the lead in one year to a depth of 2.6 centimeters and 4.8 centimeters, respectively, at the above frequencies. The same current density with direct current would eat away 70 centimeters in a year. Since the R. M. S. current density is the same and the wave form is the same in the two experiments the maximum coulombs per half-period will vary in the inverse ratio of the frequencies, but we do not find that the dissolved lead varies

1. Abstract of a paper read before the Faraday Society of London.

ered with an easily removed metallic powder. The plates show diminished weight. In Fig. 2 curve (23) shows the potential difference between a copper exploring electrode and one plate. Comparing experiments 14 and 15, we see that much more copper has been dissolved at the low frequency than the ratio of the maximum coulombs would lead us to expect. The effect is considerable in experiment 15, and as sodium chloride is largely met with in the earth, this experiment may have practical importance. The difference would have been a little more noticeable if the detachable deposit had been removed from the surface of the plate before estimating the loss of weight.

Sodium. Na_2HP_4 (strong).—The copper plates were discolored but not diminished in weight. In Fig. 2, curve (25) gives the potential difference between a copper-exploring electrode and one plate. Comparatively, this potential difference is large. If correction were made for conductivity, the phase displacements might be sufficient to show almost complete reversibility and thus account for the small effect observed. If this were so, the effect would be similar to what has already been observed when an alternating current is passed between platinum plates immersed in dilute H_2SO_4. Dissipation of energy still occurs owing to the decomposition of the electrolyte at the plates. Any copper phosphate formed in this experiment during one half-period would be reduced during the next half-period.

Aluminum. Potash Alum (saturated).—A good deal of work has been done upon aluminum in connection with alternate currents. It is known that the film formed on the surface offers considerable resistance to the electric current. In experiment 16 two aluminum plates were immersed in a saturated potash alum solution, and owing to the formation of a surface layer the internal resistance gave rise to such dissipation of energy that the solution was boiling after the experiment had progressed three-quarters of an hour. The plates were very much eaten away in places, but quite bright where they had been protected by the surface layer.

In conclusion I wish to express my thanks to Prof. E. F. Herroun for valuable suggestions. Mr. D. Sheppard worked with me all through and prepared the experiments. Mr. T. Mitchell has also rendered assistance and has worked out some of the results. To these gentlemen I tender my thanks.

Electric Elevators at Sea.

The new Hamburg-American transatlantic liner Amerika, one of the largest ships afloat, left New York for her first eastward voyage on October 26th. Electricity plays a very large part in the internal economy of this huge ship, which is 700 feet long, 74 feet six inches beam, 53 feet in molded depth, and 31 feet in normal draft. On the five upper decks, which have been named after American and German personages, communication is established from floor to floor by means of three electric passenger elevators, each capable of carrying six persons and an attendant. Every stateroom has a telephone, affording communication either with the stewards' department, or with other staterooms; and there is an entirely separate set of telephonic and other electrical signals for the use of the ship's officers. All the watertight bulkheads can be closed electrically by means of controllers in front of the navigation officers, and "electric ears" are attached to the hull below the water line, so that bell signals from a distant shore can be picked up in times of fog. A complete Marconi space-telegraph outfit is installed. There is ample ventilation and fire protection, the fans and pumps in some cases being worked by electricity, and in the culinary department there is an up-to-date refrigerating system.

The Amerika accommodates 3,400 passengers and a crew of 600. The engines are of the balanced quadruple-expansion type. Cargo amounting to 16,000 tons can be carried.

Fairfield-Olney Single-phase Railway.

The Fairfield and Olney Traction Company, which is capitalized at $800,000, has let the contract to the Western Railway Construction Company for the construction of a single-track electric railway to connect Fairfield and Olney, Ill. The line will be 35 miles long in Wayne and Richland counties, and will supply a missing link in railway facilities in the southern part of the state. At Mt. Erie, for instance, which is near the middle of the line and near which the power house will be located, the mail has at present to be carried 18 miles by stage. The road will be more particularly a freight-carrying proposition, and will transport, it is expected, large quantities of apples and other fruit. Overhead construction will be used, and the single-phase, alternating-current system will undoubtedly be employed. The headquarters of the company are at Olney and its officers are: President, John Absher; secretary and treasurer, Adam Grimes; chief engineer, John W. Wallace.

Starting a Gas-engine-driven Single-phase Railway System.

Successful starting of the Warren and Jamestown alternating-current railway system, operating between Warren, Pa., and Jamestown, N. Y., was accomplished on October 19th. The electrical equipment had several weeks' preliminary run from a small gas-engine-driven unit temporarily installed in the power house at Stoneham. On the 19th, however, the large gas engines were placed in service for the first time, and a permanent operating schedule was begun.

Probably the most interesting feature of this rather unique railway system, which was briefly mentioned in the Western Electrician of October 7th in an article entitled "Gas Engines for Power Stations," is the exclusive employment of horizontal double-acting gas engines of the heavy-duty type for the generation of power to operate the road. Two of these engines are now installed, the first of which is already operating. The second will be placed in service in a short time. These two engines will be called upon to operate in parallel on the electrical end. Parallel operation is particularly difficult in service of this kind on account of the violent fluctuations in load which occur, due to the size of the cars employed and the small number in operation at any particular time. As it is not possible to utilize storage batteries to absorb these fluctuations, the engines are called upon to sustain them, and are thus put to the severest possible test occurring in the operation of electric power plants.

The two units installed are each of approximately 500 brake horsepower capacity direct connected to 260-kilowatt revolving-field engine-type single-phase generators. Each has two cylinders arranged in tandem fashion with a single crank. They will operate entirely upon natural gas distributed by a local company. In this district the gas has a calorific value of 1,000 B. T. U. per cubic foot. A 55-horsepower vertical Westinghouse engine of the single-acting type is also in operation, driving air compressor and exciting unit for the main equipment.

Current is generated at a voltage suitable for transmission without the use of transformers, the Westinghouse single-phase system being used. Transformer sub-stations are located along the right-of-way, which reduce the line voltage to 3,300 volts for the trolley, at which pressure it is collected by the cars.

The Warren and Jamestown Street Railway Company, although recently organized upon its present basis, has been operating part of its present line for 11 years. Three years ago it began experimenting with gas power with sufficient success to induce the use of gas engines for the entire power generation. The successful starting of the power system will be accepted with general gratification and will mark an important advance in modern electric railroading.

Chicago Municipal Lighting Extension.

A third generating unit is about to be added to the new Horatio N. May arc-lighting station of the city of Chicago, which is located at Fullerton Avenue and the North Branch of the Chicago River and which was described and illustrated in the Western Electrician of April 8th last. The new outfit consists of a vertical cross-compound engine of 1,166 horsepower, built by the Shepherd Engineering Company, directly connected to a 750-kilowatt 6,600-volt 60-cycle three-phase alternator built by the National Electric Company of Milwaukee and sold by the Arthur Jones Company of Chicago. The two units already installed are of similar capacity, and as one must be kept in reserve, the new set practically doubles the capacity of the station.

Current from this station is used almost entirely for street lighting by arc lamps, and the additional capacity will be used for greatly needed lights in various parts of the city. However, it is of interest to observe that part of the load will consist of the lighting of the City Hall. In tearing down the adjacent Court House it was necessary to take out the old isolated plant, installed in 1884 to light the City Hall, and current for this purpose will hereafter be supplied by the Fullerton Avenue station, several miles away. In the City Hall there are 2,800 incandescent lamps, principally of 16 candlepower, and 60 fan motors.

Wireless Communication with the President at Sea.

From his recent trip through the South President Roosevelt returned to Washington from New Orleans by water. The armored cruiser West Virginia, which carried the president and his party, was equipped with space-telegraph apparatus, and by this means the country was kept informed of the progress of the party and the principal events of the voyage across the Gulf of Mexico and along the Atlantic Coast. Communication was easily maintained between the boat and the various land stations along the coast. The daily newspapers report that while the ship was off the Florida coast the wireless station at Washington navy yard, about 1,000 miles distant, could distinguish, intermittently, the messages it was sending to shore stations. The West Virginia was equipped with a two-kilowatt De Forest outfit.

"Electrical Engineering" in England.

The London Times Engineering Supplement prints the following self-explanatory communication: "We are frequently informed that electrical engineering is the great profession of the day. Perhaps my experience may serve as a warning to those who think of entering its overcrowded ranks. Educated at a well-known public school, having passed through a three-year course at a large electrical training institution. I am now in a corporation electricity works, receiving 25 shillings a week for my services; this after varied experience in similar appointments, resulting in nothing except excellent, but seemingly valueless, testimonials. This is no unique experience, and seems to be chiefly due to the shortsighted policy of employers who invariably accept for vacant posts, engineers who offer to fill appointments for the lowest remuneration, regardless of experience or references. Again, as to the nature of the work. Average temperature of room, 95° F.; eight hours per day, continuous work, including Sundays. Add to this the fact that work is carried out amidst the continual and nerve-destroying roar of high-speed machinery, together with the standing danger of instant death as the result of momentary forgetfulness; and, I may add, that of being compelled often to work as a fitter or laborer, I think you will see that electrical engineering is hardly the profession which gentlemen should allow their sons to enter."

Trade Press Bowling League.

Trade and technical newspaper men of Chicago have organized the Chicago Trade Press Bowling League, composed of eight teams. The first annual tournament will begin at Wood's alleys, 170 Madison Street, on Monday evening, November 6th, at 7 p. m. The league will have exclusive right to the alleys on the second floor every Monday night from seven to 11 o'clock during the winter. Prizes have been arranged for both team and individual work, and besides the pleasure of bowling it is expected to get much social enjoyment from the tournament.

The following-named papers are represented by members of the league: American Dental, American Lumberman, Black Diamond, Construction News, Dry Goods Reporter, Engineering News, Engineering Record, Engineering World, Hotel Monthly, Hotel World, Mines and Minerals, Mining and Scientific Press, Monthly Official Railway List, National Builder, National Engineer, Railway and Engineering Review, Railroad Gazette, Street Railway Journal, Western Electrician.

The officers are: President, Douglas Malloch, American Lumberman; vice-president, Norman F. Obright, Western Electrician; secretary, Charles A. Blake, Railway and Engineering Review; treasurer, C. W. Spofford, Dry Goods Reporter.

Ohio Interurban Meeting.

The first monthly meeting for the fall season of the Ohio Interurban Railway Association was held at the Chittenden Hotel in Columbus on October 26th. About 75 members were present and much interest was manifested in the proceedings. The members were guests of the Scioto Valley Traction Company while in Columbus.

Quite a little discussion developed on the question of widening cars on interurban roads in order that they may be more comfortable for passengers. This subject will probably be taken up at the next meeting and further discussed.

Another interesting feature of the meeting was the discussion of the question of establishing a bureau for the issue and redemption of mileage coupons. This is the same matter that was taken up a year ago and was temporarily postponed, the friends of the measure feeling its importance would force itself upon all the members within a comparatively short time. Coupon books are now good on 31 roads. In Ohio 3,800 of them have been sold; in Indiana, 1,900, and in Michigan, 400. This shows the popularity which they have gained in the short time they have been in use.

Electric Lights Viewed from a Balloon.

In a recent popular article a French aeronaut says: "I wish especially to say a word about the charm of night ascensions when there is no moon, and when the ascension is made in thickly populated regions, like the environs of Paris. Then the celestial constellations are not alone worthy of attention; the lights on the earth rival them in brightness. You then are struck as never before by the power of the electric light, which is visible at an immense distance. Camille Flammarion, who had the happy inspiration to make his wedding journey in a balloon, says he can never forget how he was dazzled by those two sorts of light."

Ohio Telephone Notes.

It is reported that a new company is being organized in Cleveland to take over the properties that are now owned largely by the Federal Telephone Company. It is probable that James S. Brailey, Jr., Col. Breckenridge Jones and other members of the syndicate that purchased the Indianapolis properties are also interested in this proposed deal. The idea is that the new company will take the bonds of the smaller companies now in the hands of the Federal company, thus furnishing the cash to clear up the debts, and that the Everett-Moore syndicate will retain its interest to the extent of its claims against the Federal. While the information regarding this matter is not definite, the proposed move is in line with the consolidation idea heretofore expressed in the Western Electrician. The companies controlled by the Federal are the Columbiana County Telephone Company, the Cuyahoga Telephone Company, Citizens' Telephone and Message Company of Fostoria, Findlay Home Telephone Company, Lancaster Telephone Company, Massillon Telephone Company, Stark County Telephone Company of Canton, United States Telephone Company, Youngstown Telephone Company and Zanesville Telephone and Telegraph Company.

A meeting of the Third District of the Ohio Independent Telephone Association was held at Zanesville last week with between 50 and 60 members present. Reports showed that there are now 20,571 subscribers being served by 90 exchanges, and the toll stations number 178. The Independents say that the Bell subscribers in the same territory number 7,041, with 24 exchanges and 79 toll stations. J. B. Rhodes, manager of the Zanesville company, is the vice-president of the district. The advance in Independent securities was discussed as well as matters that pertain directly to the district. Among those making short talks were Frank L. Beam, president and manager of the state association; C. Y. McVey, M. B. Overly and F. L. Cary of Cleveland; Dr. F. C. Huth of Woodsfield, C. L. Jones of Athens, S. C. Kissner of Coshocton, William Hoyle of Cambridge, W. H. Bowton and Judge Wheeler of Caldwell, C. H. Dew of Summerfield and Sherman M. Granger, president of the Zanesville company.

The Perry County Telephone Company has arranged to put in a new exchange at New Lexington and build about two miles of cable to carry the wires within the city limits. The improvements will probably cost about $8,000.

The Cuyahoga Telephone Company received the news directly from the field at Columbus of the football game between Case School of Cleveland and the Ohio State University and bulletined it on the windows of its office on Prospect Street. This was done a year ago, and it created much interest.

C.

Michigan Telephone Matters.

A telephone "ticker" or message recorder has been invented by F. C. Osborn of Detroit, and the patent is controlled by J. D. Spitzer, also of Detroit. The original instruments are installed and in use in the city. A small machine with a recording tape is placed in the subscriber's office, while a tape-punching machine, operated on the same principle as a typewriter, is a part of the central-exchange equipment. If the person desired at the telephone is absent or busy, the one calling can have his call recorded, or a message given. Messages can be transmitted and recorded while the telephone is in use and does not interfere with the regular service. Daily news can be furnished small cities and towns out in the state in a manner similar to the ticker service in large cities. The tape-punching machine can be operated nearly as rapidly as a typewriter. The system is similar to one recently described in the Western Electrician.

There has been considerable talk in Detroit over a new Independent telephone company, which may buy the franchise of the Co-operative Telephone Company, and interest capital in building up a formidable rival to the Michigan State (Bell) Telephone Company. The promoters of the new company, which will be known as the Home Telephone Company, are Max Koehler and Samuel B. Jefferies, representing St. Louis and Kansas City capital, and C. M. Burton, president of the Co-operative company, now doing a small Independent business in Detroit and using the city's conduits under a franchise which is liable to be repealed by the courts.

The Michigan State Telephone Company of Detroit is going on with extensions and putting its system into underground conduits as fast as possible. Contracts have just been let for three miles of conduits, extending out to Woodmere, a suburb of Detroit, to become a part of the city in the spring. The contract was given to John Mercier & Co. for the Detroit work and also for three miles of conduits for Ypsilanti. In the spring 10 miles of conduit is to be laid in Michigan Avenue.

W.

Indiana Telephone Items.

The Pocket Long-distance Telephone Company has been organized, with headquarters in Evansville. The object of the organization is to connect all Independent telephone lines in Posey, Spencer, Dubois, Gibson, Knox, Pike and Warrick counties with Evansville. Lines already built practically cover the territory, and but a few miles of construction will have to be done by the new company. Evansville has no connection with Independent telephone lines at present.

The Home Telephone Company of Richmond has begun the work of getting out a new directory. The company has 3,000 local subscribers, as well as a large number of rural patrons.

Harry B. Gates of Indianapolis and other Indiana Independent telephone men composing the Queen City Telephone Company are waging a strong fight to enter Cincinnati. Their cause has been in the court for nearly two years, a final hearing of which was scheduled to be had before the Supreme Court of Ohio on November 1st. The Indiana men are sanguine of success and are making every preparation to enter Cincinnati during the present year.

The Central Union Telephone Company is extending its toll lines north from Waterloo to Pleasant Lake, Angolia, Freemont and Hillsdale. The company will probably secure control of the farmers' telephone line at Angolia.

S.

Telephone News from the Northwest.

The Northwestern Telephone Exchange Company has been instructed to connect with the courthouse at Mankato, Minn., after having been excluded from the county offices for some time because of a contract with the Citizens' Telephone Company which provided for exclusive service.

The Tri-state Telephone Company will have a building erected at Albert Lea, Minn., for its exchange office.

The City Council of St. Charles, Minn., recently tendered a franchise to the Northwestern Telephone Exchange Company for a franchise there. The franchise was subject to restrictions which the company regarded as too burdensome, and refused it. Now the company has brought action in the Federal court for the city to show cause why it should not grant permission to the telephone company to install a telephone exchange.

The Northern Telephone Company has been granted admission to Minot, N. D., for a long-distance service.

The Twin City Telephone Company has started work at Milaca, Minn., making extensive improvements to the local telephone system, which it recently purchased.

The New Ulm Rural Telephone Company has secured connection with St. Peter, Minn., over the lines of the Tri-state Telephone Company, which connects with the Nicollet County Telephone and Telegraph Company.

Electricians of La Crosse, Wis., employed by the telephone and telegraph companies seek recognition of the union and the adoption of the union scale.

The Glenwood Telephone Company of Glenwood, Minn., has been incorporated by M. A. Wollan and others, with a capital of $12,000.

E. V. Benjamin has bought the exchange of the Cumberland Telephone Company at Cumberland, Wis., and will make improvements and extensions.

Frederick Dodas and Henry Menike have organized a farmers' telephone company at Webster, Minn.

The LeRoy (Minn.) Telephone Company has purchased the exchange at Richville, Iowa.

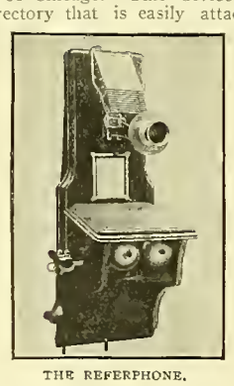
The telephone exchanges at Chester, Lime Springs and Cresco, Iowa, have been sold to Edward Hurmence and V. H. Stevens.

Construction work has been started on the new Independent toll line which is to connect Sioux City, Iowa, with Yankton and Sioux Falls, S. D.

R.

The Referphone.

A device that fills a need often experienced by users of telephones is the Referphone, sold by S. T. Fish & Co. of Chicago. This device is a ready-reference directory that is easily attached to any



THE REFERPHONE.

wall or desk telephone in a moment's time. It consists of a number of neat metal frames, each of which contains an interchangeable card on which names and numbers are arranged in alphabetical order. The Referphone does away with looking up the more frequently used numbers in the telephone directory, and may contain up to 300 names and numbers always attached to the telephone and ready for immediate reference.

The accompanying cut illustrates the Referphone attached to a wall telephone set.

Indianapolis Telephone Transfer.

Following the acquisition and transfer of control of the Indianapolis Telephone Company and the New Long-distance Telephone Company to interests represented by Breckinridge Jones of St. Louis and by the Stifel-Bauer-Brailey interests of St. Louis and Toledo, a meeting was held in Indianapolis on October 26th, resulting in the election of the following-named officers for the Indianapolis company: President, H. C. Stifel of St. Louis; vice-president, James S. Brailey of Toledo; directors, John H. Holiday of Indianapolis, A. H. Bauer and B. A. Althemier of St. Louis. The officers of the New Long-distance Telephone Company are: President, H. C. Stifel; vice-president, C. M. Foster; directors, Breckinridge Jones, J. S. Brailey, A. F. Ramsey, M. B. Wilson, Louis Hollweg.

The officials announce that the companies will remain absolutely Independent, and it is their intention to spend $1,000,000 a year for three years in pushing the companies' business and extensions and making desired improvements. The Independent Telephone Company of Terre Haute has also been acquired by the St. Louis and Toledo people. It is the belief of many Indiana telephone men that the acquisition of the Indiana properties is the beginning of a merger of the Independent companies of the East, Middle West and the West, to include the Independent companies of New Jersey, New York, Pittsburg, Cleveland, Indianapolis and St. Louis.

Cheaper Municipal Telephone Service for Chicago.

City Electrician Carroll of Chicago has awarded the contract to the Chicago Telephone Company to supply the telephones for the city's private police and fire-alarm system. Some time ago there was an agitation that the city buy its telephones and maintain the system itself, but Mr. Carroll found that to change from the present rented system would cost over $5,000 and the maintenance would be $770 a year. In view of the fact that the company offered to connect the private system with the outside system and to install more modern equipment and to do this at the greatly reduced rate of 50 cents a year per instrument, Mr. Carroll recommended that the company be given the contract. The rental will amount to $800 a year and the city gets exchange service free. The company formerly got $1.50 a year for each instrument.

NEW COMPANIES.

Sprague & Bowen of New Hartford, Iowa, have been succeeded in the telephone business by Sprague & Paulger.

The Erie-Wyoming Company of Sardinia, Erie County, N. Y., has been incorporated with a capital of $100,000.

The Childress-Wellington Telephone Company at Childress, Texas, has been incorporated with a capital of $5,000.

The Springfield-Lamar Telephone Company of Springfield, Colo., has been incorporated with a capital stock of $3,000.

At Oldenburg, Texas, the LaGrange and Waldeck Telephone Company has been incorporated with a capital of $1,000.

The Mutual Telephone Company of Okeene, Okla., has been incorporated with a capital stock of $15,000 by H. Slemmer and others.

Articles of incorporation of the Forsyth (Mont.) Telephone Company, with a capitalization of $20,000, have been filed with the county clerk. J. E. Edwards, C. M. Blair and Frederic Collins are the incorporators.

Among recently incorporated telephone companies are the Highland Telephone Company, Highland, Kan.; Miles City and Ekalaka Telephone Company, Miles City, Mont.; Valley Telephone Company, Hoxie, Kan.; Northern Telephone Company, Boulder, Colo.

The North Shore Telephone Company of Deep River, Wash., has been incorporated to build a telephone line along the north shore of the Columbia River, connecting Moowan's cannery, Knappton, Deep River, Grays River, Skamekawa and Cathlamet. The company's line is to be connected with the general system of the Pacific States Telephone and Telegraph Company. The incorporators are W. N. Mesereve, William Anderson, P. J. Brix and A. Olsen.

An increased capital stock of $25,000 is reported by the Steinauer (Neb.) Telephone Company.

GENERAL TELEPHONE NEWS.

The Southwestern Telephone Company is applying for a franchise in Texarkana, Texas.

The Commerce Telephone Company at Commerce, Texas, has increased its capital stock to $10,000.

A new office and supply house is being erected by the York County Telephone Company at Henderson, Neb.

F. C. Smith says many improvements and additions are to be made to the local telephone plant at Nacogdoches, Texas.

The Idaho Independent Telephone Company at Boise has advertised for bids for the construction of an exchange building.

An extensive system of telephone lines has been built with Cholula, Mexico, as the center. These lines connect 23 towns with Cholula.

Reports are to the effect that the Nebraska Telephone Company has secured a franchise for building a telephone exchange at O'Neil, Neb.

The Chesapeake Telephone and Telegraph Company of Williamsburg, Va., has passed into the hands of the Bell Telephone Company.

I. S. Mahan of La Mars, Iowa, has resigned as secretary and manager of the Plymouth County Telephone Company and will be succeeded by O. L. Landenslager.

W. W. Tracy has sold his interest in the local telephone exchange at Clarence, Mo., to W. E. Naylor of Haggers Grove and has purchased the exchange at Shelbina, Mo., which he will take charge of January 1st.

The records of the state government of Nuevo Leon, Mexico, show that there are in that state 2,105 kilometers of telephone lines, with 985 exchanges, in operation. Twenty-five towns of the state have telephone connection with Monterey.

The Telephone Construction Company of St. Louis has completed organization with Charles Sutter, president; R. F. Spencer, vice-president; J. L. Herman, secretary; J. H. Murphy, treasurer, and J. Schatzman, general manager. Maxime Reber is consulting engineer.

The growth of the Cumberland Telephone and Telegraph Company (Bell), operating in the South, is worthy of mention. The company was organized in 1883 with small capital, but since that time has grown steadily until now it has 131,334 subscribers. This system operates in the states of Alabama, Tennessee, Louisiana, Mississippi, Illinois, Indiana and Kentucky, with, of course, the Bell long-distance connections. The officers of the company are: President and general manager, James E. Caldwell; secretary and assistant general manager, Leland Hume, and treasurer, T. D. Webb.

MANUFACTURERS AND DEALERS.

The Hall Telephone Manufacturing Company, with a capital of $50,000, was incorporated at Albany recently by R. B. Constantine of South Orange, N. Y., and E. J. Hall of Brooklyn.

The International Telephone Manufacturing Company of Chicago reports that it has recently put on the market a combination listening and four-party-line indicating ringing key, which has a number of new and improved features. The first of this equipment is being installed on the 4,500-line-capacity central-energy multiple lamp-signal switchboard now being installed by the company at Meridian, Miss.

"Self-balancing in all positions; operated by a touch of the finger; smooth in action; without intricate or delicate parts; easily fastened to the woodwork"—these are the claims made by the Oliver Manufacturing Company of Philadelphia for its Equipose telephone arm. The apparatus is described in a pleasing manner in a recent circular sent out by the company, which will prove interesting reading to those who would have their telephone always in a position for immediate use.

A unique idea in the way of circular advertising has been hit upon by the Electric Appliance Company of Chicago. This consists of a folder of light cardboard, upon one side of which is shown part of a wall telephone with receiver. The receiver is on one flap and the hook switch on the other. Upon folding the two together the receiver fits into an opening in the switch, or "hangs up" as it were, and holds the two parts together. Inside is a little dissertation upon "listening in" or "rubbering" on the line.

"Listen and learn of some of the advantages of a private telephone system," says the Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y., in a little pamphlet which it has just issued and which portrays a few of the different styles of telephones which the company manufactures. Some of these are applicable to either the intercommunicating system or the private-branch exchange system. The pamphlet is well adapted to fulfill its purpose—to catch the eye and hold the attention of the busy man.

CORRESPONDENCE.

New York.

New York city, October 30.—Municipal-ownership arguments and counter arguments are absorbinb public attention. Mayor McClellan, speaking to the Commercial League, made a new point when he said that the city could not build new subways because it was within $40,000,000 of its borrowing limit. Candidate W. R. Hearst's answer to this is to the effect that if the city had started out to get a fair return for its franchises there would have been more than enough money, now represented by watered stock of traction companies, to build all the subways the city needs. In another speech Mr. Hearst criticized the Brooklyn Rapid Transit Company and promised the city gas at 55 cents a thousand cubic feet.

Not long ago it was announced that the Pennsylvania Railroad had placed an order for 21,000 cars. Now comes the statement that an order for 25,000 cars has been placed by the New York Central railroad, involving an expenditure of $25,000,000. The Pullman company will supply 10,000 of this order, which, it is said, breaks all records in size. To balance this enlarged equipment 50 new locomotives are also ordered.

James P. McDonald, the contractor for the New York, Westchester and Boston railway's four-track road, has started work on the five miles of line within the city limits, and, having 20 months in which to grade the tracks, expects to finish the work in half that time. Steam-shovel excavation is proceeding rapidly in the Bronx, and the subcontractors are getting ready for the concrete abutments for the bridges. The road, when completed, will be operated entirely by electricity.

There was a collision between two trolley cars on the Williamsburgh Bridge on Wednesday morning, when many passengers were injured. The cause of the accident was the casting of a wheel. Another accident of the week occurred at Flushing, when a trolley pole left the wire on a stretch of street grade, and the car lights being extinguished, the next car following ran into it.

From Albany, N. Y., comes an official report that the total valuation of the special franchises in the state is now $356,829,555, as compared with $302,688,757 for 1904. New York city franchises alone account for $302,193,550 of the total and for $50,672,100 of the increase.

Public lectures on electricity are being given at the evening schools by Prof. Charles Harrington and F. W. Huntington.

It is said that after some prolonged tests and experiments the Bell Telephone Company has failed to achieve satisfactory results with the long-distance telephoning devices which it purchased a few years ago at large expense.

The New York and New Jersey Telephone Company will immediately increase its capital stock from $15,000,000 to $50,000,000. The company operates in Brooklyn and in several counties in New Jersey.

The Cornwall (N. Y.) Telephone Company has been incorporated by New York men with a capital of $5,000. Cornwall is a center from whence comes much of New York's milk supply.

William Marconi arrived in New York from Liverpool on October 21st, and returned to Europe after a visit of a week. While here Mr. Marconi told of interesting experiments with space telegraphy on the way over. He said he both sent and received messages on the short-distance instruments, remaining in communication with passing ships for hours at a time. He also received on the long-distance instruments several marconigrams from England and America. The inventor announces that he intends to equip the new Cunard ships with both the short and long-distance sending and receiving apparatus. This will enable both America and England to be in wireless communication whenever any vessel installed with the new keys is on the ocean.

Many hundreds of electric lamps have been strung from tree to tree around Clinton Park, Newark, N. J., in preparation for a Hallowe'en carnival.

Manager Olson of the Electro-dynamic Company, Bayonne, N. J., announces that the company's factories are filled with orders for interpolar variable-speed motors and other specialties.

Extensive additions will shortly be made to the fire-alarm telegraph system in Brooklyn.

The municipal electric-light plant designed to light the Williamsburg Bridge in New York was opened formally by Mayor George B. McClellan today. The plant is established near the Manhattan abutment bridge operated in connection with the rubbish incinerator recently constructed by the street-cleaning department. The operation of the two plants, it is estimated, will bring about a saving of $12,000 a year to the street-cleaning department and a large saving in the expense of lighting the bridge. Previously it cost the city 30 cents a yard to remove from the piers all its rubbish. Burning the rubbish reduces the bulk from 100 large carts to six small carts, and the resultant ashes can be disposed of advantageously for filling in land. All disease germs are exterminated in the process and great economy is effected in the disposal of the rubbish. The rubbish thus burned serves to some extent as fuel for the boilers of the electric-lighting plant operating three dynamos. With this help in the fuel bill the cost of lighting the bridge, which at present is $80 a day, will possibly be reduced 50 per cent. The plant cost about $60,000.

D. W. W.

Southeastern States.

Charlotte, N. C., October 28.—A. J. M. Dewberry and others have secured a franchise from the town of Tuscaloosa, Ala., to operate a passenger and freight electric railway in the town and in Jefferson County. It is proposed to build the line from Birmingham to tidewater, furnishing a cheaper rate on iron and other products.

The town of Graham, N. C., will soon have an electric lighting service.

Detail plans have been received for the new electric railway at Hickory, N. C., and the engineers have gone over the ground, making final preparations for the work.

J. E. Sirrine of Greenville, S. C., will engineer the $750,000 electrical power development of the Hatton's Ford Power Company near Anderson, S. C. A dam 53 feet high and 1,000 feet in length is planned.

Mooresville, N. C., is about to vote on the question of a $10,000 bond issue for electric lights.

The Georgia Railway and Electric Company of Atlanta is contemplating some suburban double-tracking.

L.

Ohio.

Cleveland, October 28.—Considerable interest attaches to the report that the property of the Chippewa Valley Electric Railroad Company, with a line betwen Eau Claire and Chippewa Falls, Wis., has been sold. Arthur E. Appleyard was president of the company. A new staff of officers has been chosen. Local men are said to be the purchasers.

The new Doan Street line in Cleveland, from the lake to Euclid Avenue, will be put in operation Sunday. This is one of the most carefully constructed lines in the city. The ties are laid in a bed of concrete, with heavy steel rails, which will be welded. The idea is to have a line that will make as little noise as possible, as it passes almost entirely through a residence district.

Governor Herrick has made good use of the trolley cars for campaign work so far. Another itinerary has been made out that will continue from October 30th to November 4th in the northern part of the state. A private car is used for the purpose and stops are made wherever desired.

Reports are current to the effect that the Lorain Street railway property, Lorain, and the property of the Avon Beach and Southern may be turned over to the Lake Shore Electric within a short time. The Lorain property was purchased for the Lake Shore Electric by a syndicate some time ago, and was to be taken over within two years. About 13 months of that time yet remains. The same syndicate furnished the money for the Avon Beach road.

The Apple Electric Manufacturing Company of Dayton has been incorporated with a capital stock of $250,000 by H. G. Catrow, R. L. Hubler, H. T. Apple, O. D. Apple and V. G. Apple.

Although the Jamestown Electric Light Company has been lighting the streets of Jamestown for 10 years, it has just been granted a franchise More lights will be used and a new contract made. It is said the town could have avoided paying light bills any time because of the lack of a franchise.

O. M. C.

Michigan.

Detroit, October 28.—The Ross Construction Company has the contract for the roadbed of the Detroit-Bay City Traction Company. Work on the line is now in progress between Caro and Bay City and is to be completed to Caro January 1st.

The increase in passenger earnings this year over last of the Jackson and Battle Creek Traction Company is 20 per cent., while the freight shows 30 per cent. increase. A bond issue of $500,000 is said to have been sold by this company to provide for an extension of line to Detroit to compete with the Hawks-Angus line.

A. L. Stanley, manager of the Public Service Corporation of New Jersey, was in Detroit last week inspecting the Detroit United railway system. He had with him some of his officers. Mr. Stanley was formerly superintendent of the Detroit United railway.

It is stated that the Michigan Central Railroad will install gasoline-motor cars on its line between Battle Creek and Gull Lake, to compete with the electric line for the summer business.

The death of R. H. Ziegler of Detroit by a shock from a telephone wire is being investigated. It is stated that the Co-operative Telephone Company's wires cross those of the Public Lighting Commission in several places, and it is thought that the current from the latter caused his death.

The Monroe Common Council in special session has decided to raise the proposed bond issue for an improved electric-light plant from $16,000 to $20,000. If the bonding proposition carries, the

plant will be moved to a new site on the river where the water rights are free, and the plant will be entirely rebuilt.

A party of Washington (D. C.) electrical engineers visited Detroit Wednesday and, with Prof. Cooley of Ann Arbor, inspected the power houses of the Detroit United railway and the Edison Illuminating Company. They have charge of the installation of a new power plant for the Capitol, Congressional Library and new congressional buildings in Washington. The party left in the evening for Schenectady, N. Y., where the General Electric Company's plant will be visited. C. G. W.

Indiana.

Indianapolis, October 28.—The Evansville Gas and Electric Light Company has contracted to furnish the electric power for three of the interurban roads running into Evansville, and will probably supply power for the fourth one also. The company is now erecting a large plant which will be used in supplying the required power. About $130,000 will be expended in building the addition to the plant, and an additional large sum will be expended for turbine engines and the installation of electrical equipments. W. B. McDonald is secretary and general manager of the company.

W. R. Thurston has obtained a franchise to build a modern electric-light plant in Geneva, Ind. Mr. Thurston has organized a stock company and proposes to have the plant in successful operation in a few months.

The Zionsville Lumber Company of Zionsville is preparing to install an electric-light and power plant. The company is meeting with encouragement, and there is little doubt but the village will soon have an up-to-date plant.

The electric-light plant of Shelbyville has been transferred to the Citizens' Water and Light Company of Shelbyville by direction of the United States Court. A mortgage for $50,000 on the plant and property has been given to the United States Mortgage and Trust Company. The company is now proposing to make extensive improvements and install some modern machinery in the plant.

Two important questions are now being agitated and will be submitted to the next Indiana Legislature, one of which will be presented by the steam roads to secure legislation that will result in interlocking switches being placed at all crossings of steam roads and electric lines in the state. The other question, and for which there is now a movement on foot, is to secure the enactment of a law compelling steam railroads to exchange freight by the transfer of loaded cars to the interurban lines. S. S.

Northwestern States.

Minneapolis, October 28.—Richard Hutchinson of St. Paul has taken charge of the electric-light plant at Princeton, Minn.

The Northfield Light, Heat and Power Company has sold its plant at Northfield, Minn., to the Cannon Falls Electric Light Company.

The Chippewa Valley Electric Railroad Company has abandoned plans for extending its system at Eau Claire, Wis., until next spring.

The Mason City (Iowa) and Clear Lake interurban has let the contract to the Westinghouse company for the machinery for its new power plant at Emery. The contract includes a 500-horsepower engine and a 15,000-volt generator.

The Rhinelander (Wis.) Light Company has sold its wiring and supply branch of the business to C. A. Sutliff of Grand Rapids, Mich. He will put in a full line of electrical goods.

A new electric-light system is being installed at Wilmot, S. D. R.

Pacific Slope.

San Francisco, October 27.—The Ocean Shore Railway Company has ordered a large lot of machinery for the operation of its electric road between San Francisco and Santa Cruz. It includes two 2,000-kilowatt three-phase 2,300-volt General Electric generators, each direct connected to a McIntosh & Seymour vertical cross-compound condensing engine. Babcock & Wilcox boilers equipped for burning oil will be used. Switchboards, transformers and sub-station equipment, as well as car motors, will be supplied by the General Electric Company. There will be 160 car motors of 125 horsepower each, four being installed on each car. Seven 1,000-kilowatt static transformers will raise the current from the generators to 30,000 volts. Thirty 250-kilowatt step-down transformers at substations will lower this current to a suitable voltage for the rotary transformers which will supply direct current at 500 volts for the tralley line. The power house will be erected near the shore on Halfmoon Bay as soon as the tracks are completed to that point. Construction work is going on actively.

The Culiacan Electric Company, which is controlled by San Francisco capitalists, will have its electric-light plant in Culiacan, Mexico, ready for operation about December 1st. Sidney Sprout of San Francisco is the company's engineer. Important concessions have been obtained from the Mexican authorities for lighting, telephones and electric roads. A city lighting contract has been secured for a long term.

The Dayton Electric Company has filed articles of incorporation at Tacoma, Wash. The capital stock of the company is $75,000 and the principal stockholder is Nicholas Codd of Colfax, Wash. The company takes over a steam and waterpower plant heretofore controlled by Mr. Codd and will at once undertake improvements costing in the neighborhood of $20,000.

The Harriman railroad lines are preparing to install a steel derrick and electric conveyor of 25 tons capacity on the new Albina dock and to put in an electric traveling crane in the company's shops at Albina, Ore.

Superintendent Youngs of the light and power department of the municipality of Seattle, Wash., has just completed an investigation of the city's power plant on Cedar River. Mr. Youngs' report to the City Council will recommend the addition of another unit at the power plant, and if this recommendation is carried out, about $15,000 will be expended, and the plant will be increased to 5,000 horsepower.

Advices from Los Angeles state that the roadbed of the Pacific Electric Railway Company's line extending from Los Angeles to Santa Ana is completed and that service on the line will begin about November 1st.

Officials of the Spokane and Inland Electric Railway Company of Spokane, Wash., state that the entire electrical equipment for its 100-mile system has been ordered from the Westinghouse Electric and Manufacturing Company. The single-phase system will be used. Three hundred tons of steel rails have already been delivered and 350 tons additional are in transit. The Colorado Fuel and Iron Company is furnishing the rails, which will total about 10,000 tons. Passenger and freight cars of standard type, and electric locomotives for handling freight cars have also been ordered. The Spokane Terminal Company has been organized to handle the traffic of the Spokane and Inland and the Cœur d'Alene electric roads within the city limits of Spokane. The terminal company has secured a station site at Main Avenue and Lincoln Street, on which a station will be erected at once. Regular service is expected to begin on all three systems in January or February. A.

PERSONAL.

Charles L. Pillsbury of Minneapolis, Minn., has been appointed consulting electrical and mechanical engineer to the State Board of Control.

H. E. Oscomp has resigned as electrical engineer of the Appleyard electric roads to accept a position with an electrical concern in Cincinnati, Ohio.

J. T. Ross became chief engineer of the Toledo Railways and Light Company of Toledo, Ohio, on November 1st. He is is a well-known traction expert and engineer.

E. L. Hartpence, vice-president of the Acme Wire Company of New Haven, Conn., was in Chicago last week on business connected with the manufacture of electromagnets and magnet wire, in which his company is engaged.

Albert Wolford, who has been in the employment of the United Gas and Electric Company of New Albany, Ind., for the last four years, has gone to Dayton, Ohio, where, it is said, he will take a position as superintendent of the Globe Electrical Company.

Charles D. Shain of New York, who was a few years ago one of the best known and most popular members of the electrical fraternity, was in Chicago on Monday. Mr. Shain is now engaged in the automobile business and has become an "auto specialist" of wide renown.

W. F. Wilford, in charge of the operating department of the Owatonna Gas, Electric and Heating Company of Owatonna, Minn., has been made local manager of the company to succeed W. A. Stanton, who resigned to devote his entire time to the management of the Owatonna exchange of the Northwestern Telephone Exchange Company.

H. J. Brown, who was the operator for the De Forest space-telegraph system on board the steamship Haimum, which was equipped for the London Times and the New York Times in the Japanese-Russian war, was found dead in bed at Barrow, England, on October 23d. A short time ago Mr. Brown was sent to England to superintend the erection of the De Forest station for the English syndicate. His widow lives in New York city.

Charles S. Harris of Galesburg, Ill., has been elected to be the operating head of the People's Traction Company of Galesburg to succeed Thomas W. Peterson, whose resignation as general manager took effect November 1st. Mr. Harris has been secretary of the company and will now devote his entire time to its interest. Several extensions to the railway are contemplated and plans have been completed to enlarge the business by furnishing light and power to factories.

R. M. Van Vleet has been made manager of the Chicago office of the Cutler-Hammer Manufacturing Company, which makes electrical controlling devices. Mr. Van Vleet comes from the Pittsburg office of the Cutler-Hammer Company, and was formerly electrical superintendent of the Columbia Iron Works, Port Huron, Mich. He is well qualified to look after the interests of his company in the Chicago territory, having had many years practical experience in the electrical field.

At last week's meeting of the American Institute of Electrical Engineers the following-named associates were transferred to full membership: Robert Jamieson Browne, Calcutta; Percy Holbrook Thomas, New York; Norman Rowe, Guanajuato, Mexico; Charles Philo Matthews, Lafayette, Ind.; Frank George Baum, San Francisco; George G. Grower, Ansonia, Conn.; Robert Clay Jones, Dunedin, N. Z.; William Spencer Murray, New Haven, Conn.; Adelbert O. Benecke, Vailsburg, N. J.

ELECTRIC LIGHTING.

The town of Rudesheim, Germany, projects the construction of electrical works to cost $34,500.

Spencer Owen has been granted a franchise to install an electric-light plant in Springdale, Ark.

W. H. Murphy has been granted a franchise to install an electric-light plant in Osawatomie, Kan.

The Galena Electric, Gas and Power Company of Galena, Kan., has been incorporated with a capital of $100,000.

Grand Island, Neb., is about to arrange for a municipal electric-light system, in connection with its waterworks.

The Carthage Building Stone Company of Carthage, Mo., is about to put in a private electric-light plant to light the quarry and mill.

The Board of Trade of Mountain View, Cal., is advocating the establishing of a municipal electric-light plant to be operated in connection with the water plant. A committee headed by W. A. Clark has charge of the preliminary steps.

The mayor of Grand Rapids, Mich., has vetoed the amendment to the electric-sign ordinance which provides that the signs shall not extend out from the buildings over six feet. This, he declares, practically prohibits electric signs. The original ordinance allowed them to extend to the curbs.

Two 500-kilowatt steam turbines will be furnished for the Water, Light and Gas Company of Hutchinson, Kan., by the Westinghouse company. These will operate with dry saturated steam at the throttle of 150 pounds pressure and 28-inch vacuum. The 60-cycle generators will deliver two-phase current at 2,200 volts.

The franchise, wires, poles, fixtures and all the property of the Ballard Electric Company of Ballard, Wash., have been sold to the Seattle Electric Company. The Ballard company is a light and power concern, and has been controlled by interests directed or represented by J. J. McCafferty and W. R. Bell.

The Utica (N. Y.) Gas and Electric Company has entered into a contract with the Rome (N. Y.) Gas Company, whereby the former concern is to furnish electricity for lighting the city of Rome. A high-tension line will be built and power will be furnished from Trenton Falls to Rome, where it will be transformed to the proper voltage for the different requirements in that city.

An American has been awarded a contract to install an electric-lighting plant in Belize, Honduras, and to run it for a period of 21 years. Two arc lights of 1,000 candlepower, 75 incandescent lights of 32 candlepower and 15 of 25 candlepower are to be supplied at once, and if found insufficient to properly light the city not more than five additional arc lights are to be furnished and not more than one-half as many more incandescent lights.

Two 1,500-horsepower steam turbines have been ordered by the Toledo Gas, Electric and Heating Company adapted for driving a direct-connected 60-cycle generator running at 1,800 revolutions per minute and giving 7,200 alternations per minute. They will be provided with secondary governor valves by means of which 50 per cent. overload may be developed, or full load developed when operating with condenser. The generators will have four poles and will deliver three-phase current at 4,400 to 4,800 volts. The turbines will be of the Westinghouse make.

ELECTRIC RAILWAYS

A franchise has been granted to J. S. Daugherty of Houston, Texas, to operate an interurban line over certain streets of Waxahachie, Texas. The line is to connect that city, Ennis and Dallas.

Experiments are being made on the Union Loop in Chicago for the purpose of determining whether the noise of the elevated trains can be deadened by furnishing the tracks with a solid bed of gravel eight inches deep. This is done by fastening wooden cleats under the ties to hold the material

for the bed. The gravel is packed in between the ties and beneath them, so that the tracks have the appearance of a regular railroad bed.

The Chickamauga Park Commission has granted permission to S. W. Divine of Chattanooga to build the proposed Tennessee-Georgia electric railway across Missionary Ridge at Rossville, Ga. As soon as the remainder of the private right-of-way can be secured construction work is to be begun. The road as proposed extends from Chattanooga, Tenn., to Spring Place, Ga.

Cleveland people are interested in the Kansas City and St. Joseph Electric Railroad Company and the Missouri Valley Electric Railway Company. Several men at Erie, Pa., are also interested in the former, which is to have a capital stock of $1,500,000 and a bond issue of the same amount. L. W. Prior and Warren Bicknall of Cleveland and George B. Blachard of New York are interested in the latter company, which is to have a stock issue of $7,500,000 and the same amount of bonds. The estimated cost of this road is $4,446,390.

The authorities of East Troy, Wis., have granted a franchise to the Milwaukee Light, Heat and Traction Company to build and operate an electric railway through the village and town. It is said that work will be started next spring. This is the road headed toward Beloit, and it is promised that the new line from Beloit through Delavan will meet the Milwaukee road at Elkhorn, there forming a through line between Beloit and Milwaukee, via Delavan and Delavan Lake. It is also said that a spur will be run to Lake Geneva to connect either at Delavan or Elkhorn.

At the first ordinary general meeting of the Indian Electric Supply and Traction Company in London recently Sir Walter R. Lawrence presided and said this company was the first to introduce electric supply and traction into the interior of India. The directors were very sanguine as to the result. In addition to Cawnpore, the directors contemplated developing electric traction in other large towns in India, though they would not extend their operations until the success of their initial experiment was fully assured. At the present time, of £125,000 stock, £100,040 had been paid up, and the remainder would fall due in September next.

Patrons of the New York Central Railroad entering New York city will be pleased to learn of an added facility to the street-car service from and to Grand Central Station, in the establishment of a through car line running via Fourth Avenue and Twenty-third Street to the West Twenty-third Street ferry stations of the Pennsylvania, Erie, Delaware, Lackawanna and Western, Central Railroad of New Jersey, Philadelphia and Reading, Baltimore and Ohio, and Lehigh Valley. Passengers can take this means of conveyance across the city, or reach the shopping district or any other point on the line designated, without transferring.

The New York Central locomotive No. 6,000, which is being tested at the Schenectady experimental track and which was built by the General Electric Company and the American Locomotive Company, made its twenty-five-thousandth mile on October 20th, thus completing the first half of the 50,000-mile test to which it is being subjected. The motors on the locomotive were those with which the test began; the commutators were perfectly smooth; the brushes concluded the 25,000 miles with a wear of only three-eighths inch. During these tests the locomotive has been in service regardless of weather, running light or with trains up to 12 cars in length. A speed of 85 miles an hour has been indicated and in competition the electric locomotive has easily beaten the fastest steam trains on the New York Central. The total cost of all repairs on the locomotive, excluding the injury caused when the shed in which it was housed was burned, has been $428.17 for 25,000 miles. This is an average of $0.017 per mile run, and it is believed that there will be a material reduction of expense on the second half of this run.

POWER TRANSMISSION.

The Philadelphia, Lancaster and Harrisburg railway has contracted with the York Haven Power Company for the necessary current with which to operate its trolley line. An electric cable will be laid across the Susquehanna River and connected with the sub-station now being constructed on the Lancaster County side of the river.

The Manistee River Power Company has secured from the Wexford County (Mich.) board of supervisors permission to build a dam and power house on the Manistee River one mile east and north of Sherman village. William Douglas of Manistee is president of the company. The plant will be 40 miles from Manistee, 30 from Traverse City and 22 from Cadillac.

The county board of supervisors of Mason County, Mich., has granted to the Pere Marquette Light and Power Company a permit to erect a dam on the south branch of the Pere Marquette River near Ludington. J. H. Cotton is president of the company and George S. Root vice-president. It is said that a 30-foot fall can be secured with a very short dam. It is understood that the company intends to furnish power and light to Hart, Scottville, Custer, Pentwater and numerous smaller towns.

The Grand Rapids-Muskegon Electric Water Power Company has filed its acceptance of the franchise as amended recently by the Common Council of Muskegon. The amended franchise provides that a yearly franchise fee be paid the city and that consolidation with any other corporation makes the franchise void. Wires in certain streets must be placed underground. The contract has been let for the erection of a power sub-station for the company. The building will be located at Muskegon Heights and will cost about $6,500.

PUBLICATIONS.

C. W. Hunt & Co. of West New Brighton, Staten Island, N. Y., have issued a new pamphlet devoted to Hunt industrial railways, the various phases of their operation being shown by a great number of illustrations.

Cranes for use in iron and steel works equipment are described and handsomely illustrated in a new catalogue issued by the Wellman-Seaver-Morgan Company of Cleveland. These cranes are electrically operated and the illustrations show a large number of actual installations. From an artistic viewpoint the catalogue is a success and the descriptions are clear and adequate.

Recent practice in the design and construction of belt-driven alternators is well exemplified in the new bulletin of the National Electric Company of Milwaukee, which describes a line of these machines. The bulletin goes thoroughly into all the details of the generators, which are manufactured in two types, one of which has bearings supported in a cast sub-base and the other in a stationary armature frame.

Waller & Renaud of 159 Front Street, New York city, have published in pamphlet form an article on the "Commercial Examination of Fuel," by Elwyn Waller and H. Stanley Renaud, which recently appeared in a coal journal. The article describes in detail the processes involved in determining the available heat units in various samples of fuel as applied by that firm in its New York laboratory. A copy of the pa hlet may be had on request.

The O. C. White Company of Worcester, Mass., is circulating some advertising literature concerning its new strap-clamp desk lighting fixture and its new adjustable portable lamp. The former is built to attach directly to a roll-top desk, the main joint embodying entirely new mechanical principles. In the latter fixture the base is of new design, especially large and heavy to give firmness to the lamp and shade on extreme leverages of the adjustable arm.

Features well worthy of mention are embodied in the new catalogue (No. 12), which is now being distributed by the H. T. Paiste Company of Philadelphia. This catalogue is handsomely bound in cloth and is 6¼ by 4¼ inches in dimensions, with 175 pages. It contains a complete list of Edison screw-base sockets and receptacles, said to be the first complete list of this kind. New types of tablet boards are here for the fi me shown; also a new line of molding bran ocks designed on the Fielding principle. Where r possible there has been shown opposite each article listed the weight of the standard shipping packages of that article.

SOCIETIES AND SCHOOLS.

Mechanical, electrical and civil engineering students at Purdue University, Lafayette, Ind., will this college year publish an engineering annual that will contain a review of the work accomplished by the engineering societies of the university. The annual also will contain articles by members of the societies, as well as other valuable matter.

Through the generosity of George F. Baer, president of the board of trustees, Franklin and Marshall College, Lancaster, Pa., will shortly establish a course of applied electricity. A room in the science building is now being equipped with the necessary apparatus, and it is expected that the equipment will be completed in time to start the course at the beginning of the second half of the college year.

The annual meeting of the electrical committee of the Underwriters' National Electric Association will be held at the rooms of the New York Board of Fire Underwriters, 32 Nassau Street, New York city, on December 6, 1905, at 10 a. m. Reports of committees and all suggestions for changes in the code to be acted upon at this meeting should be in the hands of the secretary by November 5th in order that they may be put into print for the meeting.

Announcement is made by Lewis Institute, Chicago, of evening courses in electrical engineering. These courses are an outcome of a careful study of the needs of the men who have attended evening classes of the Institute for several years past. The Institute is open from 6 to 10 p. m. on Mondays, Tuesdays, Wednesdays and Thursdays. The courses are so arranged that it will be possible for a student to take one course and attend two evenings a week or two courses and attend four evenings.

Good work is shown by the programme for the next meeting of the Northwestern Electrical Association. President C. H. Williams says that all but one of the contributors have sent in preliminary drafts of their papers, assuring the best programme ever presented. This year papers are to be sent in at an early date and referred to a committee which reports back to the author with suggestions. Committees of three will then consider each of the final advance copies so as to be prepared to lead in the discussion and thus bring out the greatest amount of good at the meeting. A movement is on foot to hold the coming meeting in Chicago during the period of the Electrical Exhibition at the Coliseum, but no definite action has yet been taken.

Secretary White of the Indiana Electric Railway Association has issued the programme for the November meeting, to be held at Rushville on November 9th. The principal topics for discussion are "Interurban Freight and Express Traffic," and "Shall Baggage be Carried Free?" The former will be opened for discussion by a paper presented by N. E. Graston of the Indiana Union Traction Company, and the latter by a paper presented by F. D. Norveil of the Indianapolis and Northwestern Traction Company. The question box, a new feature of the association, already bids fair to become a very important and interesting feature of the next meeting. The Indianapolis and Cincinnati Traction Company will entertain the guests while in Rushville.

MISCELLANEOUS.

A 500-kilowatt Westinghouse steam turbine will be installed by the Solvay Process Company of Syracuse, N. Y. The 60-cycle direct-connected turbo-generator will deliver two-phase current at 440 volts. This company already has in operation a number of steam and gas engines in addition to 3,500 horsepower in Roney mechanical stokers. Similar apparatus is also installed in the Detroit plant of this company.

Minister Beaupré of Buenos Aires writes that the service of electric automobile cabs, under the management of a German company, began operations on October 1st. The style of cab employed is that of the victoria, which is now in common use. The cabs are all supplied with taxometers, and the fare is 21½ cents for the first 1,200 meters or a fraction thereof, and 4½ cents for every 300 meters thereafter. Mr. Beaupré expresses the belief that these electric cabs will meet with great favor and in time will replace the old horse vehicle.

The "temporary" postoffice building, erected on the lake short front in Chicago about 1894, was vacated last Saturday and the new postoffice building formally opened. Prominent postoffice officials and others were present at the exercises and one of the features of the day was a trip through the system of the Illinois Tunnel Company, where the electric mail cars for handling mail between the Postoffice Building and the various railroad stations were inspected. The tunnels now connect with the principal railroad stations and have been extended under the river to the West Side. About 50 miles of the bore has been completed.

Some successful practical tests of the Pferinann-Wendorf apparatus for preventing railway accidents were carried out recently on the Frankfort-on-Main division of the Prussian state railways. Each locomotive used was supplied with a small set of apparatus, which, with its storage battery, occupied a space only 20 centimeters in depth and breadth, respectively, and 30 centimeters in length. Communication between this apparatus and the two track rails was supplied by the metal parts of the locomotive through the axles and wheels, while an insulated contact device connected the apparatus with a carefully insulated auxiliary rail running midway between the track rails, the contact device being so arranged that it could easily be moved back and forth or sideways. Positive and negative impulses could thus be sent in different directions, frequent changes being made from one rail to another.

TRADE NEWS.

The Strang Electric-Gasoline Car Company has been incorporated in Kansas City, Mo., with a capital stock of $100,000 by S. J. Hayde and others.

Early on the morning of October 25th the factory of the O. C. White Company of Worcester, Mass., was damaged by fire, which threatened the destruction of the entire property, but which, owing to the high efficiency of the fire department, was promptly checked. The stock suffers most from the effects of smoke, water and chemicals, but the machinery and tools were all saved, though somewhat damaged. The company expects to be able to ship orders as usual as soon as its insurance can be adjusted and temporary repairs made, which

will probably be accomplished about November 4th. In the meantime it craves the indulgence of its friends and customers who have so generously favored it with their orders.

The Boston office of the Fort Wayne Electric Works of Fort Wayne, Ind., under the management of Mr. J. Allan Smith, has been moved from its old home in 518 Exchange Building, into more commodious quarters at 110 State Street, rooms 601-604 Plymouth Building. The old telephone number, Main 2044, is still retained. This change was necessitated by the large increase in business transacted by this office and the desire to handle it advantageously.

W. P. Crocket, 167 South Canal Street, Chicago, well known as western agent of the Bossert Electric Construction Company, says that the increasing business of the Bossert company necessitates the enlarging of its plant at Utica, N. Y., a new wing being added to the present building, which will give additional floor space. This will also allow larger facilities to be given to the switch and panel-board branch of the company's business, which has been demanding greater facilities.

The Foos Gas Engine Company of Springfield, Ohio, announces that the Foos engine, which it makes, received a gold medal as the "best single-cylinder gas engine" at the Lewis and Clark Exposition at Portland. The Foos engine has taken medals at all the expositions where it has been shown, and the company says that it has received many first prizes at various state fairs this fall. The popularity of the engine is such that the facilities of the plant are overtaxed to fill orders.

Baker & Co., refiners and manufacturers of platinum, gold and silver, Newark, N. J., and New York city, have been awarded a gold medal for the excellence and variety of their exhibit at the Lewis and Clark Centennial Exposition, just closed, at Portland, Ore. Baker & Co.'s exhibit was comprehensive in its character, including numerous samples of crude platinum ore, the salts and solutions of the metal and various forms of platinum ware, such as are used daily in the arts and industries. A more extensive exhibit which they displayed at the Louisiana Purchase Exposition in 1904 was awarded the grand prize.

The Haller Machine Company (electric sign works), Chicago, reports recent sales of large electric signs as follows: James S. Kirk & Co., Chicago, roof sign, five and six-foot letters; Val. Blatz Brewing Company, Milwaukee, six and 24-foot letters, display sign; Klingman Furniture Company, for Baltimore (through the McCay Engineering Company), 10-foot trade-mark and four-foot letter display sign; Klingman Furniture Company, Grand Rapids, Mich., through the M. B. Wheeler Electric Company, large roof display sign; the Topeka Edison Company, Topeka, 110-letter exchangeable roof sign; the Fair, Chicago, 37 five-foot letters, changeable advertising sign; National Tube Company, Pittsburg, 30 five-foot letters. Additional space has been secured by the company so that orders can be filled much more promptly than formerly.

The Simplex Electrical Company, manufacturer of insulated wires and cables, with head office at 110 State Street, Boston, has issued, in limited number, a highly ingenious wiring computer—something like a circular slide-rule—which incidentally advertises its product, but should prove of real value to electrical engineers and contractors. By concentric scales it is possible to determine size of wire, volts lost, carrying capacity in amperes or distance in feet from source to point of distribution, for given two-wire circuits, where three of these four factors are known. The scales are of celluloid, and the calibration is based on the formula:

$$\text{Circular mils} = \frac{\text{Feet (supply to distribution)} \times 2 \times 10.7 \times \text{amps.}}{\text{Volts lost}}$$

On the back are useful wire tables and decimal equivalents. The western office of the Simplex Company is at 1146 Monadnock Building and is in charge of H. R. Hixson.

BUSINESS.

The Chicago Pneumatic Tool Company, in its statement of earnings for the quarter ended September 30th, reports profits of $241,791. There was carried to surplus $106,915.

A. P. Munning, the well-known sales manager of the Cutler-Hammer Manufacturing Company, spent a few days in Chicago last week. Mr. Munning says that the demand for Cutler-Hammer products is greater than ever, and that the business outlook for the coming season is very promising.

Users of guy anchors are interested in the new D. & T. anchor, placed on the market by the D. & T. Anchor Company of La Crosse, Wis., and described and illustrated in the Western Electrician of October 14th. Emphasis is put on the assertion that there is no installing expense. The company wishes to forward a souvenir model of its anchor, together with its latest descriptive circular, to those interested in anchors.

The Yampa Smelting Company has just closed a contract with the Allis-Chalmers Company for six McDougall furnaces, to be installed in the Salt Lake City plant. The furnaces are of the standard Klepetke-McDougall type, but with all the latest improvements in details. Each furnace will have six superimposed hearths, each with its set of rabble arms and rakes. The furnaces are all of large size, measuring 18 feet, outside diameter. The Nevada Consolidated Copper Company of Nevada has also closed a contract for a battery of six large-sized McDougall roasting furnaces, each with six hearths.

The two-ball adjuster for incandescent lamps, which places the light just where it is wanted, manufactured by the Vought-Berger Company of La Crosse, Wis., is meeting with an unusual demand. By the use of this simple device a drop light can be placed and kept exactly where it is needed, whether in use or not. The slightest exertion puts the light in the desired location. The lamp can be raised, lowered, or carried laterally, the adjustment being automatic. There are no springs or anything to get out of order. The company has just issued a new pamphlet describing the adjuster and the uses to which it can be put, which it will be pleased to mail on request.

During the last two months the Westinghouse Machine Company of East Pittsburg, Pa., announces that it has booked many orders from foreign countries. Some of the important steam-engine orders follow: One 16 and 34 by 16-inch marine-type vertical cross-compound engine for the Kure Arsenal, Japan; four 16 and 34 by 16-inch marine-type and two 8½ by 8-inch standard steam engines for the Tehauantepec railway of Mexico; one 11 and 19 by 11-inch compound steam engine for the Furukawa Western Bureau of Japan; one 13½ by 12-inch standard steam engine for the Hokkaido Tanko Railway Company of Japan; two 10 and 18 by 10-inch compound steam engines for the Kuiskiu railway of Japan; one 14 and 24 by 14-inch compound steam engine for the Imperial Printing Office of Japan; one 9 and 15 by 9-inch compound steam engine for Graham Bros., Stockholm, Sweden; one 18 by 16-inch compound steam engine for the Rio de Janeiro Tramway Light and Power Company of Brazil, and one 18 by 16-inch standard steam engine for the Santa Cecilia Sugar Company of Cuba.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) October 24, 1905.

802,369. Circuit Controller or Electric Switch. John P. Coleman, Edgewood, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed April 1, 1904.

A shaft adapted to have longitudinal and oscillatory movements is provided with circuit-making and breaking means operated therefrom, while circuit-making and breaking means are operated from a second shaft. Means between the two shafts upon a longitudinal movement of the first shaft causes a movement of the second shaft.

802,370. Illuminating Apparatus. Paul E. Collins, Boston, Mass., assignor to the Electric Novelty Machine Company, Boston, Mass. Application filed August 29, 1904.

An arm pivotally connected with a traveling lever carries a contact portion. A fixed contact co-operates therewith and a spring connected with the arm and with a lever has a fixed pivotal support. Adjustable means connect the traveling lever with the lever connected with the spring.

802,373. Magneto Dynamo-electric Machine. Elisha B. Cutten, Butte, Mont., assignor to Robert Bosch, Stuttgart, Germany. Application filed May 29, 1903.

The armature has a primary and a secondary coil wound with a sparking device in the circuit of the secondary coil. A circuit-interrupting device in the circuit of the primary coil is adapted to be operated automatically to break the primary circuit at predetermined intervals.

802,387. Telephone Cut-out and Switch. Owen M. Galloway, Edward B. White and Adam D. Neptune, Mountayr, Iowa. Application filed September 1, 1904.

Line conductors, an instrument conductor, a switch arm to which the instrument conductor is connected are provided in the cut-out. The switch arm is adapted to include the instrument in circuit with either of the line conductors, a bell conductor being connected to one of the line conductors and including a normally closed make-and-break. The latter is opened by the switch arm when the switch arm is out of connection with both of the line conductors. (See cut.)

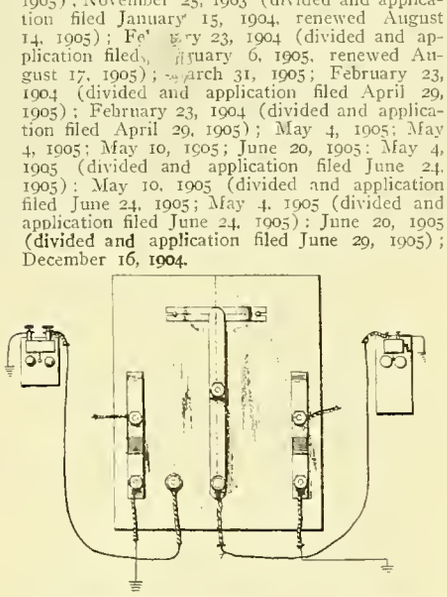
802,397. Insulator for Electrical Wires. Clarance A. Humphrey, Elyria, Ohio. Application filed February 15, 1904.

A supporting member carries a non-conducting part sleeved over the top and has a trough to receive the wire. A follower of non-conducting material engages the wire on the trough and a cap bears upon the follower and has locking engagement with the support.

802,413. Electrical Apparatus. James E. Seeley, Los Angeles, Cal., assignor to the Synchronous Static Company, Los Angeles, Cal. Application filed July 20, 1904.

Electrical apparatus described in the patent consists of an electromagnetic device for generating impulses by self-inductive action and a number of energizing connections for the device adapting it for supply currents of different effective electromotive force.

802,417 to 802,432, inclusive. Space Telegraphy. John S. Stone, Cambridge, Mass., assignor to William W. Swan, trustee, Brookline, Mass. Applications filed, respectively, February 23, 1904; November 25, 1903 (renewed August 14, 1905); November 25, 1903 (divided and application filed January 15, 1904, renewed August 14, 1905); February 23, 1904 (divided and application filed, February 6, 1905, renewed August 17, 1905); March 31, 1905; February 23, 1904 (divided and application filed April 29, 1905); February 23, 1904 (divided and application filed April 29, 1905); May 4, 1905; May 4, 1905; May 10, 1905; June 20, 1905; May 4, 1905 (divided and application filed June 24, 1905); May 10, 1905 (divided and application filed June 24, 1905; May 4, 1905 (divided and application filed June 24, 1905); June 20, 1905 (divided and application filed June 29, 1905); December 16, 1904.



NO. 802,387.—TELEPHONE CUT-OUT AND SWITCH.

This series of patents was granted to Mr. Stone for various improvements to his system which is already well-known. Further mention is made of these patents on page 353 of this issue.

802,437. Bell-ringing Apparatus. Friedrich Weule, Bockenem, Germany. Application filed April 2, 1903.

In an electric bell-ringing mechanism are a rope drum and an electric motor, an electrically controlled clutch arranged to connect the motor and drum to start the latter and a second clutch operated by the oscillations of the rope drum to alternately connect and disconnect the motor and drum.

802,451. Electric Motor. Dugald C. Jackson, Chicago, Ill. Application filed March 8, 1900. Renewed January 23, 1905.

An induction-type motor is described in the patent. The armature which is in inductive relation with the field windings has between it and the field windings an auxiliary stationary winding independent of the armature and field-windings. This winding is adapted to move relatively to the armature and inductively receives its current from the field-windings. A commutator and brushes for the auxiliary winding and means for changing the position of the brushes about the commutator are the other parts. (See cut on next page.)

802,473. Valve Regulator for Centrifugal Machines. Harald de Raasloff, New York, N. Y. Application filed June 6, 1904.

An automatic valve regulator has means to operate it controlled by an electric circuit and means for opening and closing the circuit comprising a normally rapidly moving member located in the path of a solution of variable density, whereby the motion of the member is checked by the increasing density of the solution.

802,480. Electric Interrupter or Vibrator. James E. Seeley, Los Angeles, Cal., assignor to the Synchronous Static Company, Los Angeles, Cal. Application filed February 1, 1905.

An electric-circuit interrupter comprises a magnet, an armature therefor, a torsion spring carrying the armature and means for adjusting the tension of the spring.

802,485. Railway Signal System. Charles W. Stiff and Claude L. McKesson, Colorado Springs, Colo. Application filed December 1, 1904.

Combined in a three-way switch are one inside terminal and two outside terminals. A rotating plate has on its surface next to the terminals suitable contacts. Other contacts mounted on the rotating plate are electrically insulated from each other and so arranged that they will always connect one of the outside terminals with the center terminal.

802,497. Ground Strip for Protective Apparatus. Frank B. Cook, Chicago, Ill. Application filed August 5, 1904.

An electrical protective apparatus consists of a ground plate, of ground strips secured thereto and held adjacent to each other, and projections on the respective outer surfaces of the strips. The projections are adapted to prevent lateral displacement of protective devices inserted between them.

802,498. Retaining Clip for Third-rail Insulators. William Courtenay, New York, N. Y. Application filed December 6, 1904.

A section of a rail-clip consists of a straight metal bar perforated transversely and an integral hook at one end of the bar of greater width than the bar and overhanging it. (See cut.)

802,513. Attachment for Telephone Transmitters. Louis St. J. Johnson, Baltimore, Md. Application filed June 18, 1902.

The device is an index card to be attached to the transmitter.

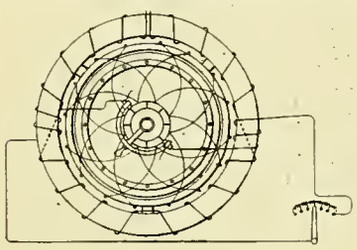
802,539. Trolley for Electric Cars. George F. Warburton, Denver, Colo. Application filed August 6, 1904.

Combined with the main trolley pole and trolley is an auxiliary trolley. A coil spring has one extremity connected with the harp of the auxiliary trolley and a flexible connection is situated between the harps of the two trolleys. A clamp is connected with the lower extremity of the spring and a rigid connection is between the trolley pole and the clamp.

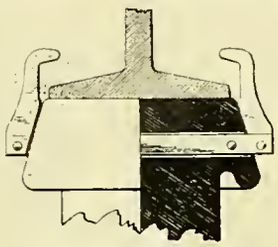
802,553. Plug Fuse Board. William F. Bossert, Utica, N. Y., assignor to the Bossert Electric Construction Company, Utica, N. Y. Application filed February 14, 1905.

A fuse-plug holder is stamped from sheet metal and has one end perforated and threaded and the opposite end formed with a foot having bolt holes. The ends are in parallel planes and joined by an intermediate portion centrally hollowed or sunken to form supporting edges or sides.

802,554. Automatic Fire-alarm System. George B. Bowell, London, England, assignor to the Pearson Fire Alarm, Limited, London, England. Application filed December 31, 1903.

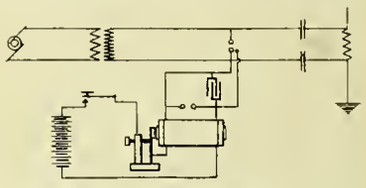


NO. 802,451.—INDUCTION MOTOR.



NO. 802,498.—THIRD-RAIL INSULATOR CLIP.

NO. 802,736.—FUSE.



NO. 802,850.—SPARK-DETERMINING APPARATUS FOR SPACE TELEGRAPHY.

A thermostatic fire-alarm system consists of a transmitter, a main circuit, a branch of the main circuit and an electromagnet. A main relay is arranged as a shunt to the branch circuit with a local relay in the branch circuit. Open-circuit thermostats are placed across the branch circuit as shunts to the relays and a switch normally short-circuits the electromagnet and is adapted to be opened by the local relay. A switch operated by the main relay short-circuits the transmitter and an open switch in the short circuit of the transmitter is adapted to be closed by the transmitter at the end of the first round.

802,573. Alarm System. John M. Latimer, Philadelphia, Pa., assignor to the Consolidated Fire Alarm Company. Application filed September 11, 1902.

Circuit-closers are arranged to operate an alarm signal mechanism. Parallel local leads form two continuous diverging circuits between each of the circuit closers and the alarm-signal mechanism. Means automatically start the signal mechanism when either circuit is interrupted and independently of the condition of the other circuit.

802,577. Conduit for Electric Wires. Robert W. Lyle, New York, N. Y. Application filed February 10, 1903.

A conduit section for electric wires comprises longitudinally grooved walls and dowel stops fixed in the grooves in the walls.

802,583. Electric-railway Signal. Elwood W. McGuire, Richmond, Ind. Application filed March 6, 1905.

Signal terminals are disposed along the track of a railway, the car having a contact adapted to pick up an electric impulse from the signal terminals.

802,584. Electric-railway Signal. Elwood W. McGuire, Richmond, Ind. Application filed March 30, 1905.

A series of partial circuits cooperates with a series of terminals adapted to be closed by a moving car for imparting an impulse of electric energy. Terminals are placed in connection with a signal-switch-operating mechanism actuated by an impulse of electric energy, the instrument being adapted to be actuated by the intermittent movements in making and breaking its switch circuit. Signal-impulse-receiving terminals are in connection with the switch of the signal-switch instrument.

802,597. Selective Signaling Apparatus. Egbert A. Reynolds, New York, N. Y., assignor to the Iron Telephone Company, New York, N. Y. Application filed August 19, 1904.

The clapper of the device is actuated by a vibrating armature, and adjustable means steady the clapper, engaging it at varying points along its rigid portion to adjust it to respond to vibratory impulses of different frequencies.

802,619. System of Electrical Distribution. John H. Anderton, Boston, Mass., assignor to the Albert and J. M. Anderson Manufacturing Company, Portland, Me. Application filed February 28, 1905.

In a system of electrical distribution is an alternating-current circuit, a motor supplied with current from the circuit, means to control the circuit of the motor, a mechanical converter rotable with the motor and electrically connected with the alternating circuit and with a source of direct current, and an indicating device included in circuit with the converter.

802,632. Self-propelled Vehicle. Edwin R. Gill, New York, N. Y. Application filed January 2, 1901.

A polyphase alternating-current generator on the vehicle has a rotary field driving motor in circuit therewith and means for varying the connections between the generator and the motor to change the relative number of poles of the two.

802,644. Telephone Desk Set. William Kaisling, Chicago, Ill., assignor to the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. Application filed November 23, 1903.

Details are described.

802,652. Dash Electric Headlight. Thomas Millen, New York, N. Y. Application filed May 15, 1905.

A headlight for dashboards of vehicles consist of an incandescent lamp with suitable reflector.

802,654. Telephone Directory. Paul C. Murphy, Seattle, Wash. Application filed November 8, 1904.

The directory is adapted to be attached to the telephone transmitter.

802,671. Telephone-exchange System. Harry G. Webster, Chicago, Ill., assignor to the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. Application filed February 14, 1903.

A line-relay is permanently serially included in circuit with one of the line-limbs and a differential cut-off relay has two windings, each permanently serially included in a limb of the line. A line signal is jointly controlled by the line and cut-off relays and a cord connects one line with another for conversation. Means are provided whereby the connection of the cord with the line causes an actuation of the cut-off relay to destroy the sub-station control of the line signal.

802,675. Electric Bell. Charles E. Avery, Jersey City, N. J., assignor to the Manhattan Electrical Supply Company. Application filed March 16, 1904.

A solenoid actuates the clapper of the bell and is controlled from any desired distant point by means of a suitable circuit.

802,676. Control of Apparatus Governing the Passage of Cars Along Railways. William A. Bartley, New York, N. Y. Application filed February 24, 1905.

An automatically operating train-stop comprises a trip for each block section and two circuits for each train stop, either of which when closed prevents the trip from being moved to its operative position. One of the circuits is opened by the passage of a train into the block section for which the stop is provided and the other is closed through the action of the train in a preceding block section.

802,684. Heat Coil. Frank B. Cook, Chicago, Ill. Application filed April 8, 1905.

The terminals are connected to two parts which separate when the heat-susceptible material by which they are connected is melted by a heating coil.

802,697. Circuit-controlling Device. Harry T. Johnson, Jersey City, N. J. Application filed April 2, 1904.

In a circuit-controlling device are a shell, a pressure-controlled plunger working therein, a spring for actuating the plunger to close the circuit when the plunger is relieved from pressure and means for rendering the device inoperative by the rotation of the plunger.

802,702. Polarity Indicator. Frederick W. Manger and Charles E. Avery, Jersey City, N. J., assignors to the Manhattan Electrical Supply Company. Application filed March 24, 1904.

A transparent tube hermetically closed and containing a suitable liquid has an electrode sealed in each end of the tube. An inclosing case for the tube is provided with a sight-opening. Contacts are carried by the ends of the case and metallic connections are placed between the contacts and electrodes.

802,736. Electric Fuse. Frank B. Cook, Chicago, Ill. Application filed July 9, 1904.

A fuse and connecting terminals therefor are associated with spring means for engaging one of the terminals. A suitable support is supplied for the other terminal, the spring means exerting a torsional stress on its engaging terminal and thereby automatically clamping the fuse in place. (See cut.)

802,740. Electromagnetic Perforator for Perforating Electric Telegraph Transmission Tapes. Patrick B. Delany, South Orange, N. J. Application filed August 17, 1901. Renewed February 20, 1905.

An electromagnetic tape perforator embodies a number of punch magnets, their controlling relays and the lever controlling the circuits of the relays. Means are adapted to draw the tape continuously past the punches and a magnet effects the stopping of the traverse of the tape. Electromagnetic means energized by currents of uniform polarity to actuate the lever to effect the punching of the strip.

802,753. Electric Bell Ringer. Ira W. Hall, Brownwood, Texas. Application filed March 21, 1904.

The bell is rung by the action of a weight, the beats being made by closing the circuit to a solenoid which actuates a trigger mechanism.

802,850. Spark-determining Apparatus for Wireless Signaling. Lee De Forest, New York, N. Y. Application filed September 21, 1903.

Transmitting apparatus includes a normally inoperative spark gap. Means intermittently produce an auxiliary or trigger spark discharge adjacent to the main spark gap and in accordance with a signal code. (See cut.)

802,875. Fire-protection Signal System. James G. Nolen and John E. Shepherd, Chicago, Ill. Application filed March 20, 1905.

Electrical signaling apparatus is used in connection with the fire extinguishing system described.

802,896. Electric Lock. Nicholas W. Webb, New York, N. Y. Application filed November 1, 1904.

An electric alarm circuit is connected with the lock.

802,939. Ground Plate for Electric Protective Apparatus. Frederick R. Parker, Chicago, Ill., assignor to Frank B. Cook, Chicago, Ill. Original application filed July 9, 1904. Divided and this application filed November 26, 1904.

A sheet-metal ground plate for electric protective apparatus has a transverse cross section which is in the form of three sides of a hollow rectangle with a flange portion extending from one end. Series of protection springs and protective apparatus are suitably mounted upon the ground plate.

802,943. Cloth Cutter. Carl Schneider, Jersey City, N. J., assignor to Solomon R. Jacobs, New York, N. Y. Application filed February 9, 1905.

The device is driven by an electric motor.

802,945, 802,946, 802,947. Electromagnetic Valve, applications filed June 25, 1903; 802,948, Electromagnetic Valve, application filed July 9, 1903; 802,949, Electromagnetic Valve-controlling System, application filed August 18, 1903; 802,950, Electromagnetic Valve, application filed August 29, 1903; 802,951, Automatically Operated Flushing System for Water-closet Bowls, application filed September 9, 1903; 802,952, Electromagnetic Valve, application filed September 9, 1903; 802,953, Electromagnetic Valve-controlling System, application filed November 19, 1903; 802,955, Electromagnetic Valve, application filed January 12, 1904; 802,956, Electromagnetic Valve, application filed January 12, 1904; 802,957, Electrical Mixing Valve, application filed January 12, 1904; 802,958, 802,959, Electromagnetic Valve, applications filed February 8, 1904. All by Isaac G. Waterman, Santa Barbara, Cal.

These patents describe electrical valve appliances for bathrooms, etc.

802,960. Electrolytic Apparatus. Frank J. Briggs, Everett, Mass., assignor of one-sixth to George F. Tarbell and one-sixth to Henry A. Locke, Cambridge, Mass. Application filed January 19, 1905.

Electrolytic apparatus comprises a cell, a dialyzer floating therein, anodes sustained in the dialyzer, a balance weight distinct from and independent of the cathode and balancing mechanism intermediate of the weight and dialyzer.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on October 30, 1905:

391,783. Automatic Electric Heat Regulator. W. A. Connelly, Boston, Mass.
391,792. Electric Railway. I. W. Heysinger, Phila, Pa.
391,793. Motor Car for Electric Railways. I. W. Heysinger, Philadelphia, Pa.
391,797. Electric Motor. W. E. Hyer, Newburg, N. Y.
391,815. Manufacture of Incandescent Lamp Filaments. J. W. Packard, New York, N. Y.
391,820. Method of and Apparatus for Dissipating Electricity in Delivering Sheets from Printing Machines. W. C. Rosney, Hyde Park, and C. L. Hull, Boston, Mass.
391,839. Individual Signaling Apparatus for Telephones. E. Davis, Boston, Mass.
391,853. Cut-out for Electric Circuits. H. C. McDill, Fort Worth, Tex.
391,855. Circuit-closing Mechanism. C. E. Ongley, New York, N. Y.
391,917. Detachable Circuit-closing Device for Electric Bells and Annunciators. J. D. Randall, Memphis, Tenn.
391,923. System and Apparatus for Electrical Distribution. M. M. M. Slattery, Woburn, Mass.
391,943. Electric Switch or Cut-out. W. C. Bryant, Waterbury, Conn.
391,954. Regulator for Dynamo-electric Machines. S. D. Field, Yonkers, N. Y.
392,018. Electrical Measuring Instrument. V. H. Enerson, New York, N. Y.
392,033. Telephony. W. W. Jacques, Newton, Mass.
392,034. Electrical Switch. O. B. Johnson, St. Johnsbury, Vt.
392,080. Electrode for Secondary Batteries. G. H. Stout, New York, N. Y.
392,090. Electric Distribution by Alternating Currents. C. Zipernowsky, Budapest, M. Deri, Vienna, and O. T. Blathy, Budapest, Austria-Hungary.
392,103. Electric Conductor. H. F. Campbell, Concord, N. H.
392,127. Insulator for Electrical Conductors. J. C. Love, Philadelphia, Pa.
392,163. Incandescent Light. E. Moreau, Philadelphia, Pa.
392,167. Automatic Electric Switch. I. L. Roberts, Brooklyn, N. Y.

WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XXXVII. CHICAGO, NOVEMBER 11, 1905 No. 20

Isolated Plant in the Heyworth Building, Chicago.

Considering size, architecture and equipment, the new Heyworth Building in Chicago ranks among the best of its kind. Its red terra-cotta and brick exterior is not showy, but its simple style and large proportions give it an appearance of massiveness which is imposing. The building is located on the corner of Madison Street and Wabash Avenue and is 17 stories above the basement, with a frontage on Madison Street of 180 feet and on Wabash Avenue of 80 feet. The corridors are of white Italian marble. The ground and first-basement floors are used for stores, while the upper stories are used for office purposes, the latter being served by nine—eight passenger and one freight—high-pressure elevators.

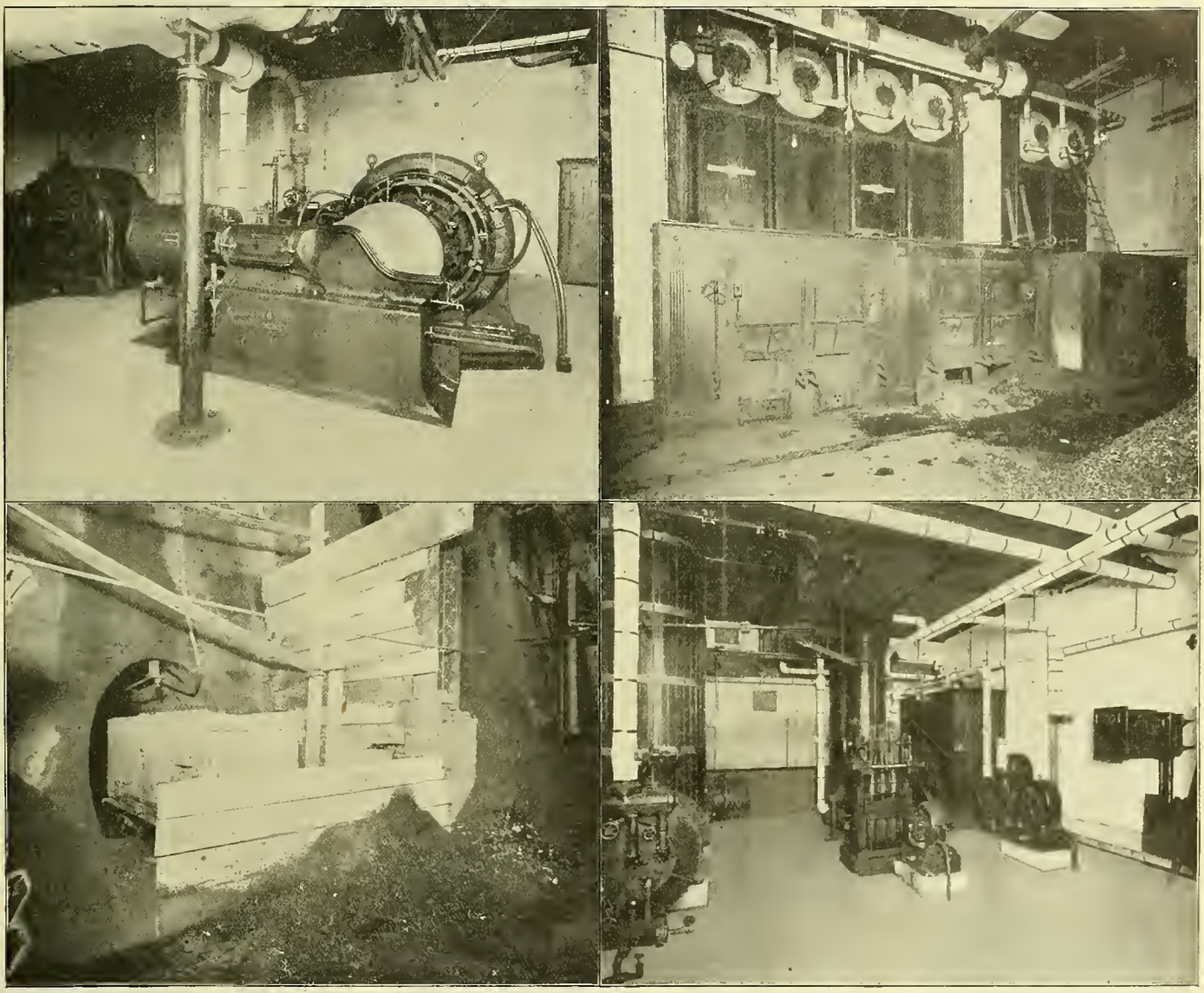


Fig 1. Two of the Three Direct-current Generating Units.
Fig. 2. View of Boiler Plant.
Fig. 3. Entrance to Illinois Tunnels, Showing Ash Car.
Fig. 4. Motor-driven Refrigerating Plant.
ISOLATED PLANT IN HEYWORTH BUILDING, CHICAGO.

Of special interest to engineers is the complete and up-to-date power plant for lighting, heating, power and refrigerating purposes. This plant is located in two sub-basements, the lower one of which is within a few feet of the level of the system of the Illinois Tunnel Company, and connected therewith by a lateral bore of standard dimensions.

Of the accompanying illustrations, Fig. 1 is a view of two of the three generating units; Fig. 2 is a view of the boiler plant; Fig. 3 shows the entrance of the tunnel to the sub-basement; Fig. 4 is the refrigerating system, and Fig. 5 a plan of the plant from above the generator room.

Referring to Fig. 1, the two direct-connected generator sets shown consist of 100-kilowatt Crocker-Wheeler direct-current machines operated by Fleming 200-horsepower cross-compound engines. The generators are run at 275 revolutions a minute. Current is generated at 125 volts and is used for lighting the building by 7,000 incandescent lamps and 50 arcs, and for power purposes, the refrigerating, house and boiler pumps being motor driven. By noting Fig. 5 the relative position of the three generating sets is to be seen, one of these units not being shown in Fig. 1.

Current is delivered from the generators to a switchboard numbered (17) in Fig. 5. The board contains seven panels, which are of black enamel highly polished, and with its fittings presents a handsome appearance. It is 7½ feet high, five feet out from the wall, both ends being shut off by a basketwork grating of electrobronze. Upon it are mounted the necessary switches and instruments for the various circuits about the building. The wires are conducted away from the board and to their destinations in the outlets on the different floors through iron-pipe conduits. The three-wire system is used, and, as is usual in isolated plants, connections are made with the Edison system so that current from there may be turned on at an instant's notice. The Arthur Frantzen Company of Chicago built the switchboard and was contractor for the wiring.

The engine room (see Fig. 1) is in the first sub-basement. To the right of the partition and still another story lower are located the elevator and house pumps and the boilers. Fig. 2 is a view in the boiler room and shows the three Babcock & Wilcox boilers which furnish steam for all purposes. These are rated at 275 horsepower each and carry steam at 160 pounds pressure. Two of the boilers are all that are required, even in winter, so that there is a reserve boiler on hand at all times for cases of emergency. A smokestack 325 feet high above the grates and eight feet in diameter furnishes natural draft.

Firing of the boilers is done by hand by one man, who also removes the ashes. And it is here that the street tunnels play an important part, for all ashes and clinkers are disposed of through them, instead of being elevated to the surface of the street. As soon as arrangements have been completed coal will be brought directly to the boiler-room floor by the electric cars of the tunnel system.

Fig. 3 is an interesting picture, inasmuch as it is one of the first to be published showing how the tunnel system will be utilized in the basements of the many large stores and office buildings which are being connected with them. The removal of ashes and the obtaining of fresh supplies of coal is a serious problem in a crowded city like Chicago at the best of times. In case of a strike the problem takes on a still more serious aspect. With the tunnel system working, however, the task is greatly simplified. In Fig. 3 the mouth of the lat-

eral connecting tunnel is shown, in which stands one of the cars which is to draw away the ashes. At (5), Fig. 5, a siding was cut through from the main tunnel under Madison Street directly into the sub-basement. This siding is approximately six feet wide by eight feet high in maximum dimensions, having an oval cross-section. The desired number of cars are each day left in this siding to be filled with ashes. When coal is brought in through the tunnels it will be dumped directly on the boiler-room floor.

Upon inspection, again, of the plan of the engine and boiler rooms, the system of steam piping may

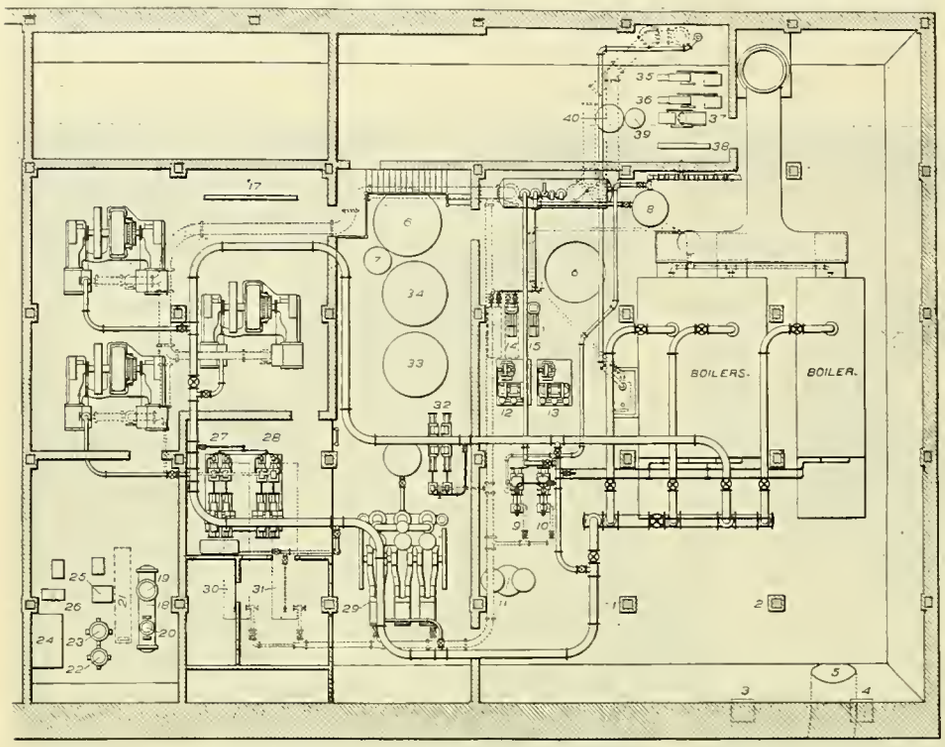


FIG. 5. PLAN OF BOILER, PUMP AND ENGINE ROOMS IN HEYWORTH BUILDING, CHICAGO.

be seen, simplicity being a marked feature of this part of the work. The irregular loop which takes its steam from the 12-inch boiler header passes around so as conveniently to supply all the steam apparatus on the two sub-basement floors, with the exception of the boiler-feed pumps, which are tapped to a six-inch auxiliary header. Adequate bends in the loop and in the various taps provide for expansion and allow the steam to pass freely.

Steam separators are installed which are drained by the Holly system, the water thus obtained being delivered to a tank to be returned thence to the boilers. The dotted lines in Fig. 5 indicate the exhaust piping which terminates in an expansion tank and in a Cookson feed-water heater. The expansion tank operates in conjunction with the gravity or vacuum system of heating, either of which may be used in the building. When the heating system is run on the vacuum principle, 22 inches of vacuum is maintained by vacuum valves and two six and nine by 10-inch vacuum pumps.

As before mentioned, the elevators are nine in number. They are operated by the hydraulic high-pressure system using 850 pounds to the square inch. A Laidlaw-Dunn-Gordon three-cylinder high-duty cross-compound pump does the work in conjunction with two 85-ton accumulators.

Five fans of a combined capacity of 2,100,000 cubic feet a minute are used to ventilate the engine room, boiler room and the basement proper, the last being occupied by an adjoining department store. That this ventilating system is an efficient one is noticeable at once upon entering these rooms, which have not the hot, stuffy atmosphere which is so often encountered in underground rooms near a boiler plant. The fans are all motor-driven, and with one exception the silent-chain drive is used. The discharge from the exhaust fans is carried to the roof, where no inconvenience to tenants is possible.

As the boiler room is 45 feet below the level of the street, the sewage has all to be pumped to the city sewerage system, which is but five feet below the street level. This is done by compressed air at 25 pounds pressure to the square inch. Compressed air is also used for various purposes about the building, especially in physicians' offices. For supplying this air three air compressors are at present used, two of the horizontal type and one vertical. They are all driven by five-horsepower motors with silent chains.

Fig. 4 is a view of the refrigerating plant, which is located on the same floor with the generators. The plant was installed by the Carbondale Machine Company and is of the type using exhaust steam to vaporize the ammonia. Three hundred gallons of water can be cooled in an hour by this plant from a temperature of 75 to 35° F. In Fig. 5 (18) represents the generator, upon which is mounted the analyzer (19). Farther to the left is the condenser (22), absorber (23), and drinking-water tank (24). The ammonia pump is numbered (25) and is driven by a Crocker-Wheeler 13/4-horsepower motor by silent chain. Water for drinking comes from the city mains and is received in a circulating tank, the circulating being accomplished by a triplex pump, driven by a four-horsepower motor.

D. H. Burnham & Co. of Chicago were the architects for the building and J. E. Lawrence is the chief engineer.

Paris Metropolitan Railway.

The Paris Metropolitan Railway Company, when it first gave service in 1900, placed on line No. 1 a number of single-truck cars both for motor and trail cars. On lines 2 and 3, when new material was ordered, double-truck rolling stock was brought into use. This was, however, not considered feasible in respect to line 1, because of the existing short-curve radius. This difficulty, however, has now been overcome and double-truck cars with rounded ends have just been approved and placed in service on line No. 1. These cars are arranged with total capacity of 75 passengers, of whom 46 can find seats. The floor of the cars is of sheet-iron and the motorman's cabin is likewise protected. The Metropolitan company has finally adopted the double-truck car, and the small cars hitherto used will be suppressed or modified accordingly.

A new power station in the northwest of Paris, situated at St. Ouen, is fast approaching completion, and the first machine is ready to be put into service. This power station was constructed especially for the needs of the Paris Metropolitan railway by a separately formed company, and the machinery already installed and to be started up in service in January next consists of three Brown-Boveri-Parsons turbo-alternator groups of 5,000 kilowatts, 25 cycles, 5,500 volts, three-phase; one similar unit of 3,000 kilowatts; two turbo-exciter groups and one motor-generator group of 250 kilowatts. This machinery will be duplicated according to the needs of the Paris Metropolitan railway, the fourth line, comprising the southern circular route, being about to be placed in service.

It may be surprising to American readers to note that such an important railway as the Paris Metropolitan (comprising 80 miles of double track, when completed) should consent to pay out large sums annually for the supply of current in lieu of constructing its own central station, as in other cities. It is true the Metropolitan (Bercy) station, owned by this company, contains about 14,000 kilowatts of generating machinery, direct-current and alternating. It is not proposed to make any addition to this station, but to purchase current from outside sources. The reason of this is the fact that the Metropolitan company works under a concession from the city of Paris, and its property at the end of 35 years reverts to the city of Paris at a bare valuation. The probable loss which will be sustained thereby offers scant encouragement to the company to build expensive power stations, with consequent charges on its capital and revenue. Thus, at the end of the concession, it is expected that the city, which will work the railway, will be obliged to continue the purchase of current from the power stations already existing rather than expend large sums on new central stations.

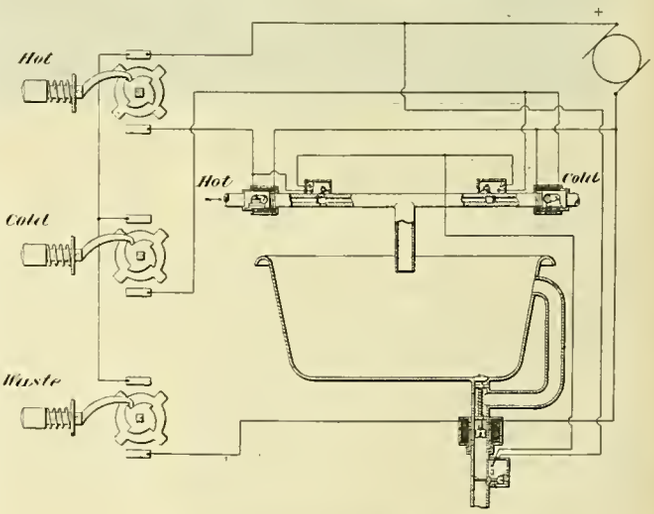
A 500-mile Trolley Trip.

William Pierson of Wabash, Ind., recently made an electric-railway journey of 500 miles in 36 hours. He left Wabash, Ind., on Saturday afternoon at 1:20 o'clock, going to Fort Wayne over the Wabash Valley line, thence over the Fort Wayne, Van Wert and Lima to Lima, Ohio, where he caught a Dayton and Troy car to Dayton. From Dayton he took the Dayton and Western to Richmond, Ind., and from Richmond he went to Indianapolis over the Indianapolis and Eastern. At Indianapolis he took the Indiana Union Traction for Marion, where he completed his journey by returning to Wabash over the Indiana Northern. The total mileage traveled was somewhat in excess of 500 miles and the time was 36 hours.

Electromagnetic Valves for Bathrooms.

Isaac G. Waterman of Santa Barbara, Cal., is the patentee of a number of inventions in the line of electromagnetic valves for controlling the flow of water to wash basins, bathtubs, etc. In all, there were issued to Mr. Waterman on October 24th 14 United States patents for such electrical devices. The one illustrated diagrammatically herewith shows the electromagnetic-valve principle applied to the supply taps and drain pipe of an ordinary wash basin, so that by merely pressing different buttons hot or cold water may be turned on or the valve in the drain opened.

As plainly illustrated in the diagram, the valves controlling the various pipes are operated by electromagnets which are energized by circuits controlled by the three push buttons shown, marked "hot," "cold" and "waste." These buttons are normally held out by springs. Upon pushing in a button the dog on the end engages a notch in the circuit connector, and upon releasing the button the spring acts to revolve the circuit closer. Another push of the button performs the same operation and the circuit is opened.



ELECTROMAGNETIC VALVES FOR BATHROOMS.

German Fire-alarm Cable System.

By Dr. Alfred Gradenwitz.

Absolute safety of operation is obviously the most important point in connection with fire-alarm signaling plants. Both the apparatus itself and the line should be entirely reliable. On this account cable lines are mostly installed in the more extensive German plants, which are either laid in the earth or introduced in tube conduits. The cable for the former alternative is illustrated in Fig. 3.

Fig. 1. Conduit Construction in Charlottenburg.

Fig. 2. Cable Following Wire Brush Through Conduit.

GERMAN FIRE-ALARM CABLE SYSTEM.

showing a three-strand caoutchouc cable, which type of cable is used most frequently in this case. Conduit cables are, on the other hand, employed to advantage wherever the street body is taken up to a great extent by drainage, gas and water pipes, so as to expose the cables to the risk of damage. Either lead cables or cables having a non-bitumized sheathing are used to this effect.

When the fire-alarm signaling plant of the city

Fig. 3.

Fig. 4.

GERMAN FIRE-ALARM CABLE SYSTEM.

of Charlottenburg, Germany, was reconstructed some time ago a type of half-armored conduit cable (Fig. 4) was chosen. This is a three-strand paper-fiber cable with copper conductors 1.5 millimeters in diameter and with half-armor—that is, with the armor partly open, the outside protecting wires facilitating the introduction of the cables. The three strands of the cable are used for the signaling and telephone services, respectively.

The cables were laid in slab-shaped cement blocks having two, three or four openings, designed as channels, either in individual layers or in several layers superposed above one another. This method of channel construction is represented in Fig. 1. The channels are interrupted by pits at given distances, these pits serve for introducing the cables and for making the cable-joining sleeves, which in this case were made from lead.

The operation of introducing the cables into the conduits is illustrated in Figs. 2 and 6. A steel-wire rope is drawn through the conduits by means of a zinc-plated iron wire, which, during the construction of the channels, was introduced into the cement conduits. This steel-wire rope introduces a steel brush (Fig. 2), followed by the cable. At the same time the iron wire is removed, in order to be again available for the subsequent cable. The brush running in front of the cables removes from the conduits any foreign matter, such as sand, small stones, wood particles, etc., liable to damage the cable on its introduction. In order to avoid any friction on the edges of the pits, the cable, at the admission and outlet pits, is run over guiding rollers, as seen in Figs. 2 and 6.

The installation of a fire-alarm box and the opening of one of the pits referred to are represented in Fig. 5, while a fire-alarm box in working order will be seen in Fig. 7.

All the apparatus and cables were supplied by Siemens & Halske, to whose courtesy I am indebted for the illustrations herewith reproduced.

FIG. 5. INSTALLATION OF FIRE-ALARM BOX AT PIT OPENING IN CHARLOTTENBURG.

Vermont Electrical Association.

The Vermont Electrical Association held its third annual convention at the Berwick House in Rutland, Vt., on October 25th. Fourteen members were present besides the visitors. After a business session several good papers were read. The papers were on the subject, "Electrical Heating Apparatus," and were read by C. W. Richards of Boston, Robert Kuhn of Detroit and H. J. Manger of Schenectady. There was an exhibit of electrical appliances, including heating apparatus, arc lamps, porcelain goods, motors, meters, etc. In the way of entertainment the guests visited the West Rutland marble quarries and the plant of the Chittenden Power Company at Menden.

Officers elected for the ensuing year are as follows: President, E. E. Gaige of St. Johnsbury; first vice-president, George S. Haley of Rutland; second vice-president, E. E. Larrabee of Bennington; secretary and treasurer, C. C. Wells of Middlebury; executive committee, Frank Barney, Jr., of Springfield, Frank Collins of White River Junction, J. E. Davidson of Montpelier, F. H. Parker of Burlington and E. D. Blackwell of Brandon.

Fig. 6. Introducing Cable in Conduit.

Fig. 7. Fire-Alarm Box Complete.

GERMAN FIRE-ALARM CABLE SYSTEM.

International Waterways Commission.

The International Waterways Commission (see Western Electrician of September 23, 1905, page 235) has passed the following resolution, copies of which have been forwarded to the United States and Canadian governments:

"Resolved, That this commission recommends to the governments of the United States and Canada that such steps as they may regard as necessary be taken to prevent any corporate rights or franchises being granted or renewed by either federal, state or provincial authority for the use of the waters of the Niagara River for power or other purposes until this commission is able to collect the information necessary to enable it to report fully upon the conditions and uses of these waters to the respective governments of the United States and Canada." (Signed.) J. P. Mabee, chairman Canadian section; O. H. Ernst, chairman American section.

It is not fully understood at Niagara why the commission felt called upon to take this action. The commission was appointed, it is understood, to consider lake levels, and apparently has nothing to do with the bed of the Niagara River, especially as the Niagara River and its power development are dependent upon the overflow of Lake Erie for their existence. It is probable that the United States government will refer the subject to the state of New York and the Dominion government to the Province of Ontario, which latter governments control the granting of franchises for power at Niagara.

The International Waterways Commission will soon consider draft regulations requiring additional works on the part of all the power companies on both sides of the river Sault Ste. Marie. The object is to maintain the navigation of Lake Superior unimpaired. When all the information regarding the situation at the "Soo" is before the commission a meeting will be held at Ottawa to prepare legislation for enactment by Congress and the Dominion Parliament, by which all the "Soo" power companies must be governed.

Mr. Sprague's Protest.

As noted in a recent issue of the Western Electrician, Frank J. Sprague has protested against the New Haven railroad's decision to use alternating-current locomotives on its New York and Stamford division, running into the Grand Central Station in New York city. His views have been opposed by Calvert Townley of the road in question, Dr. Louis Bell of Boston and E. C. Boynton of New York. To these Mr. Sprague makes reply, and among other things he says: "I am beginning to believe that I am a better friend of rational alternating-current development, applied in a rational way to railway operation (while maintaining that the limit of direct-current operation is by no means reached), than a majority of those who sing its praises on a single strident but ofttimes unmusical note, even if I am unwilling to see its present injection into the densest section of the train movement of two great railway systems with almost inevitable adverse consequences."

Overhead Construction for Electric Railways.

Harry P. Davis and Theodore Varney of Pittsburg, Pa., have recently patented some improvements in overhead construction for electric railways which are worthy of attention. The two patents alluded to were assigned to the Westinghouse Electric and Manufacturing Company, and the illustrations given herewith show the characteristic features of the devices.

Fig. 1 represents a bracket and suspension de-

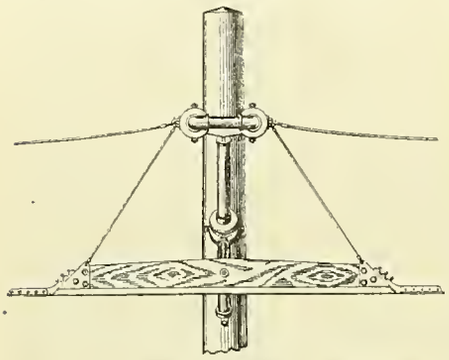


FIG. 1. OVERHEAD STRUCTURE FOR SUPPORTING TROLLEY WIRES.

vice fastened to a suitable pole. The cut shows an elevation looking toward the bracket from the front, and therefore does not show its extension out from the pole. Two sections of the trolley terminate at the suspension and are fastened to two metal castings which are carried by a bridging bar of wood or other non-conducting material. The castings are provided with a convenient clamping arrangement to hold the up-turned ends of the trolley wires. A laterally extending arm carries a double-arm extension provided with insulators which support the rods or links by which the eastings on the two ends of the bar are hung. The castings are connected by a conductor on the under side of the bar.

A suspension structure is described in the second patent (Fig. 2) which embodies two messenger cables, located side by side and at approximately the

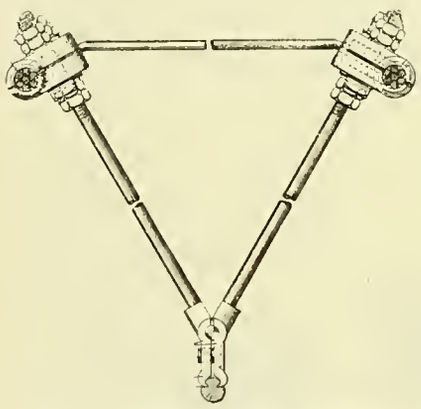


FIG. 2. TRIANGULAR TROLLEY SUSPENSION.

same level. A triangular frame supports the trolley wire, the horizontal leg of the triangle terminating at clamps on the messenger eables. The suspension rods of the triangle are bent at the lower end at right angles to their length, the bent ends fitting into L-shaped reeesses in the lower clamping member which supports the trolley.

Large Department Stores Change to Central-station Service.

Three of the large department stores of Chicago have lately abandoned the operation of electric-light and power plants of their own to take the serviee of the Chieago Edison Company. The largest of these is The Fair, which has operated a plant of its own for nearly 20 years. This establishment will require in its large building at State and Adams streets current to supply the equivalent of 27,000 16-candlepower lamps, ineluding 1,200 arcs and 500 horsepower in motors. Of the elevators in the building four are now electrieally operated, and others will probably be equipped with motors. Another large State Street store that has just taken the Edison current is that of Rothschild & Co., which will require the equivalent of about 17,000 16-candlepower lamps. The isolated plant in this store was originally equipped with the Thompson-Ryan dynamos, which attracted much attention some years ago. The third store is that of Evan Lloyd & Co., which will require "juice" for the equivalent of 5,000 16-eandlepower lamps.

Electric Motors and Their Applications.

Practical information concerning the speed-torque and other important operating characteristics of motors is valuable to engineers of industrial plants where motor-drive has been adopted, and to those who contemplate making the change from the old system of shafting to the modern and more satisfactory method of motor operation. In a paper recently read by W. Edgar Reed before the Engineers' Society of Western Pennsylvania the author makes some important observations concerning the classification of motors and their operating characteristics. According to their characteristics he divides the various types of motors into three groups, namely, constant-speed, variable-speed and compound motors. He then goes on to explain the operating features and peculiarities of the different machines and the particular field to which each is adapted.

Constant-speed Motors.

Constant-speed motors give, under normal conditions, practically constant speed for all torques and horsepower outputs within the range of the motor. The synchronous motor gives absolutely constant speed if the cycles of the eircuit upon which it operates remain constant. The other types coming

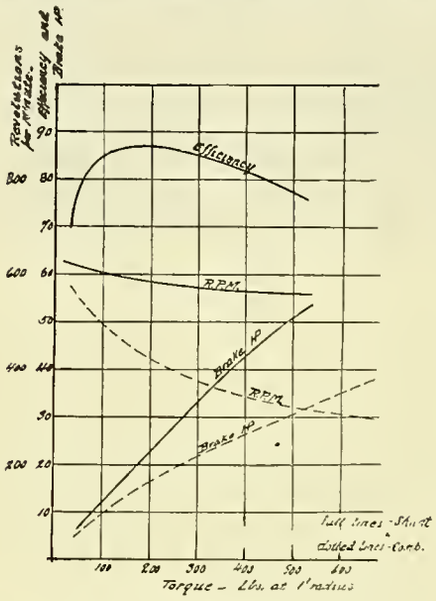


FIG. 1. GENERAL CHARACTERISTIC CURVES OF CONSTANT-SPEED MOTORS.

under this head do not give constant speed, but the variation is small, within the capacity range of the motor. This variation differs for different sizes of motors and is generally a little less as the size increases. It can also be varied by the design of the machine. Five per cent. may be taken as a very general figure to get some idea of the average value of this variation from no load to full load. The general characteristics of constant-speed motors under varying loads is shown in Fig. 1. This is a curve of a shunt-wound direct-current motor, but it represents the general characteristics of other constant-speed motors. In this curve the torque developed by the motor is taken as abscissas and the revolutions per minute brake horsepower and efficieney in per cent. as ordinates. This curve shows that the speed remains practically eonstant for all torques and horsepowers developed up to about 50-per cent. overload. The motor automatically adjusts itself to give constant speed when different loads are required of it. The efficieney is zero at no load and rises rapidly as the load comes on, reaching a maximum somewhere near full load and then gradually drops off at heavy overloads. The brake horsepower, which is proportional to the speed and torque, is practically a straight line for loads up to about full load, dropping off gradually with heavy overloads.

In order to give a general idea of the values of the starting and maximum torques and the corresponding currents taken from the line for the constant-speed motors, the following comparative table is given. These values ean be changed in any particular design to obtain speeific results, but Table 1 gives the average values for standard motors now built by the best manufaeturers:

TABLE 1.

	Amps. in Line for Full-load starting Torque.	Max. Starting Torque Times Full-load Torque.	Amps. in Line for Max. Starting Torque.
Shunt-wound	1.0	2.5	2.5
Polyphase induction { short-circuited rotor	3.0	2 to 2.5	6 to 7.5
Polyphase induction { wound rotor	1.2	2.	2.4
Single-phase induction with clutch pulley	2⅔ to 3⅔	1¼ to 1½	2½ to 3½
Synchronous	No starting torque.	0.	

The temperature rise of both the alternating and continuous motors is in general about 40° C. for

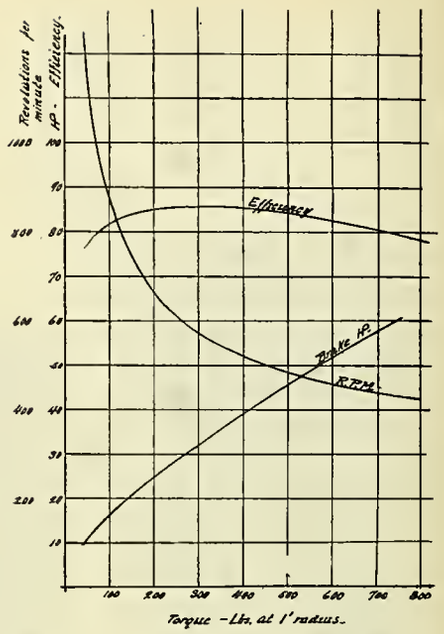


FIG. 2. CHARACTERISTIC CURVES OF SERIES-WOUND MOTORS.

continuous running at full load. The motors will also stand 25-per cent. overload for two hours, with 50° C. rise and 50-per eent. overload for one hour without injury; also 75-per cent. to 100-per cent. overload momentarily.

In general, then, for constant-speed work, where a very good starting torque is required, starting is not very frequent, the shunt and starting torque is zero and some other means is used for bringing up to speed, the synchronous motor will give very good speed regulation, and when only single-phase circuits are available the single-phase induction motor is used.

Variable-speed Motor.

The variable-speed motor is one whose speed automatically varies greatly for the different torques and horsepower outputs required of it. This variation is different for different designs of motors, but, as a very general figure to compare with the other types, this variation for series-wound motors will be from 40 per eent. to 75 per cent. increase when the load is reduced to half the normal value, and for polyphase induction motors under the same variation of load the speed will increase from 10 per cent. to 15 per cent. This variation for equal percentage change in load will be different for different parts of the curve, as it has not nearly a straight line form. The general characteristics of this type of motor are shown in Figs. 2 and 3, Fig. 2 being for the series-wound continuous, or single-phase

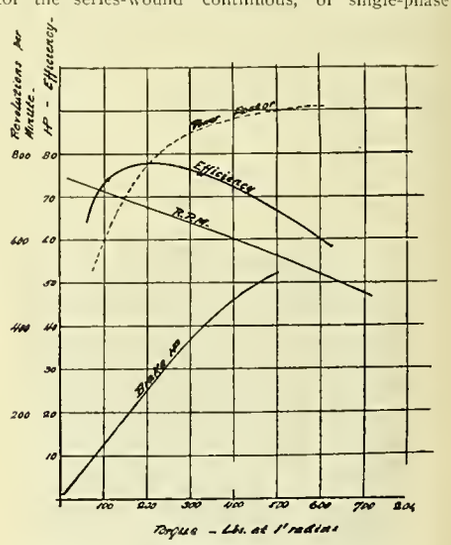


FIG. 3. CHARACTERISTIC CURVES OF POLYPHASE INDUCTION MOTORS.

series-wound alternating-current motor, and Fig. 3 being for the polyphase induction motor.

The characteristics of the motors shown in these figures are quite similar to each other except for the speed curves, which have a different flexion, the general form of curve, except speed, being nearly the same as in Fig. 1. These curves show that the maximum speed of the induction motor approaches a limit when the load is decreased. This limit is equal to the alterations of the eircuit divided by the number of poles of the motor. The speed of the series motor, however, continues to increase as the load is diminished, and at very light loads they are liable to run much too fast. The

series-wound motor should then never run at very light loads or empty, or it may run off and burst.

Table 2 shows the maximum starting torque and the current required from the line to develop this torque, together with the current required to give full-load starting torque:

TABLE 2.

	Amps. in Line for Full Load Torque.	Max. Starting Torque.	Current to Give this Torque.
Series continuous current	1.0	5 to 6	2.5
Series alternating current, single-phase	1.0	5 to 6	2.5
Induction polyphase. { Short-circuited rotor	1¾-2¼	4 to 5	8 to 12
Induction polyphase. { Wound rotor	1.2	3 to 4	3½ to 5

Comparing tables 1 and 2, it will be of interest to note the difference in value of current from the line for constant and variable-speed motors when developing full-load starting torque, and the difference in starting torque that is developed with the same current. This comparison shows why variable-speed motors are used for work requiring frequent starts and large torques.

Since these motors are run at variable speeds and outputs there is no definite horsepower rating that will easily represent the temperature rise of the motor under variable speeds and loads, and in order to have some basis of comparison for different-size motors, they are generally rated at the horsepower they will develop for one hour with a temperature rise of 40° C., 60° C. or 75° C. Or better still, curves may be made which show how long the motors will run at any output for this same temperature rise. The limit of the maximum rating of a variable-speed motor depends upon the losses in the motor and the commutation, and the best way to determine whether the motor is large enough for a particular service is not by the horsepower rating but by getting the average losses during a certain length of time or cycle of operations and determining whether it can stand these average losses without undue temperature rise. The maximum torque required must also be considered to see if the motor can develop this torque without undue sparking and heating.

This type of motor on account of giving great variation in speed for changes of load is not suited for constant-speed work, and, on account of its good starting characteristics, as shown in the table, and the small amount of current required to give this starting torque, it is especially suited for work requiring frequent starts, such as cranes, elevators, etc.

Compound Motors.

The compound-wound motor has some of the characteristics of the constant-speed and some of the variable-speed motors. The speed variation with change in load is greater than that for the constant-speed motor and less than that for the variable-speed motor. The maximum starting torque is greater than that for constant-speed and less than that for variable-speed. The current for a given starting torque is more than that for the variable-speed motor and less than that for the constant-speed motor. In Fig. 1 the dotted lines show the general characteristics of this type of motor. The curves are plotted similarly and are similar in general form to the preceding curves with the exception of the speed curve, which is a compromise between that of the variable and constant-speed motors. In different designs these starting and speed characteristics can be changed greatly.

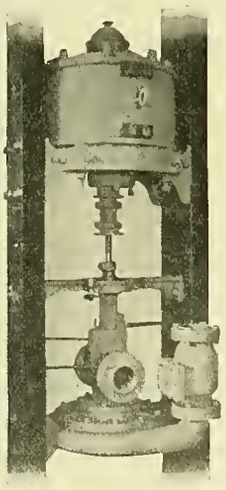


FIG. 4. VERTICAL INDUCTION MOTOR DRIVING CENTRIFUGAL PUMP.

The so-called compound-wound motor is only of the continuous-current type, but polyphase induction motors of the short-circuited or wound-rotor types are made which have nearly the same operating characteristics.

The performances of the different types of motors, under uniform conditions of constant voltage, cycles and rotor resistance, are changed if some of these factors are changed. If the voltage applied to the armature of a shunt motor or the strength of its field magnetism be varied the speed will be changed accordingly. If the field magnetism remains constant and the armature voltage is reduced the speed will be reduced in the same proportion and will then remain constant at this reduced speed so long as the above conditions remain unchanged. As the resistance of the rotor or the wound-rotor induction motor is increased the speed diminishes, or as the voltage applied to any induction motor is diminished the speed diminishes. If these factors are changed for the variable-speed motors their speeds will also change in a similar way. There are a great many ways of varying the speed of motors which are too numerous to take up in this paper. One of these is the interpolar motor, which permits of a great variation in speed by changing the field strength on the maximum size frame.

The system of operating apparatus at any one of a different number of speeds is known as variable-speed control and it renders motors especially applicable to work which requires small increments of speed over a wide range. This control is especially suitable to the operation of shunt motors for driving machine tools whereby rapid and economical production is attained. It is also applied to variable-speed motors in crane and railway work, etc.

Having given the general characteristics of the three classes of motors, Mr. Reed went on to describe a few of the many applications in actual installations. One application mentioned was that of both alternating-current and direct-current motors in mines for driving centrifugal pumps. Fig. 4 is a view of an alternating-current induction vertical motor driving a centrifugal pump for such purposes. For triplex pumps, or pumps which require very nearly constant torque during the entire revolution, constant-speed or compound motors are applicable. For single-cylinder pumps, which require varying torques during a revolution, the compound-wound motors should be used to keep down the fluctuations in current. A great saving in starting current can be made for motors which are required to start up under a pumping head if a by-pass is used for the water until the motor is up to speed. The by-pass should then be closed slowly so as to load up the motor gradually.

Chicago Street-railway Situation.

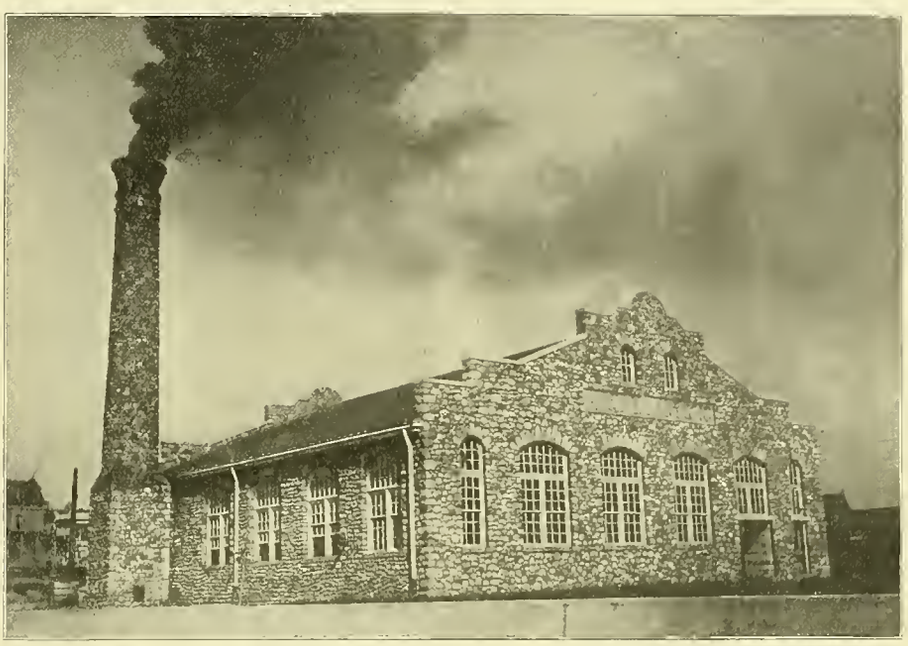
Pressure brought to bear by the local transportation committee of the Chicago City Council induced Mayor Dunne to depart a bit from his policy of granting no more permits to the traction companies for improvements to their systems. Last week he finally ordered permits issued to the Chicago City Railway Company, allowing it to lay electric feed wires necessary properly to heat the additional electric cars put on recently. The company is now at work making the connections.

In addition to repeated defeats in the City Council, Mayor Dunne is having other troubles. His special traction counsel, Clarence S. Darrow, has resigned. Mr. Darrow says he does not think he can do anything more at present to help out the plans for the success of municipal ownership and expresses the belief that nothing more can be done in this direction until after the spring election. It is hinted, however, that Mr. Darrow is not in sympathy with the mayor in some aspects of the traction question.

A Cobblestone Power House.

The interesting picture shown herewith illustrates an electric power house of attractive appearance, though of unusual construction. There are many brick power houses, a few concrete power houses, and some of corrugated iron and wood; but here is a power house built entirely of cobble or field stones from the foundation to the chimney top, and the completed structure presents a very pleasing exterior.

The plant is owned by the Mt. Clemens Electric Company of Mt. Clemens, Mich., of which Alex. Jacobi is the secretary and manager. The power house illustrated is situated on the Clinton River, and the picture shows the rear and south side of the building. As before stated, it is built of cobblestones, which are set in cement. The roof is of tile—the only outer portion not made of stones—supported by steel trusses, and the floor is of concrete.



COBBLESTONE POWER HOUSE AT MT. CLEMENS, MICH.

The stack is 65 feet high and is nine feet square at the base.

The builder of this unique structure was George H. Nichols of Mt. Clemens, and it was completed November 1, 1904. Since then it has not settled a particle.

The present capacity of the plant is 250 kilowatts in incandescent lighting and 300 kilowatts in 6.8-ampere direct-current series arc machines. The company has a contract with the city for 113 street arcs at $58.12 per light per year (moonlight schedule). The commercial rate is on the sliding scale, averaging about 11 cents a kilowatt.

The president of the company is W. S. Donaldson. F. E. Nellis is vice-president.

Chicago-Indianapolis Interurban Connection.

The Chicago, Lafayette and Southeastern Traction Company has been chartered, capitalized at $100,000, and its incorporators are William S. Reed, William N. Harding and others. The headquarters will be in Indianapolis. The object of the corporation is to build an electric railway between Lafayette, Ind., and Kankakee, Ill., where it will connect with a line now building from Kankakee to Chicago, and at Lafayette it will connect with the Indianapolis and Northwestern and thus form the necessary link in the chain of lines from Indianapolis to Chicago. Mr. Harding, one of the chief promoters, says that the enterprise has been financed and that surveys and the actual construction of the line will begin without delay.

Detroit Municipal Plant Accused of Faulty Wiring.

The Detroit correspondent of the Western Electrician writes: "The verdict of the jury which listened to the testimony in the inquest on the death of Rudolph H. Zeigler, who was killed in the basement of his store by shock through the wires of the Co-operative Telephone Company, charges gross negligence in the stringing of the Public Lighting Commission's wires with which the telephone wires came in contact. Some proper method of inspection is being talked of for all overhead wires by the lighting commission."

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DATES AHEAD.

Ohio Society of Mechanical, Electrical and Steam Engineers (annual meeting), Canton, Ohio, November 17th and 18th.

Automobile Club of America (annual exhibition), Sixty-ninth Regiment Armory, New York City, January 13th to 20th.

Chicago electrical exhibition (first annual exhibition of Electrical Trades Exposition Company), Coliseum, Chicago, January 15th to 27th.

SEVERAL recent cases of X-ray burns—if the destructive action of the X-ray on human tissue may be called a burn—direct renewed attention to the necessity of great caution in using this mysterious radiation, both on the part of operator and patient. Just what is the chemical action of the ray on the tissue is not known, but experience shows that its effects may be very serious, causing deep "burns" which are very hard to heal. It is also alleged that the injury is apt to result in skin cancers, and at least one death is ascribed to the X-ray in this manner.

THIN INSULATION, if effective, has readily discernible advantages. Therefore, the announcement from Germany that a new insulated wire has been produced in which the insulation is exceedingly thin, but at the same time a successful dielectric, possessed of elastic properties, is worthy of note. This new insulation, when used for very fine wires, is formed by acetic cellulose applied by a special machine. Although tough, supple and elastic, the insulation is said to have a thickness of but 0.03 millimeter. It is further asserted that the insulation is unaffected by humidity or a temperature of 150° C., and will suffice for a tension of 1,500 volts. For coarser wires up to two millimeters in diameter the insulation is formed of another substance of similar qualities, resembling enamel in external appearance. The latter form possesses nearly perfect elasticity and flexibility, with insulating qualities permitting it to withstand 2,000 to 2,500 volts. Unaffected by humidity, it resists a temperature up to 200° C. The insulation being exceedingly thin (between 0.015 and 0.025 millimeter) its success in many applications appears to be assured.

TUESDAY'S elections afford no great comfort to the municipal-ownership people. In New York city Mr. Hearst, running on a municipal-ownership platform, came very near being elected mayor—in fact, he insists, at this writing, that he was elected—but this fact by no means indicates that the 225,000 men who voted for him favor municipal ownership, although very likely a considerable proportion of them do. Many thousands of voters, particularly in Brooklyn, where Mr. Hearst led the poll, cast their ballots not so much because they believed in municipal ownership, but as the most effective manner of rebuking the Tammany administration and the existing order of things. There is no doubt, for one thing, that many, disgusted at the insurance scandals, voted for Hearst with the idea that, if elected, their candidate would use the lancet on the ulcers on the body politic with salutary effect. Municipal ownership did not enter especially into the calculation of these dissatisfied citizens.

In Toledo the followers of the late "Golden Rule" Jones carried the city and elected as mayor Mr. Whitlock, described as a "young novelist." The question of municipal ownership of the lighting was involved and was carried in the affirmative by a small majority.

Chicago had a quiet election, but it is significant that the candidates of Mayor Dunne's political party—embracing some of his close political friends—were all defeated. Still more encouraging is the fact that an avowed opponent of municipal ownership of the street railways was elected as alderman in the Twelfth Ward. By the death of an alderman it became necessary to elect a successor in this ward, although usually aldermen are elected at the spring elections. The successful candidate ran on a platform favoring the passage of franchise-extension ordinances and was elected by over 2,000 plurality—a two-to-one vote. This ward is on the West Side and may be taken as representative of the average citizenship of Chicago—a mean between the "silk-stocking" and "river wards." It is therefore of considerable importance that in the first aldermanic election since Mayor Dunne took office a candidate declaring for private ownership rather than the mayor's impracticable public-ownership ideas should be thus triumphantly elected.

One of the propositions placed before citizens of Chicago at the polls on Tuesday was the provision for an act authorizing the city to sell "surplus electricity" and to regulate the price of gas and electricity. This proposition was of interest to the voters, as shown by the fact that the votes cast upon it were greater in number than for any of the other propositions on the "little ballot." The vote for adoption was 124,545 against 20,504, or about six to one. The act authorizes the city to sell "surplus electricity" for heat, light and power and to prescribe by ordinance the maximum rates and charges for either gas or electricity produced by corporations other than itself. These rates and charges may be fixed for a period of five years, but if the rates are believed to be unreasonable, provision is made whereby they may be reviewed by the Circuit Court of Appeals. However, the city has at the present time no "surplus electricity" from its street-lighting plants, for Chicago is most inadequately lighted, as everybody knows. Furthermore, there is slight prospect that there will be any surplus of current available for sale for many years.

AN EVENT of more than ordinary interest to all electrical students marked the closing days of the Liége Exposition. This was the unveiling of the monument to Zénobe Gramme, inventor of the armature that bears his name and one of the leading figures in the group of men to whose indefatigable labors the world owes the dynamo-electric machine. The monument is of granite, in three parts, the first representing Gramme in his youth, the second in middle age, meditating over his inventions, and the third as crowned by the Genius of Electricity.

Gramme lived long in France, and many Americans would be apt to think of him as a Frenchman, but he was in fact a native of Belgium, born near Liége, where his monument stands, and the location of the memorial is therefore an appropriate one.

Born in 1826, of poor parents, Gramme had few early advantages. His education at school was scanty, and he started life as a woodworker or carpenter. By dint of industry and study, about the year 1851 he attained a position sufficient to pass him through the professional schools at Liége, and in 1856 he went to Paris, where he soon designed several interesting pumping machines, including a machine for heating water by friction. His observations alone enabled him to define the principles bearing on machines of centrifugal force. In 1860 he entered, through the kindness of an old friend, the Société l'Alliance, in Paris, where he perfected the Nollet machine.

Thereafter, armed with a few elementary treatises on physics, he devoted himself to electrical science—a terribly arduous task for one who at each instant was obliged to hunt in the dictionary to understand the technical terms found in his textbooks. His first attempt was an electric regulator, constructed of wood. Working with Rhumkorff and Disdéri, he made, under the direction of Bazin, experiments in electric lighting of Angers slate quarries. In 1867 he took out a series of patents for alternating-current machines, and at the same time entirely gave up practical work to devote himself to his researches.

Without pecuniary resources, he was bravely seconded by his wife and daughter-in-law, and his laboratory comprised a few rudimentary apparatus, magnets and a few pounds of copper wire with insulating material. In 1869 he took out his first important patent for continuous-current machines, and in 1872 was turned out what was really the first commercial dynamo, the forerunner of all subsequent electrical applications of this nature. It was at the Paris Exhibition of 1878 that Gramme was recognized as the great electrical inventor of his day, although he had exhibited at Vienna in 1873 and Philadelphia in 1876. He received the grand prix at this exhibition and pecuniary aid from the French government. He was also the recipient of the celebrated Volta prize and 50,000 francs from the French Academy. He was several times decorated by the French and Belgian governments. He continued working until his death in 1901, and is buried in the environs of Paris.

Gramme's work is of much importance, and it is fitting that an imposing monument to his memory should be erected by his countrymen. The exercises at the dedication of the memorial were of great interest, and we present on another page a brief account abridged from the report in one of our French contemporaries.

The Unveiling of the Gramme Monument at Liége.

The unveiling of the monument erected to the memory of Zénobe Gramme took place on October 7th at Liége, Belgium. This fine memorial was erected at the entrance of the new bridge of Fragnée. The sculptor is the well-known Belgian artist, Thomas Vinçotte. Owing to the inclemency of the weather, the exercises, says L'Electricien of Paris, instead of taking place in the open air, were held in the great hall of the Palais des Fêtes of the Exposition.

The ceremony was presided over by Gustave Francotte, secretary of state for industry and labor. The widow of Gramme occupied the place of honor, and near her were seated the members of the family. The band of the Twelfth Regiment of Infantry furnished music during the programme, and after playing the "Brabançonne," the Belgian national hymn, throughout which the entire audience remained standing, the secretary of state introduced as the first speaker Mr. Nyst, president of the committee appointed in 1903 by the Association of Engineers of the School of Liége, organized to commemorate the memory of Gramme.

In his speech Mr. Nyst gave a full report of what had been done by his committee. The idea originated in 1902 at the general meeting of the Association of Engineers of the School of Liége, which passed a resolution deciding that the memory of one of its illustrious members should be honored. The committee asked aid from the government and also from men of high standing in industry and finance. An honorary committee was constituted among the people called upon, and Mr. Montefiore-Levi of Liége, former president of the Association of Engineers, a well-known philanthropist and the creator of the technical electrical school, was named as president. This honorary committee named an executive committee to secure subscriptions, and the efforts of this committee were rewarded with great success. From 1,060 towns, corporations and private individuals there was raised a sum of approximately $20,000. The government, the state and the town of Liége also contributed generously to the fund.

With the amount thus raised President Nyst said that the committee had not only been able to erect the monument to Mr. Gramme but also to place a commemorative tablet on the house of Jehay-Bodegnée, where Gramme was born, to give annually funds enabling pupils of the industrial school of Liége to be sent abroad, and to give to the most deserving pupils of the electrotechnic school medals, which, by the way, were designed by the late sculptor Mathelin.

President Nyst closed his speech by saying that the life of Gramme should be taken as a great lesson for the laboring class, as it should be remembered that Gramme was a mechanic—a carpenter—who by his will, perseverance and genius made his way in the world and realized one of the greatest inventions without the assistance of anyone. Mr. Nyst then, in the name of all the people who had subscribed, presented the monument to the mayor for the city of Liège.

Mr. Kleyer, mayor of Liége, then spoke, saying how grateful the town of Liége was to possess such a monument, and stating that his country, and especially the city of Liége, was proud of the fact that Gramme was born at Jehay-Bodegnée in 1826. He then gave a short biographical sketch of the great inventor, the substance of which is as follows:

When Gramme came to Liége in 1855 he was simply a carpenter. For two years he attended the night classes of the Industrial School and there learned the elements of drawing, physics and geometry applied to mechanics, and this rough knowledge was greatly to influence his future.

In 1857 Gramme went to live in Paris and there he lived until the time of his death, but he always remained loyal to his native country and loved often to speak in his mother tongue, the Walloon. The first continuous-current dynamos, built from his designs and used in Belgian, were manufactured by the Jaspar firm.

Mr. Kleyer called attention to the fact that the invention of Gramme is only 35 years old, as his first patent was granted November 22, 1869. He closed with the remark that Gramme's invention was the beginning of that enormous electrical industry which has practically transformed modern life.

The Secretary of Industry and Labor, Mr. Gustave Francotte, in a much-applauded speech, said that Gramme had enlarged the horizon of human knowledge and that "men are grateful to those who, like Gramme, have honored by their work their native country and realized progress for the welfare of humanity." After congratulating his fellow-countrymen, who had shown their gratefulness and respect to Gramme, the president introduced Mr. Eric Gerard, president of the Electrotechnic Institute of Montefiore.

The speech of Mr. Gerard was very interesting, as he gave information regarding Gramme which is not generally included in his biographies. Gramme was not a brilliant pupil when he was young, and he only showed his remarkable ability when he began to study electricity. From that day Gramme had no other thought in life than to succeed and realize what he thought possible. It is remarkable that this young man, who could never learn to spell correctly, was born to solve one of the greatest problems of applied mechanics. Mr. Gerard heartily thanked France, who was so hospitable to his fellow countryman, and he specially thanked such well-known scientists as Mascart, who encouraged Gramme in his work and later claimed for him the highest honors.

Gramme worked as constructor of models in the shops of Alliance, where was then built an electrical generator invented by Nollet, a Belgian. It was there that Gramme began the study of electricity. When he had some ideas of his own and wanted to experiment he was not encouraged by the Alliance company. He then left and went to work at the Ruhmkorff shops, and after some time went to work at the Disden shops in London.

As far as is known, the idea of a continuous-current dynamo came to Gramme in 1867. He then abandoned his situation and began to work for himself in a small lodging, where his laboratory was a kitchen and his materials were rough pieces of iron and copper wire. His wife and daughter-in-law helped and encouraged him when he became discouraged and his will power permitted him to overcome difficulties.

When his invention was practically completed he obtained a patent and then tried to find someone who would help him financially to succeed. A man who should be remembered, Hippolyte Fontaine, understood the value of the discovery of Gramme and gave him very liberal assistance.

Mr. Gerard made the statement that he was always impressed by the fact that great discoveries have often been made, practically simultaneously, by two different men who have absolutely no knowledge of the researches of the other. Newton and Leibnitz discovered infinitesimal analysis at the same time; Green, and quite independently, Gauss, discovered the difference of potential. Other examples could be cited. In 1860, in a small town in Italy, a university man, Prof. Pacinotti, made an electric generator whose principle and general construction are practically identical with the generator invented by Gramme.

Pacinotti was a theoretical man and his work was of an absolutely scientific nature, and as he had no industrial relations he never tried to put his invention into practice. Gramme never had the slightest knowledge of the discovery of Prof. Pacinotti, and it is absolutely certain that as inventor he must receive the whole merit of having found out an entirely unknown electrical device.

Many testimonials have been given to Gramme showing that no contestation could arise from Pacinotti's prior discoveries. Werner Siemens, in a speech made in Berlin, January 27, 1880, concluded from a general history of electrical machines that Gramme was the first person to realize a practical industrial electrical machine producing direct current.

In 1898 the illustrious fellow countryman of Pacinotti, Farraris, declared publicly that Gramme was the inventor of the industrial dynamo.

Following Mr. Gerard, E. Hospitalier, in the name of the French electricians, said he thought that it was only justice to erect a durable monument to the memory of Gramme. He seemed sorry that France had not done so already, as Gramme lived practically all his life in Paris, and the French people had followed the evolution of the ingenious carpenter and had granted him all the honors which he deserved. Mr. Hospitalier said that since 1873 Gramme had received all the honors and wealth to which he was entitled.

Other addresses were made by Léon Janssen, president of the International Union of Street Railways; Mr. de Bast, president of the Association of the Electrical Engineers of the Institute of Montefiore, and Emile Javaux, president of the Gramme Company of Paris.

Mr. Javaux, who was a personal friend and collaborator of Gramme, said in his speech that he alone knew the methods employed by Gramme to obtain his remarkable results. Having no instruments to measure current, Gramme used a simple compass and was obliged to create himself electrical units with which he designed his engines and obtained constants which were utilized until 1880. As the only industrial electric continuous-current generators of the times were primary batteries, he took as a base of comparison the Daniell cell for electromotive force and the Bunsen cell for current. Having invented units—and that is one of the most remarkable features of his work—Gramme was enabled to understand what he was doing, and achieved a practical discovery.

Mr. Javaux closed his speech and all the discourses by stating that Gramme, although he died rich in wealth and honors, admired by experts and leaders of industry in all countries, remained until his last days of existence a good, simple, modest laborer.

The ceremony ended, the people gathered about the monument, and notwithstanding the heavy downpour of rain, the veil was lifted amid general applause.

De Forest Challenges Marconi.

Replying to recently published interviews of William Marconi while in the United States recently, in which it is alleged that unfair comparisons were attempted between work from the large Marconi long-distance space-telegraph stations and that from ships such as the West Virginia, equipped with two-kilowatt apparatus, and others carrying only one-kilowatt transmitters, Lee De Forest has challenged Mr. Marconi to a test of merits. In a public letter addressed to Marconi Mr. De Forest says, among other things: "I hereby publicly challenge you to demonstrate that vessels equipped with Marconi apparatus or like power can successfully transmit to stations using Marconi receivers, legible messages at any speed whatsoever over distances one-half or one-third those negotiated by the apparatus on board the West Virginia, either over land or sea."

Mr. De Forest cites instances where messages have been received from ships equipped by him with one-kilowatt apparatus over distances as great as 1,030 miles, and again of messages received at New York from the West Virginia while anchored at the mouth of the Mississippi, 1,200 miles, almost entirely overland. Successful communications at shorter distances are mentioned. These distances, he says, are, to the best of his information, from three to 10 times greater than any covered by Marhe says, are, to the best of his information, from on shore.

Italian papers have been commenting freely about the relation of the Marconi company with other space-telegraph companies. Opposition papers have agitated so persistently against the contract between the Italian government and Mr. Marconi, which grants an exclusive license to the Marconi company for 14 years, that Mr. Marconi wrote to the Italian minister of posts and telegraphs offering to cancel the agreement. In answer Minister Gualtierotti confirmed the policy of the government in adopting the Marconi system and refusing to permit compulsory exchange of messages between it and other systems. The minister's letter said that any discordant opinion printed in the papers does not reflect either the feeling of the country or of the government.

It will be remembered that compulsory intercommunication was the main point raised during the preliminary space-telegraph conference held in Berlin two years ago at the instigation of the kaiser, and will no doubt form a subject of deliberation at the next conference, which, it is rumored, will be held in Paris.

Proposed General Electric Stock Issue.

A special meeting of the stockholders of the General Electric Company has been called for December 5th to vote upon a proposed increase of $11,674,500 capital stock. This increase will bring the authorized capital stock up to about $60,000,000. In explanation of the new capital stock to be issued by the General Electric Company an officer is quoted as saying that the company's business has increased very largely in the last year. This requires increased working capital, which is to be provided by the stock issue. It is stated that the directors are not contemplating the purchase of any properties, and the price at which the new stock is to come out is said not to have been decided.

A meeting of district managers of the General Electric Company was held in Schenectady last week. Among those reported as present were General Eugene Griffin, first vice-president of the company; B. E. Sunny, Chicago; T. Beran, New York; E. D. Mullen, Philadelphia; C. B. Davis, Boston; Dr. Thomas Addison, San Francisco; General Irving Hale, Denver; A. P. Giles, Atlanta, and J. D. Pevear, Cincinnati.

QUESTIONS AND ANSWERS.

Incandescent and Arc Circuits in Parallel.

An electric-lighting company in Missouri is having trouble with its lighting circuits, which no one in the company seems able to remedy. The problem is this: The company operates a 2,200-volt single-phase alternator at a distance of two miles from the town to be lighted. There are two incandescent and one arc circuit running to the town, where the current is transformed to 104 volts. The arc circuit is 6.6 amperes, constant current. Upon starting up in the evening and cutting in the incandescent circuits the pressure is run up to 2,200 volts at the station, but only 101 to 102 volts can be obtained at the secondary of the transformers. After turning on the street arcs the voltage runs up one or two volts. After running four or five hours the voltage at the secondaries runs up gradually, and upon reducing the pressure at the station to 2,060 volts there is still 106 to 108 volts at the town. The line and transformers have been in use for a number of years. The incandescent and arc circuits are on the same poles. One incandescent circuit is on a two-pin arm at the top of the pole, the other on the inside pins of a four-pin arm below, the arc circuit being on the outside pins of the latter.

ANSWER.

The relative location of the four incandescent and two-series arc wires is such that there is considerable inductive effect as shown by the change in voltage just as soon as the current is turned on in the arc circuit. The second change in voltage after the station has been running four or five hours is probably due to the gradual decrease in load on the incandescent circuits and the resultant change in inductive effect as well as in ohmic drop. A better arrangement on the poles would be to have the two-series arc wires on the two-pin arm at the top and to have the four incandescent wires on the four-pin arm directly underneath.

Who Wants Something Invented?

Roy E. Salls of 220 Church Street, Burlington, Vt., appears to be looking for an opportunity for the exercise of inventive talent. He desires "pointers" in relation to "some needed inventions along the line of cement or plating or packing, etc., for the many machines of the electrical world," such an invention to "prove a success and be an improvement on the old methods." He is anxious to get in touch with "parties who are looking for one of the above proposed inventions."

Equalizer for Direct-current Generator.

A subscriber living in Davis Creek, Cal., wishes an explanation of an equalizer for a small direct-current compound-wound lighting generator.

ANSWER.

Compound-wound generators are generally used in small direct-current systems so that by compounding the generator sufficiently the pressure may be kept up at the more distant parts of the system. The system is generally fed by several separate sets of feeders, each feeder supplying a certain section. It is evident, therefore, that the more distant sections will require a greater pressure than those nearer the station. One way of doing this is by means of a "feeder equalizer," which consists simply of a variable resistance in series with each feeder. The generator is then run up to a pressure suitable for the long feeders and this pressure cut down to normal in the shorter feeders by means of the resistances.

The term equalizer is also given to a wire connecting the ends of two or more feeders for equalizing the pressure, as distinguished from supplying current.

Still another form of equalizer is used with compound direct-current machines operating in parallel. This is known as the equalizer wire or equalizer bus, and its function is to connect the series field coils of the several generators, thereby keeping the pressure of the generators at a uniform value.

The Calumet and Hecla Copper Mining Company's electric power installation, following the completion of which many steam engines will be discarded, is assuming its final shape. In the power house at Lake Linden, Mich., the engines are ready to go into commission and the generators installed. The plant will have a capacity of 10,000 horsepower. Poles have been distributed the length of the company's railway from the stamp mills to the mines at Calumet. The transformer house for lowering the voltage for the mines, shops and waterworks is being built at Calumet.

Twin Terminal Rail Bond.

A form of rail bond which possesses many excellent features, and which has stood the test of several months' actual trial is shown in the accompanying illustrations. The type is entirely new, and competent engineers who are well versed in the subject of rail-bonding have expressed themselves as satisfied that the new bond has a promising future.

As seen in Fig. 1, the flexible body of the bond is provided with two small solid terminals which have exterior hardened copper bosses. The terminals are driven rigidly into holes drilled into the lower edge of the outer side of the ball of the rail. The holes are easily and quickly drilled after being entered with the aid of a template, and these being small and bored into the ball of the rail, the strength of the rail is not impaired.

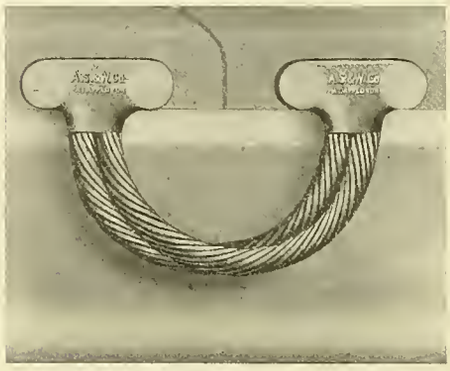
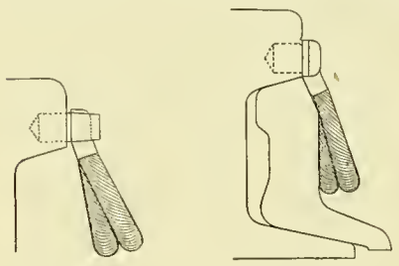


FIG 1. TWIN TERMINAL RAIL BOND.

It will be seen that the bond may be attached without disturbing the rail. The bonds being once in place, cannot work loose or break off, as in the case of the soldered bond, and since they are attached to the upper part or ball of the rail, the flexible body of the bond is held up out of the dirt.

Great flexibility is obtained by the horseshoe shape, and the contact surfaces cannot depreciate, as the holes are actually sealed from air and moisture. This bond may be quickly inspected, due to its exposed position on the rails, and does not induce theft, as it is so small that it hardly contains copper enough, and if installed as directed, cannot be removed except by breaking.



No. 2. Fig. 3.

METHOD OF USING TWIN TERMINAL RAIL BOND.

Figs. 2 and 3 show, respectively, the pin of the bond entered in the hole in the rail, and the bond after the pin has been driven home and the flexible part bent down close to the rail.

This bond is manufactured by the American Steel and Wire Company of Chicago.

Sulphur and Electricity.

A young student in the University of Illinois, Mr. Clarence White, believes that he has discovered the cause of electricity. He has carried out a series of experiments which has led him to believe that sulphur is a necessary adjunct in the production of electric current. The idea was suggested to him a year ago, when he noticed that the color of an electrical discharge and that of burning sulphur were similar. He knew that a current could be produced by heating two dissimilar elements, such as copper and sulphur, but in every instance a sulphide, sulphate or sulphuret is formed, and the resultant reaction produces an electrical current in these instances. He was also aware a current may also be produced by heating one and cooling the other of two dissimilar metals.

In his experiments Mr. White used platinum instead of copper wire, in order to prevent the formation of a sulphide. He took a galvanometer and connected the wires to make a circuit leading from the instrument. He then placed a particle of sulphur on the ends of the wires, and this, when placed in the Bunsen flame, caused the galvanometer to deflect to the right or left, according to which wire the sulphur was placed upon, showing that the current had flown in different directions. This experiment showed that the current would flow from the pole on which the sulphur was placed, and that a current could be produced without first producing a sulphide.

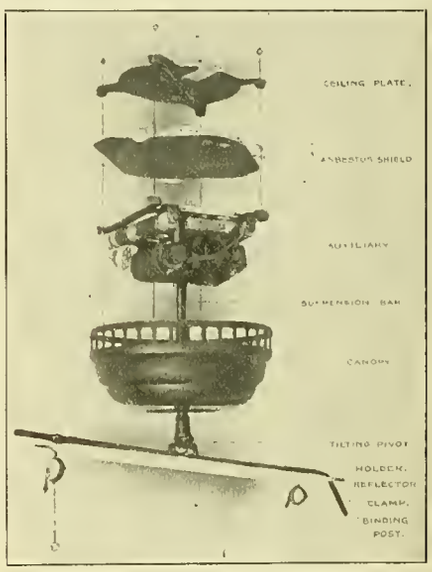
With these facts in mind, Mr. White then placed melted sulphur in a porcelain crucible containing water, which was placed over a Bunsen flame, and in this he placed two platinum points, completing the circuit leading from the galvanometer, and when the water was heated to a boiling point a current was produced, as shown by the galvanometer.

The results of his experiments led Mr. White to the conclusion that the sulphur is an important factor in producing electrical energy, for it will produce a current if merely heated to a certain temperatue. Carrying the idea futher, he believes sulphur to be a constituent of heat as well as electricity and that the two are simultaneous. There must be some other element, he conjectures, that combines with sulphur at certain temperatures to form electricity. The discovery of this element, whatever it is—it may be oxygen, radium or some other known element—he believes will lead to the production of cheap and powerful batteries.

Indoor Cooper Hewitt Lamp for General Illumination.

Cooper Hewitt mercury-vapor lamps are applicable to several kinds of interior lighting where the peculiarities of the light are not an objectionable feature. The lamps give a steady, widely diffused light which does not cast heavy shadows, and the lamps, when properly arranged, give an ideal light for many purposes, where the color is acceptable. Factory lighting is a field particularly adapted to these lamps, also lighting for drafting rooms, storerooms, etc. The lamp which is here illustrated is made as a ceiling light, and the picture shows the various parts.

Taking up the lamp part by part the first element is the glass tube. The tube, which contains a small quantity of metallic mercury, is provided with terminals which connect with the source of supply through platinum wires. The bulb at the negative end of the tube contains most of the mercury.



PARTS OF COOPER HEWITT CEILING LAMP.

The holder or fixture bracket consists of the lamp rod, the suspension bar and its attachment. The backbone supports the tube in two clamps and has a binding post at each end for connecting the leads to the tube terminals. The backbone is hung from the suspension bar and is connected to it by the tilting pivot. The bar is screwed into the crowfoot provided in the auxiliary.

Although the lamp may be used without a reflector, one is furnished if desired. The standard reflector is flat and six inches wide, painted with white enamel. It is light and attached to the backbone of the holder above the tube.

Enclosed under a 12-inch canopy is the auxiliary, which can be fastened to the ceiling or to an outlet box. The auxiliary consists of two or three coils of resistance wire, an inductance coil and usually a ballast bulb. All of these are connected in series with the tube. The special auxiliaries for series lamps have in addition an automatic cut-out.

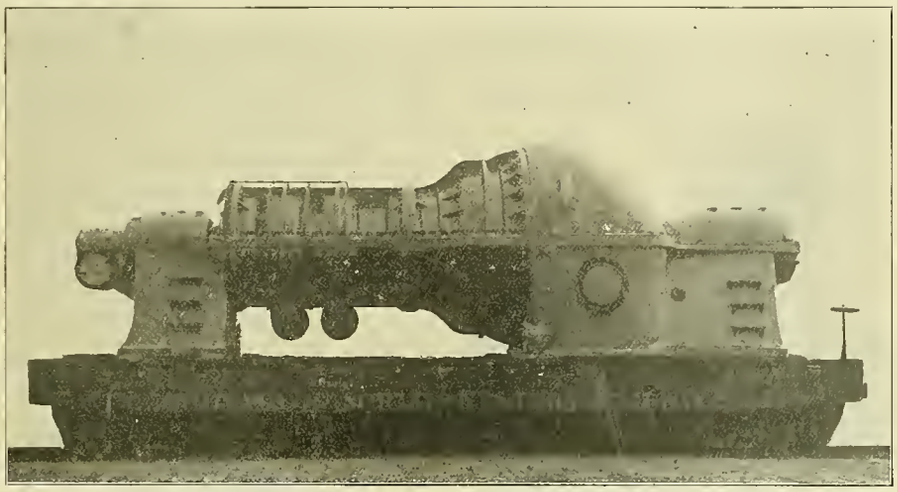
Clear glass is used for the tube, the bulb or condensing chamber and terminals being painted black. Each tube has a serial number painted on the terminals. The standard holder, the top of the reflector, the suspension bar and the canopy are finished in bright black enamel. The canopy can be finished in dull black if desired.

Fixtures may be finished entirely in brass or copper if a special lamp outfit is required; also special adjustable reflectors can be supplied. Suspension bars longer than four feet will be made to order when desired.

Allis-Chalmers Steam Turbine for Brooklyn Rapid Transit Company.

In the sixth of the large power plants built for the Brooklyn Rapid Transit Company (the new Williamsburg station) the steam-turbine floor occupies but two-thirds as much space as the required by the boilers. In an ordinary reciprocating-engine station the engine room takes 60 per cent. of the total ground space and the boiler section 40 per cent. This comparison shows that a turbine station of given capacity requires only two-thirds of the ground room needed by a reciprocating-engine station.

The Williamsburg Station, which has been erected



BODY OF ALLIS-CHALMERS 9,000-HORSEPOWER STEAM TURBINE ON 34-FOOT CAR.

near the bridge of that name, is designed to accommodate a total of nine steam-turbine and generator units, three of which are now being installed. One of these is the Allis-Chalmers 9,000-horsepower unit. A view of the body of this turbine, as it appeared when loaded on a 34-foot flatcar, for shipment from the West Allis Works (Wis.) of the Allis-Chalmers Company, is shown in the illustration herewith.

The turbine is of the horizontal multiple expansion all-around parallel-flow type, generally known as the Parsons type, operating at 750 revolutions per minute. The generator is a Bullock alternating-current machine built by the Allis-Chalmers Company at its Cincinnati works. It will carry 25 per cent. overload continuously and 50 per cent. over load for three hours with but small temperature rise.

A noteworthy feature in the construction of the Allis-Chalmers turbine is the blading. The blades are made of a special alloy and of such form and dimensions as will secure the highest economy. The individual blades are mounted in groups, each group forming one-half of a circular row. The inner ends of the blades are swaged, firmly secured in accurately spaced slots in foundation rings and riveted in slots in their respective channel-shaped shrouds. The blade rings are secured by special calking strips in accurately machined grooves in the cylinder and rotor, thus absolutely insuring against throwing out due to centrifugal force.

The channel-shaped shroud secures the blades in a substantial manner at the proper angle and spacing, and eliminates the danger of stripping, permitting the turbine to be safely operated with a minimum radial clearance. This special design of blading does away with hand work. The machine construction insures great strength, perfect alignment, and uniformity in the spacing of the blades. Having adopted the proper working principle, the efficiency of a steam turbine depends on the accuracy of angles, spacing and form of blades. All of these factors, it is said, are obtained in the construction of the new Allis-Chalmers turbine.

The lubricating arrangement is free from complications, complete and efficient. It is equipped with a direct-acting steam pump for use on starting up the turbine. The turbine and generator rotors are direct-connected by a flexible coupling, each being carried in two bearings of the ball-and-socket type. In the generator design special attention has been given to thorough ventilation.

Dimensions of the turbo-generating unit are approximately 47 feet in length, over all, 13 feet three inches in width, and 11 feet six inches in height above the engine-room floor. Its height above the foundation is scarcely more than that of the low-pressure cylinder of a reciprocating engine, of equal capacity, above the upper platform, and such cylinders are frequently more than 30 feet above the engine foundations.

It is interesting to observe that the Allis-Chalmers Company, which has upon its staff of experts the engineer who, perhaps, more than any other living man, brought the reciprocating engine to its high state of efficiency, is now so vigorously entering the steam-turbine field. But it is still true that the company finds the capacities of its shops taxed to the utmost to keep up with orders for engines of the reciprocating type.

Is Engineering Overcrowded?

Referring to the fact that at the time of the last federal census about 40,000 engineers were practicing their profession in the United States, and that at the same time at least 15,000 students were preparing to enter the engineering field, the Engineering News of New York concludes that "the majority of young men now studying to be engineers must eventually find positions requiring fully as much knowledge of business as of engineering, and that our engineering colleges should recognize this by giving their students better training in business methods." It adds that at present engineers as a whole are better employed and at more remunerative rates than at any time for a long period of years, though it concedes that this condition of active demand cannot be expected to be permanent. The inference carried by the statement in a recent paper by Prof. William Kent of Syracuse University that in 1903 nearly every engineering college in the country had applications for about twice as many graduates as it could furnish, and that in that year and in the present year the demand for engineers exceeded the supply is called in question. The Engineering News suggests that the employer who notifies one institution that he can give positions to one or more graduates is very apt to send a similar letter to other schools, and it concludes: "The youth who is debating whether he shall spend four years in an engineering school should not form the idea from Prof. Kent's statement that there are good places open for twice the engineers that the colleges can grind out. He will find that the engineering profession is a place of keen competition, a competition which has for years kept down the returns from strictly professional work to a point that has caused a large proportion of those who were formerly engaged in that work to turn aside into business ventures."

Concurrently the question of the demand for engineers is under discussion in the columns of the Engineer of London. That journal comments editorially on a letter in the London Standard from an American engineer, who raises three points: "First, does the development of American trade demand more engineers? Second, is the training now given just what is wanted? Last, can the United States export business be so much developed that more engineers must be wanted?" The Engineer says that for some time doubts have been felt in the United States concerning the efficiency of the instruction in engineering given in technical colleges and schools. And, further:

"Hitherto the policy of the schools and colleges has been to train men in the principles of mechanical and physical science in the first place, and in the second to teach them something of the application of those principles in practice. It has been taken for granted that men educated in this way must be efficient engineers, who can make everything wanted from a nut and bolt to a big mill engine. Furthermore, it has been assumed that a go-ahead country like the United States cannot have too many engineers, the product of technical colleges. In fact, teaching has been done much in the same way and on the same assumption as in Germany. It is now beginning to be understood that it is quite possible to have too many engineers. It is a familiar fact that Germany is overstocked with Charlottenburg young men who can barely earn a pittance, and now much the same thing is taking place in the United States."

The point is made that in the United States firms making machinery to sell know that they have no use for the merely intellectual young man. The highest mathematical qualifications and the most profound knowledge of physics will not enable anyone to make steam engines which he can sell at a good profit, nor will they enable a contractor to build a great dock and make a small fortune out of the building. As to the suggestion that the development of a foreign trade by the United States is necessary, that the future engineer may have a chance, the American correspondent of the Standard says:

"In Germany, but more especially in England, it is found that the engineer goes into every part of the world. He does this because the commerce of the country in mechanical lines has developed in every quarter. Therefore the men who pursue this work are not dependent upon local conditions or developments. On the other hand, in America, it is more and more clear that the engineer other than in the mining branch finds only a restricted outside field for the exercise of his talents, and is thus compelled to compete more sharply than is elsewhere the case with his compatriots."

On this the Engineer comments as follows:

"It is obvious that we have here something which has much to do with fiscal policy. It would be strange if the fact that more men are turned out of technical colleges than can find employment at home should result in a modification of tariffs, which in its turn would augment the export trade of the United States. Finally, we may point out that nothing has yet been said about the influences which gigantic trusts cannot fail to have on the work of the country and the demand for engineers; that is a question which demands much consideration on the other side of the Atlantic."

From the communications to the Engineer on the question of the demand for engineers and its relation to the supply it would appear that the situation in the United States referred to above is not more acute than in England. Some of the correspondents consider that the demand for engineers is not at fault, but the supply. One says: "There are any number of college graduates knocking about calling themselves engineers—whether justly so or not depends on the definition of that elastic word—but that there is even a fair supply of men who are of any value to the manufacturing engineer in their present condition of mind is certainly much open to question. Certainly if there are such, very few of them have crossed my path." The correspondent goes on to enumerate the qualifications needed, putting "mere knowledge" low in the scale: "In nine cases out of ten the draftsman can get everything necessary out of Molesworth, and in the tenth he can ask his friends." A man who can think independently, who can manage men, who can construct machinery that can be sold at a profit, who, in short, can bring things to pass is the kind of engineer wanted. Another writer says: "The plain fact is that there are a great deal too many men seeking employment and only the pick will get what work is going." A third criticizes the ignorance of costs displayed by many engineers and lack of ability to make a profit. The general impression gathered from the discussion is that the question is a very live one with British manufacturers in all lines of industry.

The Iron Age of New York, from which the foregoing compilation is taken, in its own comment emphasizes the point that graduates of technical schools should have knowledge of business quite as much as knowledge of engineering. It says: "The point continues to be made that the man strong in theory but with no large equipment of ability to bring things to pass will find plenty of competition as he seeks a place in which to turn his education to account." But in relation to the assertion that Germany is overstocked with Charlottenburg young men who can barely earn a pittance, things have not come to such a bad pass in the United States, despite the yearly addition of 3,000 men to the number of technical-school graduates. The suggestion than the export trade of the United States must be developed more vigorously to furnish an outlet for an overstock of American engineers can hardly be taken seriously. The American engineer may well prefer to face the situation at home rather than to fly to evils abroad that he knows not of. "Probably the chief value of the whole discussion will be in the light it may throw on the question whether the training now given in engineering schools is just what is wanted."

Scarcity of Electric-railway Men.

Reports from Bridgeport, Conn., say that with the exception of the period of the trolley strike, the Connecticut Railway and Lighting Company has never before experienced such a difficulty in getting a sufficient number of the right sort of men to man its cars as it is now having. The scarcity of men is due to various causes. One of them, it is said, is that there is a class of fair-weather trolleymen who want to work indoors during the winter and get employment in factories, practically all of which are now rushed with work. These men have left the road. An official of the Connecticut Railway and Lighting Company reports that the company could put 50 men to work at once, and if 100 came places could be found for them.

Foolish "Tariff War" Talk.

The leading article of the Daily Consular and Trade Reports of the Department of Commerce and Labor (Bureau of Manufactures) of the United States government for November 1st is entitled "The United States and Germany," and is of much interest—unusually vigorous and outspoken for a government document. It is in answer to complaints in Germany that the balance of trade with the United States is greatly in favor of the latter country, coupled with repeated threats of a "tariff war" to force the United States to improve its commercial relations with Germany, which are alleged to be unsatisfactory to the latter country. The article in the Daily Reports shows how disadvantageous a "tariff war" would be to Germany by making a careful analysis of the trade between the two countries. Taking the figures for 1904, it is shown that the exports of the United States to Germany were valued at $214,780,992, while those of Germany to the United States were $109,188,554. But "in the commercial interchange between both countries, notwithstanding the large balance in favor of the United States ($105,592,438 in 1904), there is no country in Europe whose trade with the United States is as profitable thereto, intrinsically, as is the trade of Germany with the United States to the former country." German trade with the United States is of far greater value to Germany than is the trade of that country to the United States. How this is so may be seen from the concluding portion of the article.

"Of our exports to Germany more than one-half the total value is made up of raw cotton ($109,123,685). Deducting this one article from our exports reduces our total exports to Germany to less, in value, than our total imports therefrom. Bearing in mind that Germany must buy this cotton if she would keep her factories running—she cannot buy her cotton supply elsewhere than from the United States—and that there is no other product exported from the United States upon which so little labor has been bestowed when it has entered the German ship for export to Germany, to give employment to the army of cotton operatives, it is not too much to say that this vast cotton export, when it emerges from her looms, is of more value to her than to the country where it was produced and whence it was exported instead of being transmuted in American mills to American manufactures.

"Deducting all the raw products exported to Germany—say, $200,000,000—leaves for American manufactures exported to Germany—say, $14,780,992—which is really too liberal an estimate, as compared with, at the very least, $80,000,000 worth of German manufactures imported into and consumed in the United States, for some of the American manufactures exported to Germany may have been re-exported from Germany to coterminous countries.

"Assuming that those people in Germany believe in the necessity of a tariff war 'to reduce the United States to reason,' it is hard to see, in case 'the war is declared,' how they could even inconvenience the people of the United States thereby. In the first place, the raw materials imported from Germany, $27,490,000 worth, are composed of products we could dispense with without the least inconvenience, while the $80,000,000 of manufactures now imported from Germany would be very speedily and graciously supplied by England, France, Belgium, etc. How would the 'backwater' raised from the stoppage of this flood of manufactures affect the great cotton industry of Germany, already worked to overproduction?

"While the people of the United States desire no tariff war with any country and cannot understand the cry therefor arising from German manufacturers and agriculturists, unless it is a 'bluff' to wring concessions, they are fully aware of the fact that if pushed thereto they are self-supporting; they produce everything they need and could live in themselves though the world should be mad enough to build a tariff-war wall a mile high about them. What other great nation can say as much?

"The talk of a tariff war to bring the United States to terms satisfactory to German manufacturers and agriculturists (which would shut us out of the German markets and open our markets to German manufactures) is unworthy of the high intelligence of Germany, and only confuses the question at issue. The matter must be delegated to the representatives of both governments, who, according to an unchangeable principle, will yield all that can be yielded after their own interests are fully conserved and protected."

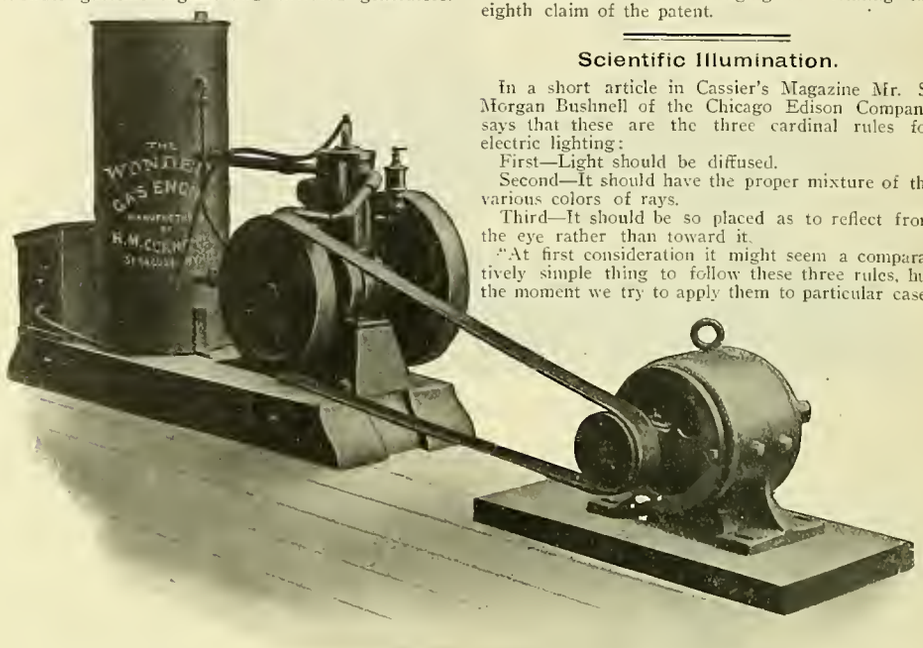
Steam Turbines in Washington Terminal Station.

When the large Union Station at the Washington terminal of the Pennsylvania Railroad is completed it will be one of the finest and best-equipped railroad stations in the world, serving all incoming and outgoing trains of Washington. In conformity with the rest of the station the power plant will be equipped with up-to-date machinery, steam turbines being selected as prime movers partially on account of the limited amount of space devoted to that purpose. Four 500-kilowatt Westinghouse steam turbines have been ordered, adapted for driving alternating-current 60-cycle generators running at 3,600 revolutions per minute. Dry saturated steam will be used at 150 pounds pressure and 25-inch vacuum, and the turbines will be capable of developing 670 electrical horsepower each. The alternating-current generators will be of the turbo-rotating-field type, with two poles and a frequency of 7,200 alternations per minute at a nominal speed of 3,600 revolutions per minute. They will deliver three-phase current at 2,300 volts, and, being of the enclosed type, will operate practically without noise.

Small Lighting Outfit for Residences.

Small lighting outfits of from six to 100 lights are desirable for private residences, houseboats, farm houses, clubs, shops, factories, stores, etc. Such outfits are manufactured by the R. M. Cornwell Company of Syracuse, N. Y., manufacturer of the Wonder gasoline engines, dynamos and motors. The sets are especially liked by farmers and others who are cut off from electric and gas connections.

Wonder outfits, as they are called, consist of Wonder gasoline engines and enclosed generators.



SMALL LIGHTING OUTFIT FOR RESIDENCES.

The company has for some time been experimenting in view of arriving at a set which would be so simplified that anyone could operate it, and believes the one here illustrated will fulfill the requirements. Most important of the features of the outfit is that it is compact, requiring very little space. The Wonder engine is simple and reliable. From the fact that the company is a large manufacturing jobber in dynamos, motors and supplies, it is in an excellent position to put a line of these outfits on the market. The outfit is shipped, as shown in the picture, connected with gas and water tanks, and also electrical connections made, so that the machine is ready to operate as soon as the tanks have been filled. The company is going to list about 30 different outfits ranging in sizes from eight lights up. The cost of operating the engine is said to be about one cent per horsepower-hour, or about one-tenth of a cent for each 16 candlepower lamp. This would be the same as 10 16-candlepower lamps 10 hours for 10 cents. There is no danger from the gasoline engine, which is manufactured to conform with the requirements of the Board of Underwriters. The stationary engine is supplied with a governor, so that it gives a steady and uniform light. The company says that the outfit has already found favor in foreign parts and that shipments have been made to Peru, Australia, China and other countries.

Patent Litigation.

Upon motion for a preliminary injunction, in the suit of the Westinghouse Electric and Manufacturing Company against the Syracuse Lighting Company, involving the Tesla split-phase motor patents Nos. 511,559 and 511,560, the defendant is restrained from putting in or using any new or additional infringing devices. The order is by Judge Ray in the United States Circuit Court, Northern District of New York. In view of expense and labor and inconvenience to the public, defendant is given six months in which to change infringing devices now in use to non-infringing devices, and at the expiration of that time the preliminary injunction is absolute against further use thereof.

In the Duncan meter case, in which the Siemens & Halske Electric Company of America was complainant and the Duncan Electric Manufacturing Company, Thomas Duncan et al. were defendants, the complainant appealed from the United States Circuit Court for the District of Indiana in the litigation growing out of the alleged infringement of certain claims of United States patents Nos. 550,823, 604,465 and 698,653. Judge Baker of the United States Circuit Court of Appeals for the Seventh Circuit now reverses the decree of the former court and orders the entering of a decree in the complainant's favor for an injunction and an accounting.

Judge Bethea of the United States Circuit Court, Northern District of Illinois, in the trolley contact spring case, in which the General Electric Company is complainant and the W. R. Garton Company defendant, holds that the Albert Anderson patent No. 412,155, for improvements in trolleys for electric-railway service, is good and valid in law; that Anderson is the original inventor of the inventions and improvements and that the General Electric Company is the exclusive owner of the patent. The court ordered an injunction restraining the defendant from infringing or violating the eighth claim of the patent.

Scientific Illumination.

In a short article in Cassier's Magazine Mr. S. Morgan Bushnell of the Chicago Edison Company says that these are the three cardinal rules for electric lighting:

First—Light should be diffused.

Second—It should have the proper mixture of the various colors of rays.

Third—It should be so placed as to reflect from the eye rather than toward it.

"At first consideration it might seem a comparatively simple thing to follow these three rules, but the moment we try to apply them to particular cases we meet with practical difficulties. It is these difficulties which the inventive genius of the electrical engineer must overcome. Already steps have been taken in this direction. For example, the old scheme of studded lights around shop windows is giving place to concealed lights with mirror reflectors placed at the top of the window. The beholder, instead of being dazzled by the glare and glitter of a hundred lights, has his attention called to an attractive window display illuminated from unseen sources and giving pleasing and restful effect to the eyes.

"The present movement toward cove lighting is another move in the right direction, but we should go further; we should not only have lights concealed around the sides of the room, as is the custom, but chandeliers should be designed which will reflect the light to the ceiling without allowing the direct rays to strike the eyes. The Cooper Hewitt mercury-vapor lamps and the Moore vacuum tubes are other evidences of progress in the right direction. In both of these styles of lamps we have a large light-giving surface, with an increase in softness and pleasing qualities. During the last five years there has been a very marked increase in the use of frosted lamps, Holophane shades and similar devices for producing a diffused lighting.

"Another feature which is now receiving more attention than in the past is the matter of quality or color of the light. It is well known that the apparent color of an object is very greatly affected by the kind of light it receives."

"The question arises, 'Is it possible to provide this quality of light artificially, or is nature so far ahead of art in this respect that she can never be approached?'

"At the present day we are a long distance from this ideal light, but at the same time the problem of how to secure it is not necessarily an impossible one. Here is a broad field for invention. The problem is to secure a soft light, evenly diffused over a large area and of such a quality as to produce the clearest illumination, and at the same time be the most soothing to the eye."

D. S. Louderback, mayor of Shenandoah, Va., will receive bids until November 21st and let franchise to the highest bidder for furnishing the town with electric lights and motor power.

China as a Field for American Electrical Development.

Opportunities existing in China for the introduction of electrical machinery and supplies form the subject of a valuable report furnished the Department of Commerce and Labor by Special Agent Burrill, who writes from Shanghai. Mr. Burrill fully describes the little that has been done for China in introducing electricity, and furnishes detailed information that will enable capitalists seeking good investments, electrical engineers and manufacturers of electrical supplies to realize that an unusual opportunity awaits them in China. What follows is taken from his report.

China has enjoyed less development along civil and electrical engineering lines than any other country of its size and importance in the world and presents a field which has evidently appealed to German, British and Japanese firms, for they are on the ground, although inefficiently represented and poorly equipped to handle a business which has offered and will continue to oresent great possibilities for our home engineers and manufacturers if they will attack the proposition with the same energy and business ability that characterize their operations and assure success in the United States.

In Shanghai, under the title of electrical companies, there are only two firms (both British) in business, each carrying a stock and doing a class of work which in the United States would be called petty contracting. One handles as its chief source of income materials entirely foreign to electrical work, while the other has at its head a man who, with the assistance of native employes, installs wiring for lights and bells in the smaller private homes in Shanghai and does work on electric fans and annunciators. I am informed that throughout the Chinese empire there is not a branch or agency of any of the large electrical supply companies of the United States, which tells the whole story. The customs duty of five per cent. on machinery certainly cannot be responsible for this condition, and it is only explainable by the assumption that the opportunities for electrical work in the Far East are not sufficiently well known or appreciated by our home companies.

There are three German firms in Shanghai handling electrical supplies as a side line, and only one of these has made any marked success in this particular field. This company orders supplies from its home manufacturers only when needed for actual work, carrying in stock less material for this line of business than would be kept on hand by the small contractor or dealer in the United States. Its business is general in character, and in its establishment, in addition to the limited stock of electrical supplies, may be found arms and ammunition, agricultural and other machinery, piece goods, tobacco, cigars and cigarettes. It also buys and sells goat and sheep skins and is, in fact, a general trading company, adopting electrical supplies as an incidental source of revenue. This description applies to the other German firms, and is mentioned only to show how little attention is actually paid to a line in which exist great possibilities.

Notwithstanding the disadvantages under which contractors labored, some creditable electrical work may be found in a few of the larger cities. The Tientsin Electric Light Company, installed at a comparatively recent date, is already, it is said, a profitable enterprise, and it is reported that a franchise for a trolley system has been granted, on which work is soon to be begun. The plant at Tientsin was installed by Arnhold Karberg & Co. of Shanghai, a German firm, and is up to date and regarded of sufficient capacity to meet any probable future demand.

Shanghai has under municipal control unquestionably the best-equipped electrical plant in China, and a franchise has recently been granted for a modern electric-railway system. Canton has also an electric-light and power company which has just obtained a 30-year monopoly, and it is maintained by those best informed as to the situation that conditions would justify the installation of an electric surface road. Hongkong has a paying electric surface road in addition to a fair electric-light and power company.

Peking has an electric-light plant. About five years ago the German firm of Siemens & Halske began the construction of a surface road, but the work was interrupted in 1900, and it has not yet been completed. Hankau is about to acquire an electric-light and power plant, but would not, for some time at least, support a trolley line.

There are a large number of small isolated plants for both light and power scattered throughout China, and these, acting as an introduction for larger and more elaborate work along the same lines, are gradually being supplanted by the installation of general plants. It may be assumed that these central plants will in turn educate and prepare the native population for the great construction work for which China apparently offers opportunities to foreign skill and enterprise.

As there are no firms in this part of the country carrying even a fair suoply of electrical material there is constant complaint because of the delay in the delivery of the goods ordered for construction work. This uncertainty, coupled with the difficulties of insuring their arrival in proper condition and according to plans and specifications, makes it almost impossible, according to electrical engineers, to give satisfactory estimates on any branch of the work.

In sharp contrast to this condition may be cited the success of the Babcock & Wilcox Company. This firm has in the last two years placed over 11,000 horsepower in the ports along the coast, and is one of the few companies engaged in the manufacture of mechanical accessories having a properly appointed agent with sufficient knowledge of his line to superintend the installation of his own material.

It is obviously impossible to give detailed information regarding the cost of construction in China. It may be said, however, that Chinese wiremen can be secured for 50 cents Mexican (25 cents gold, approximately) a day. These men would, of course, require constant supervision, but when properly instructed and watched do fairly good work. Poles up to 40 feet in length at any reasonable diameter can be easily obtained at prices ranging from $3 to $4 gold for the larger sizes (40 feet, butt tapering to 10-inch top). These poles have an average life of eight years under ordinary conditions.

It would take a competent and energetic American engineer a comparatively short time to become familiar with the situation and place himself in a position to enter a field that requires and unquestionably will receive careful cultivation in the near future. It would be necessary, of course, under present conditions, to overcome prejudices and inspire confidence. The boycott temporarily paralyzed American enterprises in China, and although it has collapsed officially, it is impossible to predict, because of its far-reaching effects, when normal conditions will be restored. It has produced a feeling of business uncertainty and timidity that neither edicts nor proclamations from Peking can immediately dispel, and the unfortunate ending of the Canton and Hankow railroad project has filled the Chinese mind with added suspicion and distrust of American methods. Notwithstanding this, however, it is certain that Chinese authorities would not hesitate to entertain a proposition for electrical construction that would be advantageous to a municipality, even though it were made by a representative of a company doing business in the United States.

In connection with the foregoing, a letter from Consul Anderson of Amoy on the same general subject is of interest. Consul Anderson is not so optimistic regarding the immediate outlook in China, but on all essental features the two reports agree. Among other things Mr. Anderson says:

The prospect for much being done in the way of electrical construction in China in the immediate future is not very bright. There is no break in the demand for electrical goods and machinery which has existed for some time, but there is not that prospect for a material increase which electrical men have hoped for and which might naturally be expected where the field for electrical work is so great. Upon the subject an American who represents an English electrical supply house says:

"It is impossible to accurately measure the actual present demand for electrical installation and supplies in China, owing to the extent of the field and the lack of any superintending agency or any official returns of work done. A review of the work actually done in the larger cities does not promise any great boom in the business. Practically all the construction work and sale of appliances are secured and handled through fiscal agents for houses in England, Germany and the United States, houses generally too small to support agencies of their own in China. There are a number of reasons why the business is held back. For instance, there are no houses in any part of China which carry in stock for immediate use even a fair supply of electrical material or supplies. The natural result is that there is constant complaint, due to the delay in the delivery and execution of orders and even in the more ordinary repair work. There is additional uncertainty in the business, due to fluctuations in exchange and the varying cost of freightage. It is very difficult to give satisfactory estimates upon any branch of work. One Shanghai firm has in the last two years placed over 11,000 horsepower in the several Chinese ports along the coast. It is significant to note that this is one of the few firms engaged in the business which manufactures mechanical accessories and maintains properly equipped agencies with representatives having sufficient technical knowledge to superintend the installation of his own material."

The disposition of the Chinese authorities in the matter of electrical installations is very much the same as it is with respect to railroad enterprises. They are disposed to grant no franchises except to Chinese people, and the Chinese people are not in a position, either financially or otherwise, to do anything. At present the electrical men who are accomplishing anything are confining their efforts to communities which are controlled by foreigners, and I doubt very much if much can be accomplished even by the most persistent efforts and by direct representation in other places in China at the present time. The feeling among the dominant classes of the Chinese people is not hostile, nor is it necessarily indifferent. But the disposition to give franchises only to Chinese, whatever may be the real reason or the real theory back of it, is unquestionably strong at the present time, and will probably be stronger before there is a reaction which will allow work to be done by foreigners. I do not believe that the work will be done to any great extent until it is done by foreigners. There are a large number of small isolated electrical plants in China for both light and power. Most of them are rapidly being rendered useless or unnecessary by general plants. In a number of cases there has been trouble over electrical-plant propositions. At Ningpo, for instance, an alleged American concern secured a franchise and organized a company to establish a light and power plant, but the scheme seems to have been little more than a swindle, and the result is that electrical installation in Ningpo is held back for probably a decade. There has been pulling and hauling in Amoy over the electric-light proposition at one time or another, but the present indications are that a franchise on Kulangsu Island, the residence portion of Amoy, will be given an American agent for a British company. The concern will be a small one at best.

The present of the electrical business in China is not very attractive for American business men, but the possibilities of the future are so great that American concerns will make a grave mistake if they fail to keep representatives in the China field. When once electrical construction in the empire is really commenced the concerns on the ground will probably have more work than they can do, and there will probably be sale for more machines and appliances than they can readily and promptly furnish.

Engineering in the Navy.

Rear-admiral Charles W. Rae, engineer-in-chief of the United States Navy, in his annual report, calls attention "to the critical condition of engineering in the navy," and points to the explosion on the gunboat Bennington in San Diego harbor, which he says, most forcibly emphasizes the necessity of serious and immediate attention.

"So few officers of the line are taking up engineering seriously that the situation is becoming alarming," says the engineer-in-chief, and he adds: "Were the country suddenly plunged into war, the navy would find itself in no condition to win battles. As necessary as good marksmanship is the ability to carry our guns to the firing line, and to keep them there amidst the havoc created by modern ordnance, and this never will be done with amateurs in charge of the machinery."

Admiral Rae submits a plan "for quickly supplying the navy with a body of efficient engineers," which provides that all the younger officers must be given engineering duty, and be made to realize their responsibility, the duty to be performed first in a subordinate capacity, and examinations to be strict, with engineering ranking with seamanship, gunnery and navigation. Further, the plan provides for a number of engineering specialists in the line, whose duty at sea and on shore shall be engineering; such officers not to perform sea duty after reaching the grade of commander. This plan, it is explained, would give a body of engineering specialists, as follows: Two rear admirals, seven captains, 11 commanders, 29 lieutenant-commanders and 33 lieutenants, of which number 62 would be available for sea duty.

"This," says Admiral Rae, "would give a sufficient number in each fleet to have a thoroughly competent engineer as chief engineer of the larger vessels, and a sufficient number to enable the commander-in-chief at all times to have available officers qualified to act in any case in which expert engineering knowledge is necessary."

Writing in the London Times Engineering Supplement, and referring to the engineering officers of English battleships and cruisers, E. S. Fortis says:

"It is fairly evident that in this direction it is necessary to have a good share of engineering ability, which is now usually supplied by taking the ordinary, or first-year, course at Greenwich. The chief engineer of a warship of 15,000 to 30,000 indicated horsepower must be something more than a master engine driver. Frequently warships are placed entirely on their own resources for extended periods, when all repairs must be executed on board, even in time of peace. In time of war, something more than this may have to be done, and only a properly trained and practical engineer can undertake its successful direction. In addition to the main propelling machinery, there are numerous other engines and motors, some 120 or more in recent vessels—including oil engines used for other purposes—on whose fighting efficiency each ship is practically dependent. If a barbette, with its great guns, fails to come up to the standard, or if an ammunition hoist fails to work or a torpedo to run properly, the chief engineer is the officer to whom the captain must ultimately appeal when all others have failed. Let us admit at once that the future gunnery and torpedo officers will relieve the chief engineer of some of his auxiliary responsibilities, and still we have to allow for future progress in engineering science applied to ship propulsion.

"We are on the eve of great advancements. The turbine engine, the heavy oil engine, the gas producer and engine, all of them heat engines, by the way, are each and every one taking a part in the

solution of problems of the near future. Experiments are also being made with gas-producer turbines, and although the progress is slow there is always a prospect of success in this direction. More than ever, therefore, will it become necessary for the chief engineer of our most important ships to be qualified in the higher ranks of professional engineering and to have been trained on a wider basis."

BOOK TABLE.

ANNUAL REPORT OF THE SMITHSONIAN INSTITUTION. By the Board of Regents. Washington: Government Printing Office. Pages (5¾ by 9 inches), 804, with 148 illustrations.

In this report are shown the operations, expenditures and conditions of the Institution for the year ended June 30, 1904. Proceedings of the various sessions of the board of regents are given, with a report of the executive committee exhibiting the financial affairs of the Institution. A total of $607,054 was expended for the several departments, and there was available for the year ended June 30, 1905, $104,548.

A valuable part of the book is the general appendix, comprising a selection of miscellaneous memoirs of interest to scientific and technical men, teachers and all others engaged in the promotion of knowledge. These memoirs relate chiefly to the year 1904, and among them are some especially interesting to electrical men, such as "Electric Welding Developments," by Elihu Thomson; "Progress in Wireless Telegraphy," by William Maver, Jr.; "Rapid-transit Subways in Metropolitan Cities," by Milo R. Maltbie, etc. Many of the half-tones are excellent, and there are a large number of drawings.

MODERN LIGHTNING CONDUCTORS. By Killingworth Hedges. London: Crosby Lockwood & Son. 1905. Pp. (6 by 9¾ inches), 119, with 74 illustrations. Price, $3.

Embodying an illustrated supplement to the report of the British lightning research committee for 1905, this book contains, besides, notes as to the methods of protection from lightning and specifications for carrying these methods into effect. The vagaries of lightning, as shown by numerous examples, in which the course of the bolts could be observed by their effect, are recounted in an interesting manner. Although lightning cannot be counted on to do the thing expected, still there is little doubt that the structures which are protected by approved lightning rods or conductors often may be saved from destruction, and the book goes quite thoroughly into the matter of how such accidents may be averted intelligently. Inaccuracies have unfortunately cropped out, as is shown on page 103. Here reference is made to another journal where the Western Electrician is evidently intended. In the matter of illustrations much is lacking, many crude and almost useless sketches having been reproduced as they were sent in by contributors to the subject. With a little pains the sketches might have been redrawn and made into diagrams which would have been a credit to the work.

SYNCHRONOUS AND OTHER MULTIPLE TELEGRAPHS. By Albert C. Crehore, Ph. D. New York: McGraw Publishing Company. 1905. Pp. (six by 9¼ inches), 124, with 42 illustrations. Price, $2.

Three natural divisions of the general subject of multiple-telegraph apparatus are treated under as many headings in this work. The first of these divisions takes up methods of obtaining independent telegraph circuits by the use of direct and alternating current on the same wire. The ordinary Morse apparatus, of course, makes use of direct current. The capacity of the wire may be obviously doubled by making use of alternating-current impulses, with suitable apparatus in circuit which will not allow of the interference of the two kinds of signals. This is called the duplex-diplex system, and the approved methods of applying this system are described in Part I. Methods of obtaining synchronism at distant points are described in Part II. Such methods depend for their operation upon the principle of the synchronous rotation of two bodies at distant points, controlled by the telegraph apparatus. The plans for doing this, which are described, are those making use of the single Morse wire, the duplex Morse wire and the synchronous multiplex wire. Synchronous telegraphs proper are described in Part III., which proceeds to make use of the methods of obtaining synchronism which are described in Part. II. Excellent diagrams of the necessary connections are scattered throughout the text, and help to simplify an otherwise somewhat complicated subject.

WIRELESS TELEGRAPHY: ITS HISTORY, THEORY AND PRACTICE. By A. Frederick Collins. New York: McGraw Publishing Company. 1905. Pp. (six by 9⅛ inches), 299, with 332 illustrations. Price, $3.

Although the art of space telegraphy can scarcely be considered as a "factor of the first magnitude in the scheme of social and commercial economics which forms the foundation of our complex mode of living," as is stated by the author in his preface, it is true, that, during the comparatively few years since its discovery, this new triumph in the field of applied electricity has made great strides in a practical way. Confronted at the very beginning with that mysterious and all-pervading substance upon which the transmission of electric waves through space depends—the ether—the author has collected in the first chapter the most prominent and plausible theories which have been advanced as to its nature, following this with a chapter on wave motion and electric waves in general. Then, after a few chapters on the general theories of mutual inductance, capacity, resistance, electric oscillations, etc., the real work of the book is taken up—the apparatus by which space telegraphy is made possible. The principal systems now in use are described under distinctive heads, such as "Interrupters," "Electric Wave Detectors," "Transmitters," etc. There is also a chapter on wireless telephony. A brief historical retrospect is given at the beginning of each chapter to enable those who are but slightly familiar with the subject to obtain a connected idea of the developments in the various branches of the art.

PRINCIPLES OF ELECTRICAL POWER (CONTINUOUS CURRENT) FOR MECHANICAL ENGINEERS. By A. H. Bate. London: E. & F. N. Spon. New York: Spon & Chamberlain. 1905. Pp. (4⅞ by 5¼), 204, with 63 illustrations. Price, $2.

Progress in the application of electrical power, especially in the field of motor drive in industrial works, makes it imperative that the man whose work has hitherto been confined strictly to the mechanical branches be more conversant with the operation of electrical machinery. Textbooks which may be available to him often have the fault of being too mathematical and theoretical for one who does not wish to go more deeply into the subject than is necessary to accomplish the practical results which he desires to attain. Simple explanations of how electrical apparatus is operated and how it will act under the conditions of actual practice are the groundwork of this book, which is directed to the practical man rather than the student. There seems to be much of mystery surrounding electricity and its working to the man who has not paid much attention to the matter. On this account the author has devoted considerable pains in an attempt to dispel such a feeling on the part of mechanics and those in general who find the time has come when they must at least understand the principles of operation of electrical apparatus. Electrical terms that are used are explained by the context and distinguished by heavy type where they occur for the first time.

Many times the practical man who has no time to go to school again, turns away from the subject of electricity with a feeling that its intricacies are too deep for him to master, whereas, if the truth were known, the electric motor is more simple than the steam engine, and the principles of its action may be explained without any more abstruse mathematics than the rule of three. This fact is manifest by a glance at the pages of "Principles of Electrical Power," for there only arithmetical expressions are to be found; yet if one follows carefully the directions he finds within these pages he may feel confident that he will be able to take care of ordinary direct-current apparatus even if he cannot answer the question, "Why is a line of force?"

PHYSICS. By Charles R. Mann and George R. Twiss. Chicago: Scott, Foresman & Co. 1905. Pp. (5¾ by 7½ inches), 453, with 237 illustrations. Price, $1.25.

From the frontispiece, which is a representation of the Twentieth Century Limited in full flight, to the concluding pages, which are devoted to that little particle of matter which scientists believe they have cut in two for the last time—the electron—this book may be characterized as up-to-date in every particular. It is a book which will open the eyes of the high-school student to a great many things which are to be found in the industrial world, which he has never thought of, but which are directly along the lines pursued in the study of physics. Although intended primarily for a high-school textbook, the work is expected to appeal to the more intelligent class of mechanics and artisans whose work is based on the principles of this every-day science. The style is plain, simple and straightforward, with plenty of illustrations, which conspire to make the book interesting from beginning to end. No mathematics are used beyond arithmetic and the simpler principles of algebra and geometry, and even a knowledge of these is not strictly essential to an intelligent perusal of the greater part of the book. The pages are full of life and "go," which appeals strongly to the humanistic side of the students.

That acceleration is proportional to the force is a well-known fact; those who have studied physics will remember having the fact brought home to them in sundry ways. In this book the illustration adopted is that of an eight-oared shell, each of the sturdy oarsmen representing an accelerating force. In discussing fluids a pump with a capacity of 25,000,000 gallons a day is illustrated; also an air-compressor plant and a compressed-air drill working in a mine. These few examples go to show the original and interesting manner in which the work has been prepared, which is a characteristic feature throughout the text. Of the two authors, Mr. Mann is connected with the University of Chicago and Mr. Twiss with the Central High School of Cleveland. In the production of this book the authors and publishers have made a step in advance of the old and familiar landmarks characteristic of previous elementary textbooks on physics.

Michigan Telephone Matters.

The Twin City Telephone Company of St. Joseph and Benton Harbor purposes to spend $33,000 in putting its wires in the main parts of the cities underground.

Thirty-two representatives of Independent telephone interests of the state met at the Hotel Normandy, Detroit, a few days ago, and spent most of the day discussing the situation as to Independent telephone matters, especially the opposition in Detroit to the introduction of another system in the city. A committee was appointed to draft a set of resolutions to be presented to the Detroit Board of Commerce expressing regret at the stand of the board against an Independent system in Detroit. The resolutions state that 8,000 Michigan citizens are interested in the Independent movement in the state to the extent of $6,000,000 against only 80 citizens of the state with a $200,000 investment in the Bell. It is also contended that business which now goes to Toledo because of the Independent connection with that city would come to Detroit with an Independent exchange established there. Among the prominent telephone men present at the meeting were A. C. Raub of Wilkesbarre, Pa.; E. B. Fisher and J. B. Ware of Grand Rapids; C. B. King of Ann Arbor and F. M. Howard of Flint.

The tangle that the Co-operative company of Detroit has been in for the last two or three weeks is partially cleared up by Judge Swan's denial of a petition by Charles A. Thacher of Toledo to prevent the sale of the company to Max Koehler and Samuel Jeffries of St. Louis. The St. Louis people will now go ahead with their company, which was organized to take over the Co-operative company. The name of the new company is the Home Telephone Company. Its capital stock will be raised to $3,000,000. Plans will be drawn for an exchange of at least 10,000 subscribers. W.

Telephone News from the Northwest.

The council of Albert Lea, Minn., has refused to grant the Northwestern Telephone Exchange Company the right to extend and improve its system in that city, because the company refuses to accept a certain ordinance regulating the telephone business in the city. The Northwestern threatens litigation if it is not permitted to make the extensions and improvements.

The South Dakota Central Railroad, which is constructing a line between Sioux Falls and Colton, S. D., will install a telephone system on its line with connections between stations, so that an instrument may be plugged in at almost any point and connection gained with the dispatcher.

The Random Lake (Wis.) Telephone Company has been incorporated with a capital of $5,000.

A telephone exchange is projected for Melby, Minn.

The Minnesota Central Telephone Company has reduced its charge in New Ulm, Minn., for business service, from $2.50 to $2.

The Great Western Telephone Company proposes to build a line from Pierre, S. D., to the Black Hills, and has applied for a franchise at Pierre.

The Independent Telephone Company of Council Bluffs, Iowa, is taking bids for the erection of a new exchange building.

The Southwestern Iowa Telephone Association held its annual convention at Council Bluffs on October 28th.

The Terril (Iowa) and Lake Center Telephone Company has been formed and will construct a line. C. M. Varney is president and H. Everett secretary-treasurer.

The Long Grove Mutual Telephone Company has been incorporated at Long Grove, Iowa, with $10,000 capital. R. K. Brownlie is president and G. B. Maxwell, secretary. R.

Indiana Telephone Items.

The Dunlap Telephone Company has been incorporated with a capital stock of $20,000, to build an exchange in Osceola, Ind., and lines in St. Joseph, Elkhart, Laporte, Kosciusko, Marshall, LaGrange and Noble counties. William D. Kauffman is among the incorporators.

A telephone company headed by O. L. Barger has petitioned the Marion council for a telephone franchise. The petitioners state that, if granted, an automatic telephone system will be established. The company proposes a service rate not to exceed $1.75 a month for residence telephones and $2.75 for business telephones.

The telephone question is a paramount issue in the municipal campaign in Kokomo.

A traffic agreement has been effected between the Monticello Telephone Company and the Yoeman Telephone Company in White County. A new toll line to connect the companies will be built.

The Citizens' Telephone Company of Terre Haute has ordered plans and is now asking for bids for

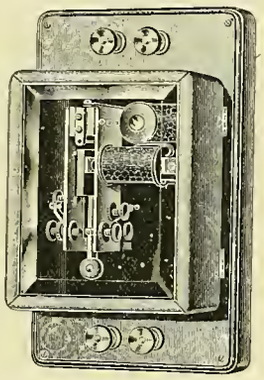
the construction of a modern exchange building. The controlling interest of the company has been secured by the Kinloch people of St. Louis, and the new management announces that many improvements will be made.

The Pocket Long-distance Telephone Company, capitalized at $20,000, has filed articles of incorporation, with headquarters in Evansville. Toll lines are to be built through Dubois, Martin, Daviess, Knox, Pike, Gibson, Posey, Spencer, Vanderburg and Perry counties. R. N. Parett, Phillip Dilly, A. J. Paton and Allan Gray are the directors. S.

Pole-changer for Telephone Work.

Illustrated by the accompanying picture is the improved type, style No. 1, Sandwich pole-changer manufactured by the Sandwich Pole-Changer Company of 200 Eddy Street, Sandwich, Ill. This device is made in four styles for both alternating and pulsating current, and its efficiency and reliability are stated to be of a high order.

Simple, rigid and compact in construction, the mechanism is mounted on an oak base and covered by a neat oak hinged box with beveled plate-glass



POLE-CHANGER FOR TELEPHONE WORK.

front and complete instrument. The outfit measures only nine by six by five inches, and weighs but four pounds.

It is so constructed that it will work either in a horizontal or vertical position, thus admitting of it being mounted on cabinet or hung on the wall, and, as it is practically noiseless, it is not objectionable in the telephone operating room.

The machine has but three contact springs, which are made of helmet bronze, and have contact points of heavy platinum. The contact springs engage alternately from their opposite sides, and consequently cannot be forced out of their normal position by extended use.

As the whole mechanism is securely mounted and locked in one solid, heavy brass frame, it is impossible for any parts to get out of adjustment, and therefore it requires no adjusting after leaving the factory.

No primary cell is used, as the vibrator is fed directly from the main batteries through resistance coils, and the consumption of current is said to be hardly one milliampere, which is practically unnoticeable. This eliminates renewal expense of the separate battery, and also does away with the trouble from frozen elements where it is necessary for the ringer to be kept in a cold room in frigid weather. The company guarantees this device, which it offers to ship on 30 days' free trial.

The Strenuous Life in Melbourne.

What the Melbourne papers call a Gilbertian situation was recently created in that city by the telephone girls of the central exchange. They suspended all telephone work in the busiest hour of the day in order to have themselves photographed in a group. They were allowed five minutes for the purpose by the head of the department, but the operation lasted for nearly half an hour, during which numerous fussy subscribers were "ringing up" in vain. The Metropolitan Fire Brigade, failing to get any response, dashed at full speed to the exchange, and retired disgusted on learning the true state of affairs. The Melbourne papers are flooded with letters calling for the abolition of the "lady telephonist." A board is inquiring into the incident.—Pall Mall Gazette.

The telephone service of Melbourne, it may be added, is an example of public ownership, being operated by the Postoffice Department.

Continued complaints come from United States consuls about carelessness of correspondents in attaching the required postage stamps to foreign letters. One consul writes: "Numerous persons have recently called at the consulate showing letters on which they have been obliged to pay 5, 10, 15, and in some instances 20 cents postage. These matters appear small, but there are few things which so irritate a business man as being obliged to pay penalty postage on letters and printed circulars. Many of the business houses in America forward packages of circulars in sealed envelopes requiring letter postage which could be sent as printed matter."

GENERAL TELEPHONE NEWS.

H. S. Mulkey has been granted a 20-year franchise for a telephone exchange in Mansville, I. T.

The Macon (Mo.) Telephone Company has purchased a lot and is putting up an exchange building.

A franchise has been granted R. D. Nichols to construct telephone lines to Renton, to connect with the Independent system of Seattle, Wash.

The council of Griffin, Ga., has named a committee to investigate the alleged deficient service of the Southern Bell Telephone Company and report at a subsequent meeting.

Henry Stinson of the Toledo (Ohio) Home Telephone Company has gone to Indianapolis to assume the position of chief electrician and acting general manager for the Indianapolis Telephone Company. H. B. Sale, general manager, will take a temporary vacation.

The Chihuahua Telephone Company in Chihuahua, Mexico, has obtained an extension of its franchise in the city and state of Chihuahua for a further period of 25 years. It is stated that the company will make important improvements and extensions to its system.

The Chicago Telephone Company reports that the number of instruments now in use in the city has crossed the 100,000 mark. The report for October shows the total number of instruments in use in the city is 100,509, a gain over the previous month of 1,717. The total number of instruments in use on the toll lines is 37,203, a gain over the September report of 409.

Sealed proposals will be received at the office of the engineer, United States Reclamation Service, Billings, Mont., until December 15th for installing a telephone system having eight or more telephone stations and 22 miles or more of pole line. Particulars may be obtained by application to the chief engineer of the Reclamation Service, United States Geological Survey, Washington, D. C., or to Robert S. Stockton, engineer, Huntley, Mont.

Writing on October 25th to J. Harris, vice-president of the Automatic Electric Company of Chicago, E. B. Fisher, secretary of the Citizens' Telephone Company of Grand Rapids, Mich., notes that since the automatic system was adopted on January 9, 1904, the number of subscribers of the Grand Rapids company shows a net gain of 1,629. This gratifying increase was made notwithstanding a raise in rates. The company expects to have 7,000 subscribers before the holidays.

At a meeting in East Orange, N. J., a few days ago the directors of the Federal Telephone Company of Cleveland elected all the old officers. F. S. Dickson is president and E. W. Moore general manager. Nothing new has developed in the proposed new company to take over the Federal telephone properties. J. B. Hoge has been in St. Louis for some days, and it is supposed that he is conducting negotiations to that end. According to figures given out for September, the gain in new telephones installed was 1,252.

At a meeting of Independent telephone men held in St. Louis a few days ago steps were taken, it is said, to put the United States Independent Telephone Company upon an operative basis. It was decided to build a plant in St. Louis to manufacture apparatus to supply all western cities. A conference committee, representing St. Louis, Indianapolis, Cleveland, Kansas City, Pittsburg and Louisville men, took steps toward standardizing the equipment, and some of the companies adopted new policies to conform with the work that is to be done. The plans of the company include the extension of lines and systems already owned, and building new plants where there are none, as well as work along lines of consolidation wherever it seems necessary. New York is the objective point at present, but it is understood that there is a movement to build in some of the large eastern cities.

MANUFACTURERS AND DEALERS.

The Kansas City Electric and Telephone Supply Company of Kansas City, Mo., has been incorporated with a capital stock of $50,000.

The Fahnestock Transmitter Company of Brooklyn, N. Y., has changed its name to the Fahnestock Electric Company, the address being still the same, 132 Havemeyer Street.

The Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., reports having closed contracts for switchboards at Varna, Ill.; Urich, Mo.; Bouton, Iowa; Atalissa, Iowa; Leonard, Mich.; Stuttgart, Kan.; Stromsberg, Neb.; Stelhensport, Ky., and Yates City, Ill.

Articles of incorporation were recently filed at Oregon, Ill., by the Killbuck Telephone Company of Oregon. The promoters are E. A. Foster, T. H. Lines and G. A. Sawber. The capital stock is $1,500, and the main office will be at Monroe Center, Ill.

CORRESPONDENCE.

Great Britain.

London, October 25.—The report of the advisory board of engineers to the Royal Commission on London Traffic has now been presented and in effect contains a most complete elaboration of the recommendations made in the main report of the commissioners, dealt with at length in the Western Electrician a short time ago. The report must have a special interest for our friends across the Atlantic, inasmuch as one of the members of the board of engineers was Mr. William Barclay Parsons, a well-known traffic expert on that side. The views expressed in a special article on this matter in the Western Electrician still hold good as regards the later publication, and generally there is little more for me to add. New main avenues and streets, accommodating tramways and all sorts of means of communication are recommended, the cost of millions of money not seeming a bar to their adoption in the eyes of the board. That these improvements are necessary to bring about a better distribution of traffic cannot be gainsaid. As I have already said, such improvements could hardly be contemplated without the co-operation of private enterprise, but with the present opinions obtaining upon the municipal councils of London the day will be far distant when such co-operation will be a thing accomplished. Even if it were, enormous difficulties would still have to be overcome. Still, the commissioners have done their work thoroughly and have disclosed a state of affairs not even contemplated by those who agitated for the appointment of the commission a few years back, and for the reason I have before pointed out, America may take the credit for having been instrumental in instigating this inquiry.

The only instance of a combined overhead trolley and underground-conduit electric-tramway system in this country, viz., at Bournemouth, has quite naturally exceptional charms for tramway men in this country especially, as the history of tramways in this seaside resort has also been somewhat uncommon. At one time a tramway company ran cars from the boundary of Bournemouth to Poole, some seven miles away, but when the municipal boundary was extended to include Poole, municipal eyes were inevitably cast upon the tramways. An arbitration was agreed upon, and here again uncommon things happened, for the company claimed a sum approaching $2,500,000, while the corporation valuation was about $350,000. Eventually a sum in the neighborhood of "half way" was awarded and the company's lines passed into the hands of the Bournemouth corporation. Poole lies to the west of Bournemouth, and the corporation has just completed a new section to Christchurch, on the east. The complete through route, consisting of trolley at either end and conduit in the center, was officially inaugurated last week. The work of changing over from the one system to the other is accomplished very expeditiously, the trolley arm being fastened down and the plow dropped in only a few seconds.

For the first time in the history of the attempt to get Parliamentary powers to run tramways over the Thames bridges and along the Victoria Embankment the city corporation and the London County Council are in complete accord, and to those acquainted with the subject it is almost astonishing to know that both parties will come to Parliament this year with measures to bring about the existence of electric tramways in this neighborhood. The London County Council will again seek its tramway powers, while the city corporation will ask for authority to widen Blackfriars Bridge to facilitate the construction of the tramways.

A new graving dock has been built by the London and South Western Railway Company at Southampton, and erected at the side thereof is an electric crane, made at Bath, England, capable of lifting 50 tons at a radius of 87 feet; the largest electric traveling crane in existence, the makers claim.

The question of the supercession of electric lighting in some streets of the city of London by gas lighting has quite naturally led to considerable controversy in both the gas and electrical journals. Estimates have now been published showing that the contract given to the gas company is at a higher figure than need have been quoted had the city corporation given the electric supply companies an opportunity of showing what they could have done with modern arc lamps. I have already stated the circumstances of the change of contract. It has been stated by the engineer to the electric supply company that the gas people change the mantles every day!

A conference of London municipal authorities was held last week to consider the advisability of promoting an electric power scheme for London, probably in anticipation of the reintroduction of the $25,000,000 scheme which was nearly passed last session. The proceedings were private.

The overhead power-transmission scheme in North Wales, in which electrical energy will be generated by waterpower, is developing, and already official sanction has been obtained for erecting overhead mains along certain routes. G.

New York.

New York city, November 6.—The Rapid Transit Commission at a meeting a few days ago decided to appeal from the injunction obtained some months ago by the Interborough company to prevent the removal of slot and weighing machines from the subway. The board decided to carry the matter to the Court of Appeals to get a ruling on its powers over the subway management. The board also received the report of George A. Soper, who was appointed last June to make an investigation of the sanitary conditions of the subway. Temperature, humidity, bacteria and dust were studied, but the report does not attempt to devise a system of cooling or of ventilation. The report says there is no cause for alarm over the subway air. It was announced that the part of the subway north of One-hundred-and-fifty-seventh Street to King's Bridge would be open about January 1st.

The Electric Time-switch Manufacturing Company of this city has been incorporated, with a capital of $100,000. The directors are Annie L. Spiegel, Louis Spiegel and Adolf Fanto of New York.

Eugene Clapp has resigned as chief engineer of the Brooklyn Rapid Transit Company to go with William Barclay Parsons. The new Brooklyn Rapid Transit chief engineer is W. S. Menden.

Electric lights in the tower of the Times Building will flash the results of the election tomorrow night so that persons can see them for miles around. The electric signals will be flashed from a point 365 feet above the street level. A steady light to the north will show that McClellan has been elected; a steady light to the east will indicate Ivins' election, and a steady light to the south will indicate that Hearst has won. Jerome's election will be indicated by a steady light to the west. A light to the north, waving from east to west, will indicate Osborne's election. A light to the south, waving from east to west, will indicate Shearn's election.

The New Globe Electric Manufacturing Company of Amsterdam has been incorporated with a capital of $250,000 to manufacture electrical and mechanical apparatus. The directors are R. W. Brown, George I. Hemel, John E. Larabee, Richard Murphy and W. C. Zehanfler of Amsterdam and Eugene Moore of Johnstown.

C. S. Saunders, president and general manager of the Buffalo Pole, Line and Constructing Company said that he will begin today the preliminary work of electrifying the West Shore railroad for a distance of 81 miles between Rochester and Syracuse by means of power from Niagara Falls. It is expected that both freight and passenger business on this section of the West Shore road will be operated by electricity by another summer.

D. W. W.

Dominion of Canada.

Ottawa, Ont., November 4.—The Town Council of Levis, Que., had a long sitting one night recently to decide whether the town should have an electric or a steam plant for the waterworks. During the discussion of the subject the electric lights suddenly went out, leaving the council for some time in darkness. That settled the question. The council decided upon a steam plant, and gave the contract.

James Kent, manager of the Canadian Pacific Railway telegraphs, states that the telegraph system of the Canadian Pacific was never in better condition than it is today. The company is increasing its telegraph mileage as fast as it can to meet the wants of the rapidly developing districts in the Canadian West. This year the company has strung about 3,000 miles of wire, half of which was copper wire.

It is reported that the new Buffalo, Niagara and Toronto Railway Company, with its scheme for an electric line from Niagara-on-the-Lake to Fort Erie, with branches to St. Catherines and Welland, is a move in the fight between the Canadian Pacific and the Michigan Central for control of the Toronto, Hamilton and Buffalo Radial Railway. It is asserted that the Canadian Pacific has created the new scheme so that if the Michigan Central gets control of the Toronto, Hamilton and Buffalo, the Canadian Pacific Railway will not be shut out of the Niagara district. With the control of the Hamilton, Grimsby and Beamsville line, the Canadian Pacific, by building the proposed Buffalo, Niagara and Toronto line, could reach every part of the peninsula.

Canadian Minister of Marine Hon. Raymond Prefontaine has returned from his recent trip to Sable Island and expresses himself as delighted with the splendid results obtained by the Marconi signal station on that island, although it has only been established there a little over a month. He said: "I am informed that from 80 to 100 messages a day are received at present at the Sable Island station. They communicate with Camperdown, near Halifax, N. S. There is not an American liner passing a hundred miles away that does not communicate with Sable Island."

It is said that the Marconi people are considering making another change in their transatlantic station at Cape Breton, N. S. A chief trouble with the Glace Bay station is that while messages can be transmitted from there, it is not possible, with anything like equal facilities, to receive. This has been the point where failure has come. Marconi officials will give out nothing at all, but it is thought that if a new station at Lorne Head is erected, it will be used for the reception of messages, while that at Glace Bay is reserved for transmitting. The cost of the first Table Head station was practically defrayed by the money given to Marconi by the Dominion government when he first determined to build transatlantic stations in Nova Scotia. The present Glace Bay station has cost over $150,000.

Much that is interesting is found in the annual statement of the Montreal Street Railway. The road's progress for the last 11 years can be traced, and in no year has there been a pause in expansion and progress. In 1895 the road carried 32,906,000 passengers; last year it carried 86,433,099 passengers. The gross earnings jumped from $1,000,000 to $2,707,000. Including stock, bonds and mortgages, the road is paying dividends and interest on $9,509,367. The share of the city of Montreal in the earnings this year was $147,724, being an increase of over $40,000 in three years. During the year passengers were carried over the lines of the company at the average rate of 3.09 cents each. In time the new cars now being constructed, in which passengers pay as they enter, thus doing away with the collecting through the car, as now generally in vogue, will be used exclusively. Managing Director Ross states that this type of cars is saving 15 per cent. in fares, and the continued presence of the conductors on the platforms will largely decrease the number of accidents. During the year 130 cars were added to the equipment, and there is now a total of 775 cars in commission.

W.

Winnipeg, Man., November 4.—A new power association has been formed of prominent business men of this city to inaugurate a municipal power scheme pending necessary amendments to the city charter. It expects to deliver electric energy in Winnipeg within a year. Big Bonnet Falls is selected as the site for the source of power.

F. H. McGuigan of the Grand Trunk Railway has stated that his company will require power to draw at least 850 tons in one train through the St. Clair Tunnel.

The Welland Electric Power Transmission Company, with headquarters at St. Catharines, will use the Welland River to generate its power, and contemplates running power lines to St. Catharines and Toronto by way of Milton and Brampton. Under its charter it also has power to build to Guelph.

The Toronto Electric Light Company offers to do the city lighting at 19 cents per night for each light for five years, or 17¾ cents for 10 years. The city is now paying 20½ cents per light.

Foley, Lock & Larson of Winnipeg are installing one of the largest isolated electrical plants west of Toronto. The work is under the supervision of Ernest S. Harrison and the machinery is to be used in connection with the company's new candy and biscuit factory. The installation includes two 100-horsepower tandem compound engines, manufactured by A. L. Ide & Sons of Springfield, Ill.; two 75-kilowatt 250-volt generators and 27 motors. This will be one of the largest isolated plants ever installed in Canada.

The London (Ont.) street-railway directors have appointed T. D. Benson secretary-treasurer. No manager will be appointed. The road will be governed by the directors, of whom T. H. Smallman is the local head. It has been decided to expend a large sum in completing and overhauling the entire system, adding additional rolling stock and electric appliances.

Premier Whitney states that the appointment of an electrical commission will be made at the ensuing meeting of the Ontario Legislature. The duties of the commission will be to deal with all electric-railway affairs, such as disputes over rights-of-way and with municipalities.

H.

Ohio.

Cleveland, November 4.—By December 1st through service between Dayton and Toledo will be an established fact, according to announcements made by Manager F. D. Carpenter of the Western Ohio. By that time the extension of the Western Ohio from Lima to Findlay will be completed and cars will be operated from Findlay over the Toledo, Bowling Green and Southern. The running time for the limited cars from Dayton to Toledo will be four hours and a half, the distance being 160 miles.

An increase of capital stock from $6,000 to $3,000,000 has been made by the East Liverpool Traction and Light Company. This action was taken for the purpose of completing the merger deal, which includes the East Liverpool and Rock Springs Traction Company, the bridge between East Liverpool and Chester, Pa., the Chester Light and Power Company, the People's Light and Power Company and Rock Spring Park.

It is said that negotiations have been progressing in the proposed merger of the Avon Beach lines and the local line at Lorain with the Lake Shore Electric. It is also said that the Lake Shore is making arrangement to run through cars from Elyria over the Lorain Street railway line, the Avon Beach line and the main line to Cleveland.

The Toledo Gas, Electric and Heating Company has about completed its lines in the downtown section of the city. The new turbine engine is in operation and is supplying current for the West End.

The Supreme Court has rendered a decision adverse to Toledo in the universal-transfer case.

Judge Evans of Columbus has held that the franchise of the Indianola Heat and Light Company of that city is valid.

Important improvements are contemplated by the Mahoning and Shenango Railroad and Light Company, the merger of the Youngstown and Sharon roads. New and improved cars will be put on and many other betterments made. It is said that another line may be built between Sharon and Newcastle, Pa.

The Sandusky Southwestern Railway Company of Wapakoneta has increased its capital stock from $1,000,000 to $2,000,000.

O. M. C.

Indiana.

Indianapolis, November 4.—The Capital City Electric Company of Indianapolis has filed articles of incorporation. The capital stock is $5,000. The object of the company is to manufacture, buy and sell electrical and steam appliances and machinery of all kinds. William Phipps, L. S. Phipps and A. F. Eggers are the directors.

The Evansville Gas and Electric Light Company is engaged in putting in a big gas main which will surround the city for the purpose of equalizing the gas pressure in all parts of the city.

Municipal ownership of the electric-light plants and other public utilities is the paramount issue in the campaign just closing in the cities of Terre Haute and Fort Wayne. Both political parties in each city are pledged to municipal ownership of such utilities, but differ widely as to the best method of bringing it about. The new cities-and-towns law of Indiana provides that such question shall be submitted to a vote of the people.

The officials of the Union Railway Company at Indianapolis are letting contracts for the improvement of the Union Station. The contract for the electrical work and the heating and lighting are the most important, since the cost will approximate $75,000.

Arrangements are making by officials of the Indianapolis and Cincinnati Traction Company, operating between Indianapolis and Shelbyville and between Indianapolis and Rushville to entertain the meeting of the Indiana Electric Railway Association in Rushville on November 9th. An opportunity to inspect the single-phase alternating-current electric system of the company will be given at the meeting.

The Indiana Union Traction Company is trying to devise a satisfactory method of serving lunches or light refreshments on its through cars between Indianapolis and Marion and on other long runs. It is thought a buffet luncheon will be possible.

Frank Bruff has been employed to make plans for the new Union Traction station to be built at Kokomo. The building is to be two stories with a 70-foot frontage. The freight department will be in the south end.

Profiles and maps were filed with the clerk of Montgomery County this week locating the right-of-way for the proposed western extension of the Indianapolis, Crawfordsville and Western Traction Company, which has its grade completed from Indianapolis to Crawfordsville.

Manager Gardner Wells of the Terre Haute Traction Company has informed the people of Paris, Ill., that the interurban line from Terre Haute to that place will not be built until the Illinois Legislature amends the law, which would require the company to incorporate under the laws of that state. The line has been built to within a few miles of the state line.

J. S. Farrell & Co. of Indianapolis have been awarded the contract for the electrical construction of the barracks, guard-house and gymnasium of the Fort Wayne army post, near Detroit, Mich. The company has also recently been awarded the entire heating contract and electrical construction for Fort Harrison, near this city.

S. S.

Rocky Mountain States.

Boise, Idaho, November 3.—The Common Council of the town of Haines, Idaho, has granted the application of J. F. O'Bryant to install and operate a power and light plant in the corporation limits for a period of 30 years.

The McCabe Water, Light and Power Company of Prescott, Ariz., has been incorporated with a capital stock of $50,000 by H. A. Suttle and Hiram E. Todd, both of Peoria, Ill.

W. T. Campbell of Eugene, Ore., and associates will, under the name of the Oregon Electric Power Company, appropriate water from Mackenzie River for the purpose of generating electric power. The power house will be located about 11 miles from Eugene. The company offers to furnish power for the proposed municipal electric-light system.

The Malad Light and Power Company has been incorporated with a capital stock of $100,000 by C. F. Little, D. S. Taggart, C. M. Jay, J. A. Largent and G. C. McLaughlin. The company will conduct an electric-light and power plant at Malad, Utah, having succeeded to the rights of G. C. McLaughlin and Frank Moore. Offices will be maintained at 145 Meith Block, Salt Lake City.

A.

Northwestern States.

Minneapolis, November 4.—The franchise of the Mankota and St. Peter Railway and Lighting Company of Mankota, Minn., has been extended to February 12, 1906. By that time the franchise of the Willard company also expires and one or the other will then be granted an extension.

The Des Moines (Iowa) Interurban Company is considering the advisability of building a trolley line from Boone to Ames.

The subscription books of the Black Hills Traction Company have been closed. The construction work is nearing completion.

There is talk of a new electric railway from Council Bluffs to Griswold, Iowa. It is reported that James J. Hill is interested.

N. N. Johnson has resigned as superintendent of the Stillwater (Minn.) Gas and Electric Light Company.

The Southern Wisconsin Interurban Company's franchise at Janesville has expired. It is thought that the Rockford, Beloit and Janesville line will apply for a franchise to extend its road through Janesville to Madison.

The Winona (Minn.) Railway and Light Company is planning to build several extensions to its street-railway lines.

It is proposed to install an independent electric-light plant at the courthouse at Crookston, Minn.

Brasie & Co. have sold the electric-light plant at Becker, Minn., to John Hintz.

The contract has been let to the Westinghouse Electric and Manufacturing Company for a complete street-lighting system at Moorhead, Minn. R.

Pacific Slope.

San Francisco, November 3.—The Pacific Gas and Electric Company will soon be the dominating factor in the local light and power situation. Sufficient stock of the California Gas and Electric Corporation and the San Francisco Gas and Electric Company has been deposited with the Union Trust Company to assure the consolidation of the two concerns. The privilege of disposing of the stock of the San Francisco Gas and Electric Company at the rate of $25 cash and $65 in bonds of the new company expires Novembere 15th. The details of the consolidation are being handled by N. W. Halsey & Co., bankers of New York and San Francisco. The San Francisco Coke and Gas Company has the only competing gas plant and the Mutual Electric Light Company carries on the only opposition electric-light plant of any size.

The Santa Cruz Portland Cement Company, which is constructing a new factory with a daily capacity of 5,000 barrels of cement, has ordered induction motors for operating the machinery. There will be more than 20 motors, the largest having a capacity of 850 horsepower. The aggregate horsepower in motors exceeds 5,000 horsepower.

The Central California Traction Company is pushing its construction work in Stockton, Cal., and will complete at least seven miles of electric street railway by next March, thereby saving its franchise.

The Oro Water, Light and Power Company of Oroville, Cal., has closed contracts for the equipment of its electric power transmission plant at Pentz. A 16-mile pole line will connect with Oroville, where a large amount of power is used for the operation of gold dredges. There will be two units, each consisting of two Pelton wheels, one at each end of the shaft, with a railway-type General Electric three-phase 1,000-kilowatt generator in the middle. Water from the company's ditch system will be used to operate the wheels under a head of 465 feet. The tail water will be discharged into the system supplying Oroville with city water.

The Ocean Shore Railway Company has awarded contracts for the electric equipment of its power house, sub-stations and cars to the General Electric Company, and for the steam-engine and boiler plant to Charles C. Moore & Co. The power house will be erected at Balboa, on Halfmoon Bay. W. L. Holman of this city has been awarded the contract to build a number of the 50 cars. These will be capable of making 60 miles an hour, each carrying four 125-horsepower motors. Construction work is now under way at each end of the road.

The San Jose and Santa Clara street railway, embracing the electric road from San Jose, Cal., to Santa Clara, and the electric line from San Jose to Alum Rock has been sold to L. E. Hanchett and his associates, who recently purchased the Santa Clara Interurban Railroad Company. The eight-mile line to Alum Rock will be rebuilt and equipped with modern cars. The purchase price is reported as $650,000. Hugh Center, one of the original owners, refused to state what interests were represented by the purchasers, but John Martin of the California Gas and Electric Corporation has become a new stockholder. It is also reported that Edwin Hawley, who is interested with George Gould in the Western Pacific railway, is in the deal. The Santa Clara Interurban is to be extended by the same new owners from Santa Clara to San Mateo.

The City Council of Eugene, Ore., has closed a contract with Engineer Kelsey for the construction of municipal light and water plants, for which bonds to the amount of $200,000 have been voted. The limit of legal indebtedness has been reached and the legality of the bond issue may be questioned.

A franchise has been granted by the commissioners of King County, Wash., to Otto Standahl for three electric railways—one from Renton to Tolt via Issaquah; one from Renton to Seattle, and one from Seattle to West Seattle. Mr. Standahl is treasurer of the Seattle, Everett and Skagit road, which was recently bonded to build suburban lines.

The Hawthorne Improvement Company has granted an additional right-of-way to H. E. Huntington for the four-track electric road from Los Angeles to Redondo via Inglewood. The company has purchased 300 acres located at Freeman Station. It is the intention of the company to subdivide and put in a water supply.

The Rubicon Water and Power Company has been incorporated by G. S. Wall, A. S. McDonald, R. A. Jackson, George C. Davis and H. D. Jerrett, with a capital stock of $1,000,000, and makes San Francisco its principal place of business. A.

PERSONAL

E. L. Goldschmidt of Milwaukee, representing the Wire and Telephone Company of America, was in Chicago last Saturday in the interest of his company.

Arthur Warren has resigned as manager of the publicity departemnt of the Allis-Chalmers Company and will sail for Europe about the end of November.

H. B. Rockwell of New York city, for 10 years connected with the New Hampshire Traction Company, has accepted the position of general superintendent of the Mobile (Ala.) Light and Railway Company.

T. F. Grover, who resigned recently as general manager of the Eastern Wisconsin Railway and Light Company, with headquarters in Fond du Lac, Wis., has moved to Chicago with his family and is now engaged in business in this city.

George L. Lindsley, president of the Lindsley Bros. Company of Chicago, is receiving the congratulations of his friends on his recent marriage to Miss Marie Alice Stone, daughter of Mr. and Mrs. P. F. Stone of Rockford, Ill. The ceremony was witnessed by many of Mr. Lindsley's friends from the West and Northwest.

A. J. Purinton has been elected general manager of the Fairmont and Clarksburg (W. Va.) Traction Company. Mr. Purinton has lately been general manager of the Springfield (Mass.) and Eastern Street Railway Company. At a recent meeting in New York by the board of directors of the company, plans were approved for the extension of the trolley line to Clarksburg from Fairmont.

Bernard V. Swenson, who is now secretary and treasurer of the American Street and Interurban Railway Association, spent a few days in Chicago last week while on his way to Madison, Wis., to complete arrangements preparatory to taking up permanent residence in New York city. Mr. Swenson has entered enthusiastically upon his new work and speaks optimistically of the future of the association since the reorganization of its affairs which took place at the Philadelphia meeting. He has succeeded in securing desirable offices at 60 Wall Street, which will be the headquarters of the association, and where a library will be established and records filed.

Edward C. Dobbelaar, assistant engineer and electrician of the New York Sun, who was killed at Fort Lee, N. J., met his death through a peculiar trend of circumstances. In attempting to save buildings near his home from destruction by fire he tried to cut a high-pressure electric wire that was grounded in the branches of a tree overspreading the houses. Sparks were falling on the shingle roofs when he placed a ladder on rubber supports, and, mounting to the rung nearest the wire, clutched the wire with his left hand preparatory to severing the circuit with a pair of rubber-insulated pliers. The insulation of the wire must have been defective, for no sooner had he touched it than the current grounded through his body. He fell heavily to the ground, unconscious, and died within a few seconds. The line pressure was 2,500 volts.

A. P. Peck, who is well known in the Middle West as a successful salesman of electrical machinery, has joined the Allis-Chalmers Company and will hereafter be connected with the New York office of that company. He will travel throughout the New York district, giving attention particularly to the sale of power and electrical machinery. Mr. Peck is an associate member of the American Institute of Electrical Engineers and a native of Chicago. He was graduated from Purdue University in 1892 with the degrees of B. M. E. and E. E. Immediately after graduation he became identified with the Chicago World's Fair as assistant engineer of arc lighting. From 1894 to 1896 he was with the Westinghouse Electric and Manufacturing Company. It was under his supervision during this time that the motors and wiring were installed in the cars of the Chicago City Railway Company. Beginning his career as a salesman in 1896, Mr. Peck was first employed by the New York Belting and Packing Company. In 1898 he became identified with the manufacture of electric signs, and was engaged in that business for three years. His next connection was with the engineering department of the Chicago Edison Company, selling power and lighting apparatus. About three years ago he joined the National Electric Company as electrical sales agent, and made Milwaukee his headquarters. His territory included Northern Michigan, Wisconsin, Iowa and Missouri. Mr. Peck's connection with the Allis-Chalmers Company began in the early part of October.

A. P. PECK.

ELECTRIC LIGHTING.

A number of citizens have secured a franchise and will install an electric-light plant at Friend, Neb.

Frank A. Higley has been granted a 20-year franchise for an electric-light plant in Osborne, Kan.

The Santa Fe railroad is putting in an electric plant near Argentine, Kan., to light is shops, yards and depot.

W. R. Thurston of Berne, Ind., has been granted a franchise to build an electric-light plant at Geneva, Ind.

The electric-light company of Trenton, Mo., is negotiating to furnish light to several of its neighboring towns.

Lehigh, I. T., has granted franchises to the Consumers' Ice Company to operate an electric-light and power plant.

Smith & Weaver of Woodstock, Fla., want information as to cost, etc., of a small power plant to operate a barrel factory.

In Baldwin, Kan., the proposition to issue $10,000 in bonds for a municipal electric-light plant was carried. Bamberg, S. C., has also voted to issue $15,000 in bonds to build an electric-light plant.

The town of Williamston, N. C., wants to correspond with electric companies relative to the installation of an electric-light plant. S. J. Everett is secretary of the Business Men's Association.

Clarence H. Ellis of Alton, Fla., wants bids on both a direct-connected 45-kilowatt generator set and on a 45-kilowatt belted generator; 60-horsepower engine and 75-horsepower return tubular boiler; also on a 35-kilowatt generator set.

The American Light and Traction Company's report of its earnings for the nine months ended September 30th shows an increase in the earnings for that period of $104,118 and an increase in profits footing up to $95,783. The surplus September 30th was $2,036,021.

Alfred H. Brooks, chief of the Alaskan division of the United States Geological Survey, reports that the city of Fairbanks, in the Yukon-Tanana district, which a few years ago was a howling wilderness, is now lighted by electricity, and heated by steam, has three banks, one daily and one weekly paper and fine public schools.

This rather curious advertisement appeared in a London newspaper: "Spectacles for electric light, incandescent gas and other powerful illuminants. —— & ——'s thermoscopic lenses protect the eyes from glare, and render the above lights soft and cool." In this country the glare-dispelling apparatus is put about the light in the form of shades rather than on the head of the user as spectacles.

Tower lights are not looked upon with favor by General Manager Freshney of the board of public works of Grand Rapids, Mich. He is of the opinion that the 160 tower lights now burning on the 40 towers would be put to better use if they were distributed among the resident sections of the city, and asked the city attorney for an opinion as to placing the locating of lights in the hands of the board of public works.

The People's Light and Railway Company of Streator, Ill., and the Streator Gas and Light Company have been purchased and the two properties combined by the recently incorporated Illinois Light and Traction Company. The new corporation is capitalized at $400,000, and, in addition to extending the local lines will build an interurban road connecting Streator and Ottawa, Ill. Negotiations are pending, it is said, for the purchase of the street-railway plants and the lighting plant at Ottawa.

Col. F. W. Blees has disposed of his stock in the Northwestern Electric Heat and Power Company of Kearney, Neb., and retired from business November 1st. William E. McCully of Macon, Mo., is one of the new owners and general manager. Mr. McCully is also general manager of the Macon Gas and Electric Light Company, Marshall (Mo.) Electric Light and Power Company, Palmyra (Mo.) Light and Water Company and several other industries. The new president of the company is Thomas E. Wardell and the vice-president is Fred H. Tedford. The resident manager will be S. J.

Duncan of Marshall, Mo. L. E. Watson, who has been manager of the plant, has accepted the position of manager of the Beatrice (Neb.) electric plant.

ELECTRIC RAILWAYS

In Topeka, Kan., is was decided recently in court that the Kansas railroad commission has no jurisdiction over interurban electric lines.

The Chicago City Railway Company has begun the remodeling of 80 cars used on its Halsted Street line. About $50,000, it is said, will be put into improvements in the equipment on this line.

The Bloomington, Pontiac and Joliet single-phase electric railway, designed to run from Bloomington, Ill., to Joliet, Ill., through Pontiac and Dwight, has put in operation an additional length of line of about 10 miles.

Henry M. Bowen of De Soto, Mo., general manager of the proposed Hillsboro and De Soto electric railway, says the line will be built from St. Louis through De Soto, and to the Flat River country within the next year.

Consul-general Listoe reports the first use of electricity as a motive power in Rotterdam. He says electricity has been put in the place of horses. The new power is furnished by the city, which is building a large central plant.

E. J. Spencer of St. Louis, president of the Texarkana Light and Traction Company, has been appointed receiver of the Texarkana (Ark.) Electric Street Railway Company on petition of the Colonial Trust Company of St. Louis.

The proposed trolley line between Easton, Pa., and Washington, N. J., is now to be completed, according to the announcement of T. A. Hay, president of the company. The large concrete piers where the trolley line will span the public road leading to Uniontown and Port Warren, are completed.

Application has been made to the City Council of Chickasha, I. T., for a franchise for an electric street-railway system. J. G. V. Redmon, W. T. Crosless, U. S. Jones and W. G. Shannon are named as the grantees. Several of these men are connected with the Washita Valley Interurban Railway Company, which proposes building a line from Anadarko to Shreveport, La.

Consul Thomas H. Norton of Smyrna calls attention to the construction of tramways in Asia Minor, and believes that American construction companies may find business there. It is unfortunate, he says, that the prejudice against the introduction of electricity as a motive power still continues in Turkey, but the construction of horse-car lines there may offer a market for the sale of discarded types of American street cars.

The persons proposing the construction of an electric railway connecting Mattoon and Decatur, Ill., and connecting with lines to Springfield, Bloomington and East St. Louis, have incorporated as the Decatur, Sullivan and Mattoon Transit Company. Construction work is to be taken up next spring. The road is to be 42 miles long. R. B. Starbuck of Mattoon has been elected president of the company; J. M. Cloakey of Decatur, vice-president, and W. A. Steele of Sullivan, secretary-treasurer.

On a down grade and sharp curve near the Cornell campus the rails of the Ithaca Street Railway Company were coated with soap a few nights ago. When a loaded car approached several men emerged from the darkness and pulled the trolley from the wire. Only the fact that an experienced motorman and conductor were in charge, who succeeded in replacing the pole and reversing the power, saved the passengers from precipitation into the deep gorge. The act is thought by the railway company's manager to have been done by college students of Ithaca under the guise of a college prank. A reward is offered for the identification of the guilty persons.

Passenger traffic on the elevated railways of Chicago for the month of October shows good gains in all cases compared with October, 1904. The Metropolitan shows the largest gain in the daily average of passengers carried, being 15.20 per cent. The South Side Elevated gained 11.44 per cent., the Northwestern 9.89 per cent., and the Chicago and Oak Park road 9.05 per cent. The daily average of passengers carried on the several elevated roads in October, 1905, and October, 1904, respectively, is as follows: Metropolitan, 131,990, 114,572; South Side, 92,824, 83,291; Northwestern, 80,642, 73,385; Chicago and Oak Park, 49,137, 45,057. With the exception of the month of June on the South Side line the October figures on all the roads are the largest shown this year.

PUBLICATIONS.

The hydro-electric plant of the Spring River Power Company of Joplin, Mo., is described in a recent bulletin issued by The Arnold Company of Chicago, which was the engineer on the work. The description is largely reprinted from articles appearing in the technical journals. The bulletin will be sent by The Arnold Company on request.

The Schug Electrical Manufacturing Company of Detroit, Mich., has issued a folder describing its line of induction spark coils. The folder contains a number of diagrams useful to the users of jump spark coils.

Insulating Black, a quick-drying protective varnish for electrical work, is manufactured by the Standard Varnish Works of New York and is said to have high insulating qualities. Particulars concerning this varnish are contained in a small folder sent out by the company.

Typical illustrations of concrete structures, such as bridges, abutments, piers, building foundations, etc., are contained in an interesting booklet issued by the cement department of the Illinois Steel Company of Chicago, the annual output of which is said to be 2,000,000 barrels. Several good testimonials from the company's patrons are also contained in the booklet, showing what they think of Universal Portland cement.

Direct-current mercury-vapor lamps for ceilings are one of the late productions of the Cooper Hewitt Electric Company of New York, and are described in a recent bulletin. The new ceiling light operates on a current of 3.5 amperes, two lamps being placed in series for 196 to 244 volts. The lamps are made in two sizes, for 98-106 volts and 106 to 122 volts, the tube of the former being 17½ inches and the latter 20¾ inches long. The automatic type of lamp described in the bulletin has a small solenoid or magnet on the suspension bar just above the holder. When the circuit is closed the current flows through the solenoid, which tilts the tube for starting.

SPACE TELEGRAPHY.

Judge Townsend, in the United States Circuit Court, has refused to vacate an order issued on May 20th at the instance of the De Forest Wireless Telegraph Company suspending the injunction granted against the Marconi company in its suit against the De Forest company for alleged infringement of patents. The final outcome of the case rests with the decision of the United States Court of Appeals.

SOCIETIES AND SCHOOLS.

The University of Minnesota has issued a bulletin relating to its School of Mines, giving general information concerning the personnel of the faculty, admission requirements, fees, etc., also outlining the courses of study. In the School of Mines this year there are 15 seniors, 15 juniors, 36 sophomores and 41 freshmen.

At the first meeting of the new executive committee of the Old Time Telegraphers' and Historical Association in Washington, D. C., President William H. Young presided. H. F. Taff was elected as secretary and James H. King treasurer. It was decided that the reunion in 1906 should be held on October 9th, 10th and 11th in Washington.

Under the direction of Howard D. Minchin of the University of Rochester, N. Y., a class in electrical engineering has been started at the evening high school in Rochester. Most of the pupils are stationary engineers averaging 40 years old. A two-year course is suggested, lessons to be given every Monday evening during the night-school seasons.

It is expected that the proceedings of the twenty-eighth convention of the National Electric Light Association, held at Denver and Colorado Springs, will be ready for distribution about November 20th. The papers, reports and discussions presented at the conventions of this association are now so voluminous that they can no longer be bound in one volume, and, following last year's precedent, this work will be issued in two volumes, volume II. containing the Question Box and Wrinkles, which alone comprises over 700 pages.

MISCELLANEOUS.

At La Crosse, Wis., an electrical inspection ordinance has been introduced in the City Council and referred to the committees on fire and judiciary.

At Minneapolis the tax commissioners have allowed an appropriation of $1,500 for the employment of an outside electric-wiring inspector, and the city attorney has been instructed to draft a suitable ordinance covering the supervision of overhead construction.

A train to be known as the Oriental Limited has been equipped by the Great Northern Railway and will be put in regular service on November 19th between St. Paul and Puget Sound points. The new train is a model for comfort and convenience in train equipment. In placing the new train in service the Great Northern has had in mind not only the retaining of travel but to create it. This end should be accomplished, inasmuch as in undertaking a journey of 2,000 miles the ease and comfort with which it can be accomplished has become a first consideration with the tourist or business man. The Oriental Limited is made up of a locomotive of the most advanced and powerful type; elegant day coaches, seating 84 people; new tourist sleepers; new dining cars; palace sleeping cars, and a compartment observation library car.

The Scranton (Pa.) Street Railway Company is testing the utility of concrete poles for its trolley wires in place of the usual wooden or iron poles. The concrete poles are about 30 feet long and one foot in diameter at the butt, tapering to seven inches at the top. An iron rod extends through the center. While costing more than wooden poles the company believes they will last much longer and result in a saving in the end.

The report of the electrical engineer for the District of Columbia for the last fiscal year has been submitted, showing items of cost in connection with lighting streets, fire-alarm system, police patrol, municipal telephone service and electric works in public buildings. Under act of Congress it is reported that over 2,000 miles of aerial telephone wires were erected, including cables, while about 1,100 miles have been taken down. There were nearly 12,000 poles for electric wires in the District at the end of the year.

Although the steam engine of today must compete with the simplicity, compactness and effectiveness of the steam turbine and the high commercial economy of the gas engine, there are still many cases where it is found advantageous to install this class of prime mover. It is asserted by the Westinghouse Machine Company that the advent of the steam turbine and gas engine only seems to stimulate the demand for prime movers of all types and the steam-engine business keeps pace with this demand. This company has within the last few weeks booked orders for more than 75 steam engines, aggregating 10,764 horsepower.

Two workmen were killed, presumably by gas, in the tunnels of the Illinois Tunnel Company of Chicago last week when they entered the bore to determine the amount of damage done by water which found its way to the tunnel when one of the city water mains burst near the corner of Eighteenth and Clark streets. Water from the broken main did a large amount of damage to property in the neighborhood. Although the tunnel is 250 feet from the point where the pipe broke, water rushed into the shaft and forced open the air lock gate releasing the compressed air from the tunnel. Gas then seeped into the tunnel from the surrounding soil.

TRADE NEWS.

The American Electric Sign Company has removed from 133 Summer Street, Boston, to larger quarters at 44 High Street.

Receivers have been appointed for the Warren Electric Manufacturing Company of Sandusky, Ohio. They are R. E. Schuck, John Whitworth and James Flynn, local bankers. Frank Warren has succeeded L. G. Read as manager. The company is reported to be solvent, but the management since the death of C. C. Warren has been criticized.

The National Electric Company of Milwaukee, manufacturer of Christensen air brakes, air compressors and electrical machinery, has opened a Cleveland office at No. 416 Electric Building, in charge of George S. Hastings, who will handle the complete line throughout Ohio, Indiana, Michigan, West Virginia and New York as far east as Schenectady, and electrical machinery only in Pennsylvania as far east as Johnstown.

Information has just been received to the effect that the Minerallac Company of Chicago has been awarded a prize of 500 francs ($96.50) and given honorable mention by the Industrial Association of France for the ingenious electroscope which it manufactures. This device is used to indicate the potentials on underground and overhead cables. The Industrial Association opened a competition about a year ago for an indicating instrument which would serve to protect workmen and those engaged in the installation of electrical conductors carrying dangerous potentials.

The Rail Joint Company has been organized by filing at Albany, N. Y., a certificate of incorporation, with a capital stock of $1,500,000, of which $1,000,000 is common stock and $500,000 preferred stock. The officers of the company are: President, Frederick T. Fearey; vice-presidents, Lawrence F. Braine and Percy Holbrook; treasurer, Fernando C. Runyon; secretary, Benjamin Wolhaupter. This company will take over the business and properties of the Continuous Rail Joist Company of America, the Weber Railway Joint Manufacturing Company and the Independent Railroad Supply Company.

Catalogue No. 13 of the Keystone Electrical Instrument Company of Philadelphia supplementing catalogue No. 12 has been issued, covering Keystone standard direct-reading instruments for direct-current circuits, in switchboard and portable types. Accompanying the catalogue is a circular relative to the patent situation of Keystone instruments. This circular gives the opinion of the company's

counsel, Joseph C. Fraley of Philadelphia, concerning the validity of the Keystone patents. Briefly abstracted, Mr. Fraley's opinion states that none of the instruments listed and described in catalogues Nos. 12 and 13 infringe any claims, valid or invalid, of any patents held by the Weston company.

Electrical engineers experienced in matters appertaining to the technique of methods of high insulation will be interested to know that W. Strohn, connected with Emil Passburg, inventor and manufacturer in Berlin, Germany, of all vacuum apparatus made under the Passburg patents, has come to America and taken up his residence in Buffalo, to become associated with Joseph P. Devine of Buffalo. Mr. Devine has for years exploited successfully in the United States the Passburg vacuum drying process. This system of drying under vacuum is the result of 25 years' practical experience in the production of drying apparatus and its auxiliaries for removing moistures from various materials. Incidentally it may be said that Mr. Devine has introduced the Passburg system into the majority of the larger electrical manufactories in the United States and Canada.

On November 3d a petition in involuntary bankruptcy against the Ruthenberg Reduction Company of Niagara Falls was filed in the office of the clerk of the United States District Court in Buffalo by an attorney who represented several claimants. This company has an experimental plant on the lands of the Niagara Falls Power Company, and was making experiments with the process of Marcus Ruthenberg for the electrical reduction of steel. Some of the men connected with the company appear to feel that the process will yet prove a commercial success, and they may continue the work. It will be remembered that Mr. Ruthenberg also experimented in Lockport, N. Y.

BUSINESS.

The National Electric Company of Milwaukee has recently closed a contract with the Arbuckle-Ryan Company of Toledo, Ohio, for two 250-kilowatt engine-type alternating-current generators for installation at Canton, Ohio.

The Westinghouse Machine Company of East Pittsburg, Pa., has within the last few weeks received orders for its turbines from the Lumberton Cotton Mills, Lumberton, N. C.; from the Waltham Gas Light Company, Waltham, Mass., four 500-kilowatt turbines; the Gulfport and Mississippi Coast Traction Company, Gulfport, Miss.; Suburban Electric Company, Scranton, Pa.; the Pennsylvania Light and Power Company, Pittsburg, Pa.; the Water, Light and Gas Company, Hutchinson, Kan., and the Winston-Salem Power Company, Winston-Salem, N. C.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) October 31, 1905.

802,967. Method of Bonding Electric Conductors. Harold P. Brown, Montclair, N. J. Application Filed January 3, 1905.

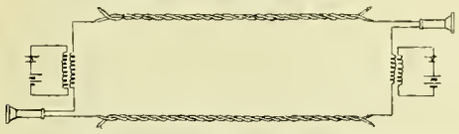
Surfaces for brazing or soldering are prepared, according to this process by placing the bond in the proper relation to the surface to which it is to be united and supplying heat to make the connection by flameless chemical reaction.

802,981. Wireless Signaling Apparatus. Lee De Forest, New York, N. Y. Application filed December 10, 1902.

Several wave collectors are associated with a wave-responsive device between each collector and the earth. Conductors connect the upper ends of the wave collectors in pairs, a shunt connection is placed between the earth connections of the wave collectors and an indicating mechanism is situated in the shunt connection.

802,993. Trolley-wheel Bearing. Robert Kissinger, Columbus, Ohio, assignor of one-half to S. B. Hartman, Columbus, Ohio. Application filed March 27, 1905.

Mechanical parts relative to the bearings of trolley wheels are the basis of this patent.



NO. 803,110.—COMPOSITE CONDUCTOR FOR TELEPHONE LINES.

802,994. Terminal Connector for Electric Conductors. John H. Kliegl and Anton T. Kliegl, New York, N. Y. Application filed December 8, 1904.

Upstanding wings are a part of the body portion of the connector, a perforated plate extending from the body portion. A tongue or strip extends between the wings from the plate and has a perforation near the plate.

802,999. Fuse Block or Cut-out. Harry W. Lawrence, Denver, Colo., assignor to the New England Electric Company, Denver, Colo. Application filed April 30, 1904.

Features of a fuse block are described in which the fuses for two conductors are enclosed in two chambers in the block separated by a partition. Apertures through the ends admit the conductors.

803,008. Motor Vehicle. Herman P. Moorrees, New York, N. Y. Application filed October 6, 1904.

An electrically propelled automobile is described.

803,009. Motor Vehicle. Herman P. Moorrees, New York, N. Y. Application filed February 24, 1905.

A method of mounting the motor of an electric automobile is the basis of the patent.

803,010. Insulator. Elmer P. Morris, East Orange, N. J. Application filed June 6, 1904.

A secondary insulator for lines of relatively high-potential difference is described which consists of a flat body of hard porcelain longer than the primary insulator carrying the conductor. A groove or grooves across the upper surface are substantially parallel to the course of the conductor, and means integral with the insulator provide for attaching it to a support.

803,020. Controller for Electric Cars. Francis A. Roche and Francis J. Roche, Somerville, Mass. Application filed March 15, 1905.

The handle and its associated parts of an electric car controller is described.

803,042. Knitting Machine. Charles H. Wynne and Eustace C. Wynne, Leicester, England. Application filed February 7, 1905.

Electric stop motion for knitting machines operated by motors embodies mechanism operated by an armature which acts to throw the driving gear out of action.

803,107. Transmission of Electric Currents. Isidor Kitsee, Philadelphia, Pa. Application filed May 20, 1904.

A telephone cable comprises several independent composite line conductors, each conductor comprising conductively independent conductors twisted together throughout their lengths.

803,108. Electric Transmission of Intelligence. Isidor Kitsee, Philadelphia, Pa. Application filed June 24, 1904.

Combined with an all-metallic telephone circuit is a series of devices inserted at different points in the line and adapted to increase the efficiency of the line. Each of the devices consists of a support and a pair of twisted wires around the support. One terminal of each of the wires is connected to the line, the other terminal remaining free.

803,109. Transmission of Intelligence with the Aid of Electric Energy. Isidor Kitsee, Philadelphia, Pa. Application filed September 17, 1904. Renewed May 4, 1905.

Three insulated conductors twisted in intimate relation with each other form the circuit, two conductors having each one connected to a separate station. The third is connected with one end to one of the stations and with the second end to the second of the stations more or less remote from the first-mentioned station.

803,110. Transmission of Electric Current. Isidor Kitsee, Philadelphia, Pa. Application filed November 28, 1904.

Varying electric currents are transmitted by a composite line conductor comprising two insulated and inductively independent conductors. Each conductor consists of a continuous series of inductive convolutions, the series being in inductive relation with respect to each other throughout the entire lengths of the conductors. Each conductor is also electrically connected with a single station. (See cut.)

803,111. Transmission of Intelligence with the Aid of Electric Energy. Isidor Kitsee, Philadelphia, Pa. Application filed March 25, 1905.

Three conductors connect two stations more or less remote from each other, the three conductors forming one open circuit, the inductive relation of one of the conductors to the other being reversed at predetermined intervals.

803,112. Transmission of Intelligence with the Aid of Electric Energy. Isidor Kitsee, Philadelphia, Pa. Application filed April 10, 1905.

The transmitting line comprises four insulated conductors divided into two pairs, the conductors of each pair twisted around each other and all four conductors connected to each other so as to form one continuous circuit.

803,120. Conduit Section for Manhole Terminals. Robert W. Lyle, New York, N. Y. Application filed January 13, 1903. Renewed August 4, 1905.

A multiple-duct terminal section for electrical conduits has the partitions between the ducts at one end of greater thickness than at the other. The relative arrangement of the duct openings at the ends of the terminal section, with relation to the cross-sectional plane of the section, are indentical at each end of the section.

803,131. Method of Firing a Powder Charge Simultaneously Throughout Its Length. Francis I. Du Pont, Wilmington, Del. Application filed February 25, 1905.

As a means of igniting simultaneously a number of powder charges, a conductor of high resistance is made to form part of an electric circuit embedded in and extending throughout the length of the charge.

803,136. Electric Switch. John J. Ruddick, Newton, Mass., assignor to the United States Electric Signal Company. Application filed November 27, 1903.

An actuating member of the switch is normally held in position by a spring. Means independent of the actuating member cooperating with the contact member move the former from its normal position to operate the contact member.

803,147. Electric Furnace. Edwin Appleby, Chicago, Ill. Application filed January 28, 1905.

A vertically disposed receptacle mounted in the frame and open at the bottom contains a second receptacle open at the top and telescoping with it. A pair of electrodes is mounted in the frame and extends into the furnace near the lower end of the first receptacle.

803,176. Air-supply Apparatus for Submarine Vessels. Simon Lake, Bridgeport, Conn. Application filed February 17, 1905.

A valve for admitting air into the interior of the vessel is controlled by an electromagnet.

803,180. Means for Producing High-potential Electrical Discharges. Oliver J. Lodge, Birmingham, England. Application filed October 10, 1904.

Means for producing a continuous high-potential discharge of electricity in one direction comprise apparatus for supplying electrical current pulses of high potential, high-potential mercury rectifiers connected to the current-supplying means and adapted to transmit the pulses always in one direction, condensers adapted to receive the pulses and discharging means connected to the condensers.

803,199. Space Telephony. John S. Stone, Cambridge, Mass. Application filed June 20, 1905.

Means for radiating a substantially continuous train of electromagnetic signal waves and means for varying the amplitude of the waves in accordance with the sonorous vibrations of articulate or other sounds are combined with a receiving system comprising means for selectively absorbing the energy of the waves and means quantitatively responsive to the variations in the amplitude.

803,208. Trolley Catcher. Warren W. Annable, Grand Rapids, Mich., assignor of one-half to J. Watson Fitzgerald, Grand Rapids, Mich. Application filed March 31, 1905.

A traveler movable on the pole has a cord connected to it and engaging a pulley on the pole.

803,209. Control System for Electric Motors. Ralph E. Bates, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed February 1, 1905.

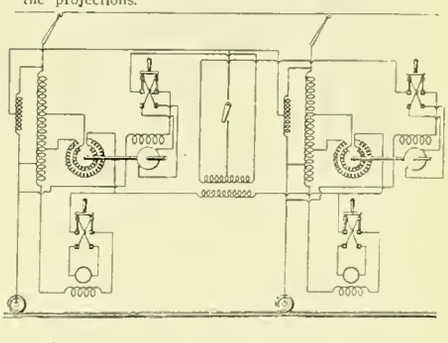
A controller comprising one or more manually operative conducting segments and one or more automatically operative conducting segments is associated with a second controller that is moved by and in proportion to the extent of movement of the manually operative conducting segments. A third controller is operated by the governed member and in proportion to the extent of movement of the second controller.

803,210. Trolley-retrieving Device. Henry B. Clarke, Chicago, Ill. Application filed January 16, 1905.

A trolley-retrieving device embodies a suitable casing and support therefor, a take-up member movably mounted within the casing and connected with the trolley-cord and a locking mechanism for locking the take-up member.

803,212. Switch for Electric Circuits. Frank Conrad, Edgewood Park, and Arthur B. Reynders, Wilkinsburg, Pa., assignors to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed November 21, 1903.

Two pairs of stationary contact terminals are associated with a movable member comprising contact blades having lateral projections, clamping-wedges and means for moving the wedges in opposite directions to engage the projections.



NO. 803,213.—ALTERNATING-CURRENT CONTROL FOR RAILWAY MOTORS.

803,213. Alternating-current System of Control. Frank Conrad, Edgewood Park, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed April 3, 1905.

Combined with a supply circuit are a number of main electric motors and of motor-operated voltage regulators for varying the speed of the main motors. An adjusting transformer, the primary winding of which is connected between corresponding points in the circuits of the main motors, is provided, the secondary winding of the transformer having its end terminals respectively connected to the terminals of the regulator-operating motors and an intermediate point connected to the supply circuit. (See cut.)

803,214. Controlling System for Railway Vehicles and Trains. John L. Crouse, New York, N. Y., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed January 22, 1903.

Electropneumatic controlling mechanism for electrically-propelled vehicles or trains contains brake-setting mechanism and a normally open controlling circuit therefor. A governing switch for the vehicle or train-propelling mechanism having a spring-restrained, manually operated handle and means engaged by the handle, when released, to close the brake-controlling circuit and thereby effect application of the brakes are further provided.

803,215. Overhead Structure for Electric Railways. Harry P. Davis and Theodore Varney, Pittsburg, Pa., assignors to the Westinghouse Electric and

Manufacturing Company, Pittsburg, Pa. Application filed October 19, 1904.

An overhead structure for electric railways comprises two trolley-conductor sections having upturned ends, a non-conducting bar having metal end pieces to which the upturned ends of the trolley-conductor sections are clamped, a pole, an arm projecting laterally from the pole and provided with insulators and suspension means connecting the insulators to the metal end pieces.

803,216. Suspension Device for Trolley Conductors. Harry P. Davis and Theodore Varney, Pittsburg, Pa., assignors to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed January 17, 1905.

A support for trolley conductors comprises two messenger cables and a triangular frame provided with means for clamping it to the cables and to the trolley conductor.

803,233. Electric-control System. Henry D. James, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed April 3, 1905.

The controller is arranged to select a sequence of taps from a transformer and supply different voltages therefrom to the translating device. Means prevent the rupture of any current-carrying circuit by the contacts of the controller.

803,237. Electric Relay. Isidor Kitsee, Philadelphia, Pa. Application filed May 3, 1905.

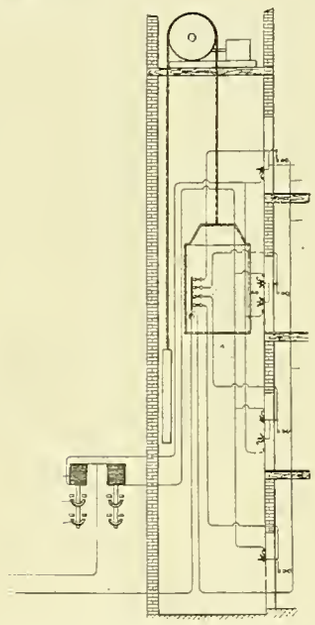
Electrically transmitted impulses are utilized by a relay embracing a series of conductors of paramagnetic material loosely supported by a series of second conductors. Repeating means are included in the circuit and locally operated electromagnetic means to keep at a strained position the paramagnetic conductors. Electromagnetic devices are operatively connected to the transmitting circuit to vary the strained position of the paramagnetic conductors in accordance with the impulses received.

803,245. Plug or Connection for Electric-light Line Wires. Charles P. Parnell, New York, N. Y., assignor of one-half to Harris M. Fletcher, New York, N. Y. Application filed April 19, 1904.

A coupler for electric sockets embodies a non-conducting body part, a threaded exterior conductor and an interior conductor, the terminals being yieldingly supported.

803,252. Trolley for Electrically Propelled Vehicles. Norman W. Storer, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed February 15, 1905.

A trolley bow has a contact member provided with a wide flat contact surface and with one or more lubricant-containing grooves.



NO. 803,378.—ELECTRIC-ELEVATOR CONTROL.

803,253. Electric Regulator or Controller. Harve R. Stuart, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed September 26, 1903.

Combined with a transformer winding having a number of spaced leads are a magnetizable core having an exposed helical winding and means for producing longitudinal movement of the core and winding and simultaneous rotation of the winding to effect uninterrupted contact between the winding and at least one of the leads.

803,254. Method of Regulating Alternating-current Electromotive Force. Harve R. Stuart, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed September 26, 1903. Renewed October 25, 1904.

Varying the electromotive force of an alternating-current work circuit is done by supplying to the circuit voltages that are the resultants of voltages which are varied step by step and auxiliary opposing voltages which are varied uninterruptedly between zero and values approximately equal to the voltage steps.

803,263. Electrolytic Cell. Henry S. Anderson, El Paso, Texas. Application filed June 21, 1905.

In an electrolytic cell are combined an anode and a mercury cathode. A porous diaphragm is placed between the anode and the cathode, and means for causing a solution of the substance to be decomposed to flow between and in contact with the diaphragm and the mercury cathode are supplied.

803,281. Socket-key Extension. Vivian B. Fuller, Indianapolis, Ind. Application filed March 21, 1905.

An extension for socket-keys comprises a clamp to engage the key, set-screws for fastening the clamp to the key, a stem and a universal joint between the stem and clamp.

803,322. Motor Actuator. Daniel Bacon, New York, N. Y. Application filed February 25, 1905.

Several independent motors are loosely mounted upon a shaft and adapted to be rotated constantly in opposite directions. A disk is rigidly attached to and rotates with each motor and carries a set of electromagnets. An armature mounted upon the shaft is adapted to be rotated by either of the motors as desired, the magnets being under the control of suitable mechanism whereby electric energy is shifted from one set of magnets to the other.

803,339. Internal - combustion Engine Regulator. Albert N. Hatherell, Appleton, Wis. Application filed June 21, 1904.

The electric igniting device of a gas engine is described in the patent.

803,340. Counter for Circuit-breakers. Edward M. Hewlett, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 21, 1902.

Automatic tripping mechanism of the circuit-breaker coöperates with an attachment comprising a supporting-plate, a lever pivoted thereto and manually operative to trip the breaker. A counter is mounted on the plate and an operating member extends into the path of movement of a portion of the mechanism.

803,348. Annunciator. Carl W. Lebeis, Yonkers, N. Y. Application filed January 24, 1905.

Letters of an annunciator are moved by an electromagnetic mechanism.

803,365. Electric Railway. Maurice C. Rypinski, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 31, 1902.

A sectional working conductor is combined with a feeder, connections between the feeder and the sections of the working conductor, switches in the connections, actuating coils for the switches and separate switches operated from one working position to another by a passing car for controlling the connections of the actuating coils.

803,378. Control of Electric Elevators. George A. P. Weymouth, Melbourne, Victoria, Australia. Application filed April 3, 1905.

Circuit-controller apparatus is supported in the path of the lift to be moved thereby in either direction, the circuit-controller comprising a base, a pivotally mounted tumbler carried by the base, the tumbler comprising a body portion provided with legs and a terminal; the base is provided with a terminal adapted to be engaged by the terminal carried by the tumbler for closing the circuit and other means for securing the tumbler in an adjusted position. (See cut.)

803,410. Electromagnet. Arthur C. Eastwood, Cleveland, Ohio. Application filed April 1, 1904.

A substantially cylindrical shell of magnetic material has end portions also of magnetic material, one of the end portions being removable and being flanged to fit over the cylindrical shell. There are openings through the end portions, a winding within the shell and a plunger of magnetic material movable through the winding and the openings in the end portions.

803,414. Remote-control Regulator. John L. Hall and William C. Yates, Schenectady, N. Y., assignors to the General Electric Company, Schenectady, N. Y. Application filed March 20, 1905.

Resistances and contacts therefor cooperate with a contact arm and means for shifting the latter over the contacts, the means include a disk mounted in fixed relation with the arm, a support mounted for movement independent of the disk, a fixed stop, oppositely disposed pawls pivoted to the support with their free ends adjacent to the disk and yieldingly held against the stop and an electromagnetic means for vibrating the support to rotate the disk in either direction at will.

803,423. Electric-lamp Socket. Norman Marshall, Newton, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 24, 1900.

Details are described.

803,442. Apparatus for Short-circuiting Turns in Armature Coils. John F. Shoemaker, Madison, Wis. Application filed April 13, 1905.

Short circuiting the turns in the armature coils of a motor is done by combining with the armature shaft of the motor, a disk fixed to the shaft adjacent to the end of the armature. A series of contact points are carried by the disk, a movable disk is mounted upon the armature shaft, a fiber band is carried by the movable disk, and blades pivotally connecting the fixed disk and band are adapted to be thrown into electrical connection with the contact points upon the fixed disk.

803,451. Rheostat. George E. Stevens, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 1, 1904.

A rheostat comprising a resistance unit consists of a helical insulated resistance having its turns continuously forced together to form a rigid structure and a cooperating helical contact movable over the surface of the unit to progressively engage its turns.

803,452. Rheostat. George E. Stevens, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 12, 1904.

The resistance unit consists of a helical insulated conductor with proper terminals.

803,453. Rheostat. George E. Stevens, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 12, 1904.

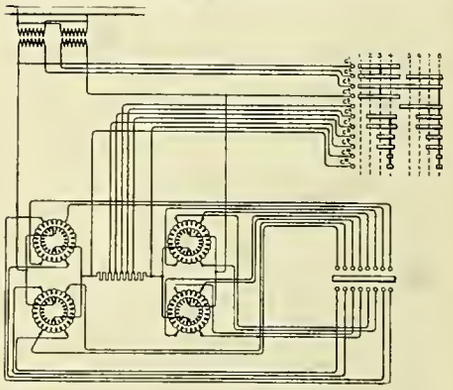
A rheostat comprises an elongated resistance unit having exposed contact surfaces extending throughout its length, a cooperating contact spring-pressed into engagement with the surface and means for increasing the pressure of the contact and moving it longitudinally in response to a pull in one direction.

803,462. Alternating-current Motor Control. Charles E. Barry, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 24, 1904.

Combined with a number of alternating-current motors are a resistance connected in circuit therewith, transformer-windings adapted to supply current to the motors, means for connecting the windings in parallel and in series and means for varying the amount of resistance in the motor-circuit. (See cut.)

803,486. Magnetically Operated Switch. George H. Hill, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 18, 1904.

Associated with a magnet coil are a movable core therefor, a shaft supported by the core, pivoted links engaging opposite ends of the shaft and switch-contacts supported on opposite ends of the shaft.



NO. 803,462.—CONTROL SYSTEM FOR ALTERNATING-CURRENT MOTORS.

803,493. Long-distance Electric Circuit. Mark S. Lewis, Medford, Mass., assignor of one-third to George F. Woodley, Providence, R. I. Application filed May 4, 1905.

In an electric circuit are a conductor comprising two wires connected only by condensers in multiple, each wire having one end open, the other end being connected to a telephone, telegraph, or other signaling instrument leading to a battery and ground.

803,502. Railway-signal System. James C. Mock, Detroit, Mich. Application filed January 11, 1902.

Cooperating with the main-track circuit and the signal controlled thereby is a branch track having parallel with one of its rails a conductor adapted to contact with a wheel passing along the rail, the conductor and rail being in parallel with the main-track circuit.

803,513. Space Telephony. John S. Stone, Cambridge, Mass. Original application filed June 20, 1905. Divided and this application filed June 29, 1905.

Transmitting vocal or other sounds, including articulate speech, is accomplished without the use of guiding wires by developing a substantially continuous train of electromagnetic waves, modifying the amplitude of such waves in accordance with the air vibrations accompanying the sounds to be transmitted, receiving the energy of the waves so modified in a receiving conductor and converting the energy of the resulting electrical oscillations into air waves corresponding to the sounds.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on November 6, 1905:

392,213. Transformation and Distribution of Electric Energy. William J. McElroy, Pittsburg, Pa.
392,230. Electric Regulating and Hand-setting Mechanism for Clocks. W. S. Scales, Somersville, Mass.
392,244. Secondary Battery. H. Walter, Cincinnati, O.
392,301. Telephonic Circuit. R. M. Bailey, Williamsport, Pa.
392,326. Telephone Switchboard. C. C. Gould, Batavia, N. Y.
392,370. Regulator for Alternating-current Generators. R. P. Sellon and W. M. Mordey, Victoria Works, Belvidere Road, County of Surrey, England.
392,385. Electroplated Coil for Electrical Measuring Instruments. E. Weston, Newark, N. J.
392,386. Electrical Measuring Apparatus. E. Weston, Newark, N. J.
392,387. Electrical Measuring Apparatus. E Weston, Newark, N. J.
392,400. Electric Discharge Device. R. Belfield, Pittsburg, Pa.
392,403. Switchboard for Telephone Exchanges. F. Blake, Weston, Mass.
392,438. Combined Electric-meter and Electric-clock System. P. Lange, Pittsburg, Pa.
392,439. Electric Meter. P. Lange, Pittsburg, Pa.
392,440. Electric Gas Lighter. J. H. Lehman, Philadelphia, Pa.
392,443. Magneto Signaling Apparatus. M. W. Long, Harrisburg, Pa.
392,444. Railway Signal. M. W. Long, Harrisburg, Pa.
392,470. Operating Alternate-current Motors. W. Stanley, Jr., Great Barrington, Mass.
392,471. Alternate-current Electric Motor. W. Stanley, Jr., Great Barrington, Mass.
392,476. Reflecting Galvanometer. E Weston, Newark, N. J.
392,478. Galvanometer. E. Weston, Newark, N. J.
392,490. Commutator Bar for Dynamo-electric Machines. C. E. Billings, Hartford, Conn.
392,573. Method of Making Electrodes for Secondary Batteries. C. H. Thompson, Detroit, Mich.
392,574. Electrode for Secondary Batteries. C. H. Thompson, Detroit, Mich.
392,577. System of Electric Meters. A. Wurts, Pittsburg, Pa.

WESTERN ELECTRICIAN

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LIBRARY OF ELECTRICAL ENG'G.

Present Status of the Chicago Freight Tunnels.

From time to time the Western Electrician has kept its readers informed of the development of the system of tunnels which is being built under the business district of Chicago by the Illinois Tunnel Company. The tunnels are being constructed under an ordinance granted to the Illinois Telephone and Telegraph Company by the City Council on February 20, 1899, and a supplementary ordinance passed in July, 1903. Actual work was begun on the system in September, 1901, by the Illinois Telephone Construction Company, with Mr. George W. Jackson as general manager and chief engineer.

During the last year the system has been greatly extended. The total number of feet of subway completed on October 21, 1905, was 205,181, or nearly 39 miles. Of this amount, 101,579 feet was constructed between November 1, 1904, and October 21, 1905.

The congested central business district of Chicago comprises about 1½ square miles of territory and is nearly surrounded by the passenger stations and freight depots of the 25 trunk lines, which makes Chicago the greatest railroad center in the world. It is estimated that the freight handled daily at the freight depots in Chicago amounts to more than 112,000 tons. With the present facilities afforded by the tunnel the latter is expected, when in complete running order, to relieve the congestion and facilitate the transaction of business in the business section, removing about 80 per cent. of the heavy teaming from the streets. Fig. 2 is a map of the central portion of Chicago, showing the extent of the system and the railroad terminals served. The shaded area shows the congested business district.

The tunnel as built is egg-shaped, with walls of concrete. The walls are 10 inches thick, with a 14-inch bottom. The standard bore is six feet wide and seven feet six inches high, inside measurement, and is at an average depth of 40 feet below grade. The tunnels are built with the assistance of the pneumatic system, although a number of thousand feet were constructed without the use of air. The work is pushed day and night, and the 24 hours are divided into three eight-hour shifts. The shift which goes to work at 4 p. m. is known as the driving shift. This shift is relieved at midnight by another shift that finishes the drive, taking out the bottom, and doing the trimming. The day shift does the concreting. Great precaution is observed at every stage of the work. Half-hourly reports of the progress of the work are forwarded to the chief engineer's office, and any fluctuation of the air pressure or change in the nature of the soil is immediately reported to the chief engineer in person, who remains in touch with the work constantly. Fig. 1 illustrates a typical street intersection and shows the cables of the automatic telephone system, tracks, trolleys, etc.

One advantage of the concrete tunnel over a brick one is that there is no chance for a settling of the streets. In using brick it is impossible to dig a tunnel so true that the brickwork will fit snug, consequently it is necessary to back-fill with clay, slabs or any other material. This leaves voids which are bound to cause settlement. In the use of concrete it is necessary to tamp the concrete tight, to get a perfect bond, and in so doing every void, no matter how uneven, is filled, making it apparently an impossibility for any chance of settling.

Besides the standard bores, there has been a large amount of special construction done, such as intersections and trunk tunnels, as shown by the following table:

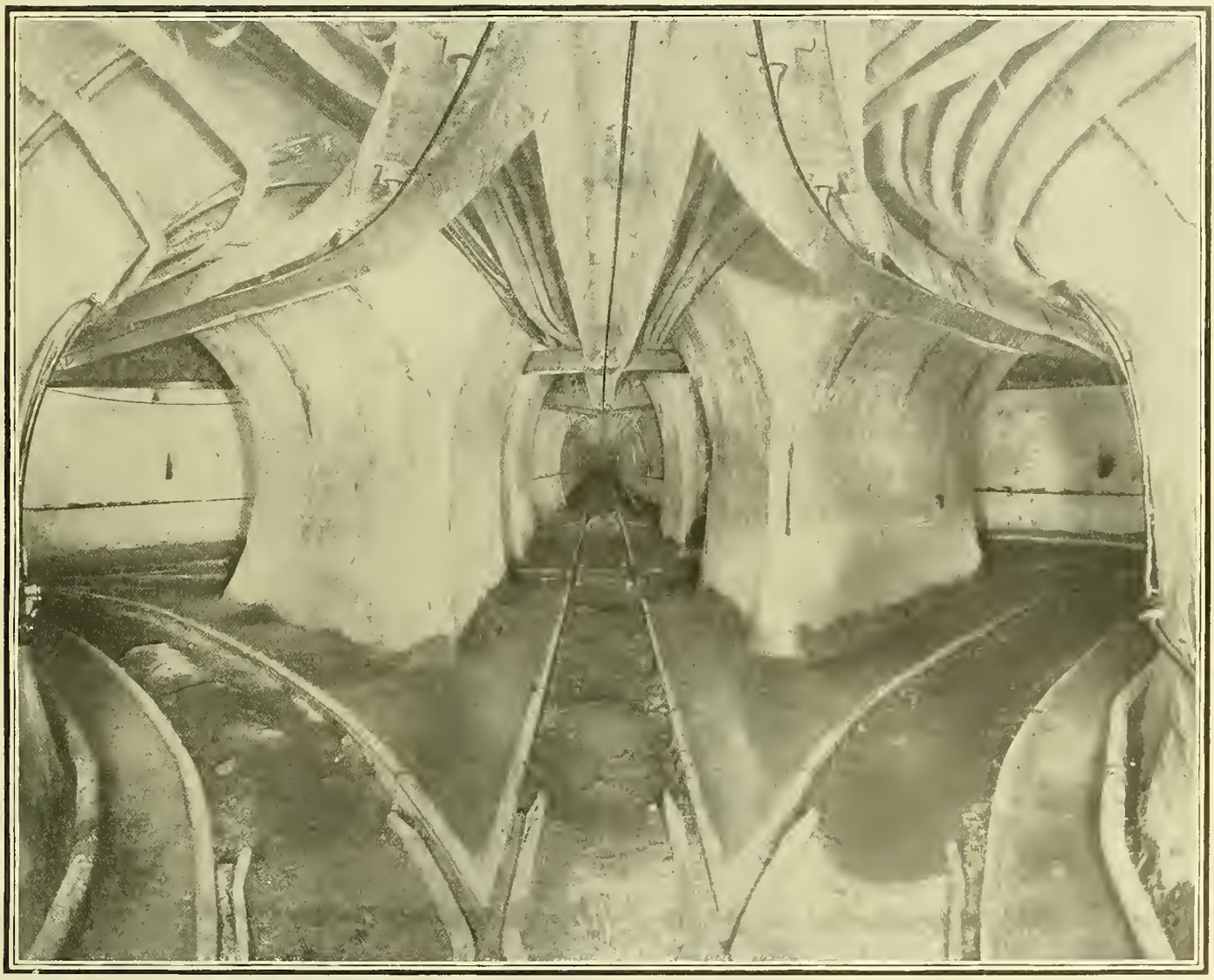


FIG. 1. TYPICAL STREET INTERSECTION IN CHICAGO FREIGHT TUNNELS, SHOWING TELEPHONE (AUTOMATIC) CABLES, TROLLEY WIRES, TRACK CONSTRUCTION, ETC.

INTERSECTIONS.

	No.
Four-way intersections	93
Three-way intersections	57
Two-way intersections	91
Turnouts	27

TRUNK TUNNELS.

Width.	Height.	Length.
12 feet 9 inches	14 feet	110 feet
12 feet 6 inches	9 feet	127 feet
12 feet	9 feet	178 feet
12 feet	13 feet	285 feet
14 feet	10 feet	150 feet

What, no doubt, will be of great interest to the engineers, practical men and contractors, is the fact that during the months of April and May last there were five miles of tunnel constructed under the streets of Chicago. During the month of April there were constructed 10,105 lineal feet, and during the month of May there were constructed 12,619 lineal feet of tunnel, with the necessary appurtenances to make it practical to operate electrically propelled trains: such as rails, trolley system, permanent lighting, drainage system, etc. The construction of this number of feet, with the

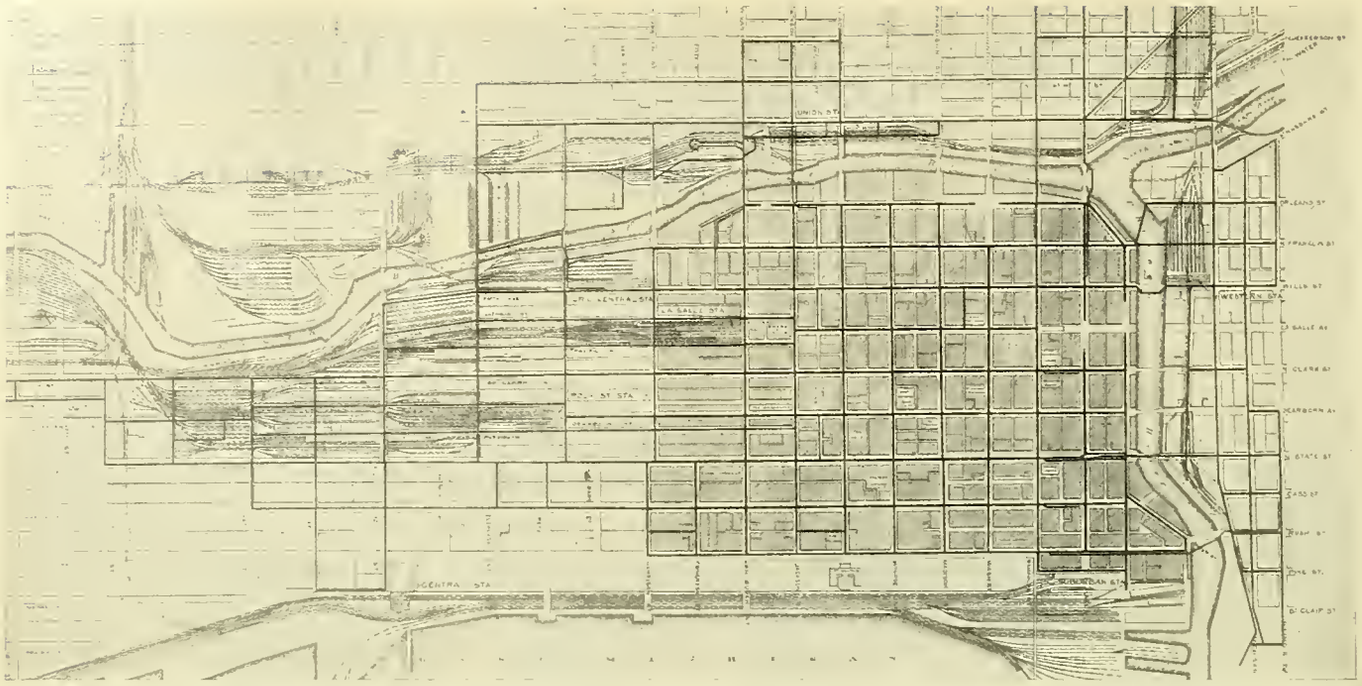


FIG. 2. MAP OF CHICAGO CENTRAL BUSINESS DISTRICT, SHOWING RAILROAD TERMINALS, FREIGHT TUNNELS IN HEAVY BLACK LINES AND CONGESTED AREA IN SHADING.

necessary intersections, by-passes, etc., in the time mentioned above, is something entirely out of the ordinary, when it is taken into consideration that the general average in tunnel construction up to the present time has been at the rate of two miles per year, even under the best of conditions and where the soil has been uniform.

In carrying out the work it has been necessary

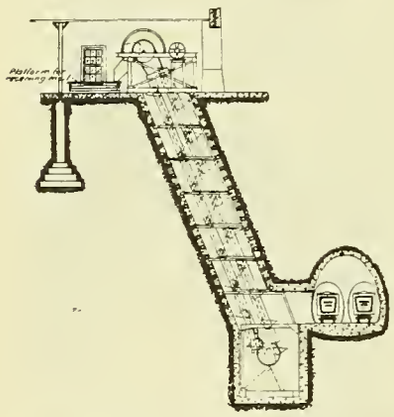


FIG. 3. CONVEYOR SHAFT CONNECTING LA SALLE STREET RAILROAD STATION WITH TUNNELS.

during the last two months to excavate about 60,000 cubic yards of material, and manufacture and place into position about 35,000 cubic yards of concrete. All the excavated material was transported through the completed tunnel system and deposited at Grant Park, at which point it is being used for filling, for the improvement of the park. Fig. 7 shows a third-rail type of locomotive pushing a loaded train of excavated earth out of the tunnel at the Grant Park opening. In connection with this work there was transported through the tunnel about 1,500 cubic yards of excavated material daily from the following buildings: Heyworth Building, Majestic Building, Mandel Brothers, Marshall Field and the new Edison Building on Market Street, and, in fact, all the new buildings being erected in the

FIG. 4. STANDARD MAIL CAR FOR TUNNEL SERVICE.

downtown district are having the excavated material hauled away by the tunnel company.

Transporting excavated material and wreckage through the tunnel system, at the present stage of its usefulness, is beneficial to the public and the users of the streets of Chicago, owing to the fact that it is already the means of keeping a large number of teams off the streets, which previously were engaged in hauling refuse and excavatings from the new buildings. It has already been, then, the means of removing a part of the congestion, as well as keeping the streets free from dirt and refuse which falls off of wagons engaged in this class of teaming.

In New York, Boston and Philadelphia many structures have been built which extend 30, 40 or 50 feet below the street surface, and such basements are now being built in Chicago and will be available in a way more advantageous than in the

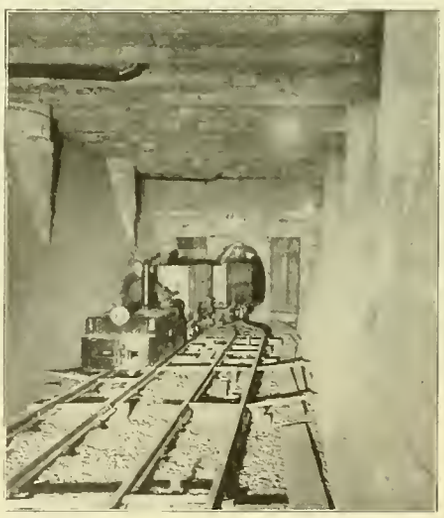


FIG. 5. DOUBLE-TRACK ENTRANCE TO MARSHALL FIELD & CO.'S BASEMENT.

above-named cities, since the floors of the sub-basements will be carried to the level of the subway. Fig. 5 shows the double-track entrance to the basement of Marshall Field & Co.'s store.

Conditions caused by the many styles of buildings which are to be tapped, and the many purposes for which the tunnel is designed, are a constant tax on an engineer's ingenuity, as no two buildings are alike, and each requires its own treatment. Where the tunnel connects with a building whose basement extends but one story below the street grade, a turnout or by-pass is constructed leading from the main tunnel to the inside of the curb line, where it connects with a shaft leading to the basement under the sidewalk. Specially designed elevators lift the cars to the basement floor, where, with the use of a turntable, they can be shoved wherever they are desired. The elevators so far in use are tested to carry 30,000 pounds. Fig. 6 shows a typical shaft from a basement down to the tunnel, an "observation" car used to take guests through the tunnel being at the bottom of the shaft.

Twenty-four inches is the gauge of the permanent track, and the Illinois Steel Company's 4¼-inch 56-pound rail was adopted as the standard rail. The rail is fastened by U-bolts to a specially designed cast-iron chair embedded in the concrete floor of the tunnel. The great number of crossings and switchings in use necessitated by all the street intersections, turnouts or by-passes leading to the different buildings made it imperative that this part of the track system be as near perfect as could be made. The crossings in use are all bolted to steel plates that extend over the entire crossing, and this is also embedded in the concrete floor. The switches are those known as the split switches, and the frogs are constructed the same as the right-angle crossings.

Overhead trolleys are used throughout, except at the incline at the Lake Front (Fig. 7), where the Morgan third-rail system is used. The third rail consists of a steel strip about one-half inch in thickness by four inches in width, clamped between insulated wood stringers laid lengthwise in the center of the track. The rail furnishes not only the current for the locomotive, but the means of moving the locomotive also: for it is provided with an opening for cog wheels which are pressed on to the axles. A No. 0000 figure-8 trolley wire is

FIG. 6. TYPICAL SHAFT FROM BASEMENT TO TUNNEL LEVEL.

adopted as the standard. held in place by Porter & Berg standard barn trolley hangers placed 15 feet between centers.

Automatic section insulators and other devices will be in use at all street intersections, which enable the current to be cut out in any block during temporary repairs without shutting off the current from any other part of the system.

Much consideration has been given to the style of cars and electric locomotives to be used for the work. On the incline at the Lake Front it was found advisable to use the Morgan B type of locomotive, while in the tunnel proper there are two types in use, viz., the Jeffrey standard MH locomotive and the General Electric standard LM locomotive. The weight of the Jeffrey locomotive is six tons, and it is equipped with two 18-horsepower motors. The weight of the General Electric locomotive is five tons, and it is equipped with two 20-horsepower motors. The locomotives are of a low and compact construction.

Cars in use are the Kilbourne & Jacobs and the Bettendorf double-truck types. The cars are 12 feet six inches in length over all and 47 inches in width. They are of steel and iron construction throughout, and can be used either as gondola or a flat car. Every car is equipped with the M. C. B. coupler. The weight capacity of the car is 30,000 pounds. The double trucks are so built that the cars readily operate upon a curve of 15-foot radius. At the present time the box cars are equipped with the Newman patent dump box, which has a capacity of 3½ yards. The number of locomotives and cars now in use is large and is rapidly being increased.

Adequate lighting is furnished in the tunnel by electricity. Current for light and power is supplied at present by the Chicago Edison Company. Power for the trains will later be furnished by a 5,000-horsepower generating plant. Direct current at 250 volts, the rails furnishing the return, is the system now in use.

The tunnel company has leased from the Northwestern University a tract of land on the Chicago River at Twenty-fourth Street, where it will erect its own power house. The company will also erect large warehouses, where it will be possible for merchants who only have a limited amount of space to store a large supply of goods, drawing upon it as needed. These warehouses will be erected on the company's own property on the west bank of the Chicago River at Taylor Street.

Besides the work of removing excavated material, the company is now doing much of the work of conveying mail to and from the railroad stations, and some coal is being transported. Fig. 3 shows the conveyor and conveyor shaft which connects the La Salle Street Station with the tunnels. Plying between the stations and the new Federal Building, where the postoffice is located, are special mail cars of the type shown in Fig. 4.

Facilities for handling coal are perhaps best shown by the gravity system at the yards of the Chicago and Alton. Here it has been arranged to dump the coal directly from the cars of the Alton into bins or hoppers beneath the tracks. From these hoppers chutes run down to the tunnel, where they are provided with two branches, so that two cars may be loaded at the same time by one chute.

There is an automatic telephone at each street intersection of the tunnel, and all trains are operated by telephone orders. The cables for the telephone system are hung from the roof of the tunnel, with a specially designed adjustable strap. Guards are stationed at street intersections, and every precaution is taken to avoid accidents. The many connections already made with the tunnel insure thorough ventilation. The floor of the tunnel is dry and as smooth as the average cement pavement.

The tunnel system now extends from Indiana Street, on the north, to Fifteenth Street on the south, and west as far as Halsted Street, and it is rapidly being extended beyond these limits. An employe of the company was once asked by a friend where he worked, and his reply was, "In New Chicago." The term "New Chicago" is an apt one, as the system furnishes to a certain extent a duplicate set of streets for parts of Chicago. These streets are lighted by several thousand electric lamps, and at the street intersections have bronze street signs.

Construction of this work requires a large force of men, including artisans and men of all trades. The payrolls of the company carry nearly 2,000 names, while it is safe to say that at least 200 more are employed by the company, hauling supplies and material for the work. And yet, notwithstanding all the different trades represented and the army of men employed, there have never been any labor troubles or dissatisfaction among the men.

FIG. 7. ELECTRIC LOCOMOTIVE PUSHING CARS LOADED WITH EARTH OUT OF TUNNEL.

FIG. 8. GROUP OF PROMINENT POSTOFFICE OFFICIALS AND OTHERS INSPECTING TUNNELS.

Three weeks ago, upon the occasion of the formal opening of the new Federal Building, the Illinois Tunnel Company invited a number of the distinguished postoffice officials and their friends who were present at the opening exercises to take a trip through the tunnels, particularly to inspect the mail-handling facilities. Fig. 8 is a group picture taken on this occasion, showing some of the officials who enjoyed the trip. From left to right the gentlemen in the picture are: Postmaster F. E. Coyne of Chicago; Ferdinand Peck of Chicago; E. H. Thorpe, general superintendent of delivery of Washington: E. L. West, superintendent of the sixth division of railway mail service; J. M. Masten, assistant general superintendent of railway mail service; F. H. Galbraith, superintendent of mails of Chicago; Colonel Le Roy T. Steward, superintendent of delivery of Chicago; General W. S. Shallenberger, second assistant postmaster-general; George O. Von Erta, superintendent of construction of the Federal Building, and George W. Jackson, general manager and chief engineer of the Illinois Tunnel Company.

Work on the Chicago and Milwaukee Electric Railroad.

The Chicago and Milwaukee Electric Railroad Company has now completed the section of its road from Zion City, Ill., to Kenosha, Wis., which fills in the missing link making possible electric-railway connection from Chicago to Milwaukee. It is expected that this section will be open for traffic by December 1st. Like the rest of the line the grading has been done to permit of the laying of four tracks, with which part of the line is already equipped. It is the purpose of the company to extend its road the whole distance to Milwaukee, and next spring will in all probability see it to Racine, from which point the distance left will be comparatively short. Whether any traffic arrangement will be entered into by the Chicago and Milwaukee Electric Railroad with electric-railway companies now operating north of Kenosha, pending the completion of its own line, is as yet not determined.

A new power plant will be built soon. It will cost, it is said, $1,000,000. The present plant at Highwood, though barely adequate for present purposes, is nowhere near sufficient for the contemplated extensions, especially as the line is branching out to the west from Lake Bluff, and has reached Rockefeller, some distance beyond Libertyville.

Driving grinders in paper mills by means of electric motors has been discussed for several years, and there has always been some question as to the feasibility of the scheme. The operation of several grinders by Westinghouse alternating-current motors recently installed has, however, been reported so entirely satisfactory as to leave no question as to the practicability and efficiency of this drive.

Electrical Subway System in Havana, Cuba.

Work has been begun on a subway system for electrical wiring in Havana, Cuba, by the Havana Subway Company. This installation will be the first of its kind to be placed in operation in the island of Cuba. Unusual care was used in planning to obtain efficient flexible distribution throughout the city. It is said that the work presented some difficulties not met with in the United States. The contractor for the work, George M. Painter,

CONSTRUCTION OF ELECTRICAL SUBWAY IN HAVANA.

who was also the engineer in charge of the planning of the system, was congratulated by the city engineer, D. Lombillo Clark, for the up-to-date engineering which he had embodied in his plans.

Work has been started on Aguila Street, and as soon as they can be secured 500 men will be used to push it to completion within the six months specified by the contract. Service manholes will be provided, so that every other number on each street will have facilities for individual underground connection. The cost of the work will be between $800,000 and $1,000,000, for the present installation.

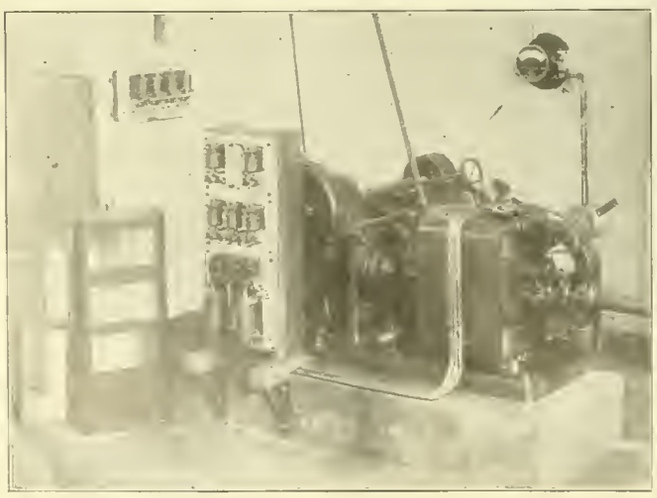
Among the companies which are now using overhead construction are the Red Telefonica de la Sociedad Anonima, which has the exclusive telephone concession; the Compañia de Electricidad de Cuba; Havana Electric and Gas Company, and the Havana Electric Company. The government telegraph lines are also carried overhead.

Since the Havana Subway Company is providing space for all kinds of electrical conductors, it is probable that the operating companies will be able to rent space cheaper from it than to install and maintain their own underground equipment individually.

A New Automatic Electric Elevator.

Automatic elevators enjoy popularity in some classes of service where the calls upon them are not frequent, since the car may be operated by the person desiring to use it, and doing away with the services of a special employe. This form of elevator is now quite extensively used in Europe for passengers, and in some cases for freight. But the automatic system is only feasible where the errors which the users might make are prevented, and where the operation of the system itself is quite reliable, so that the car will arrive at the exact point where it is desired without accident. These conditions seem to be met by the new automatic electric elevator illustrated herewith, which is brought out by a Berlin concern. The driving motor, drum and relay devices of this system are shown in the picture. The operation of this system is dependent on the fact that the car is controlled by push-buttons in the car or basement, or on the outside of the shaft, which, by means of properly disposed relays are made to operate the elevator motor, and when the car has risen to the story desired it is stopped by a tripping device.

Briefly the operation of the elevator is as follows: Supposing the car to be in the first story and a person on the second floor wishes to bring it up. He presses the button which is placed on the outside of the shaft. This button is in the circuit of a "flow relay" corresponding to that story. When the button is pressed the relay receives current and it is held in place by a supplementary circuit. By means of the "floor switch" current is given to the starting contact and to the motor. When the motor is fully running and the elevator reaches the floor of the second story, apparatus located at this level is made to trip a horizontal projecting lever on the car and bring it to the vertical, and this opens the circuit. Then the brake magnet comes into action and the motor comes to a stop at once. In order to bring the elevator mechanism to a stop from the interior of the car the current can be broken by pressing open the "holding button" in the car, by which the current of the relay apparatus and also the motor current is broken. To bring the elevator down from the third floor, say, to the second, the relays are made to work in a corresponding manner. If the elevator is to be operated from the car itself, as when one wishes to go out at any desired floor, one of the buttons is pushed inside the car, which are in parallel with the floor button mentioned above, and the operation of the relay apparatus is the same as before described.



A NEW AUTOMATIC ELECTRIC ELEVATOR.

High-potential Discharger for Dispelling Fog.

High-potential discharges for the dissipation of fog, smoke, etc., by condensing or coagulating the constituent particles was probably first given serious attention by Sir Oliver Lodge, the eminent English scientist. As early as 1884 he published the discovery that such action is attributable to high-potential discharges and that the phenomenon might be put to useful purposes, such as the dispelling of fogs or the condensation of fumes in certain chemical processes, as, for instance, the condensation of lead fumes in the manufacture of white lead by the furnace process. In the Western Electrician of January 14, 1905, there was given the substance of a letter from Sir Oliver to the London Times on the subject of the utility of the process, in which it is apparent that the apparatus then employed to do the work would be of prohibitive cost for practical purposes. It is with interest, therefore, to note that a patent has just been granted to Sir Oliver upon means for producing high-potential discharges for this purpose.

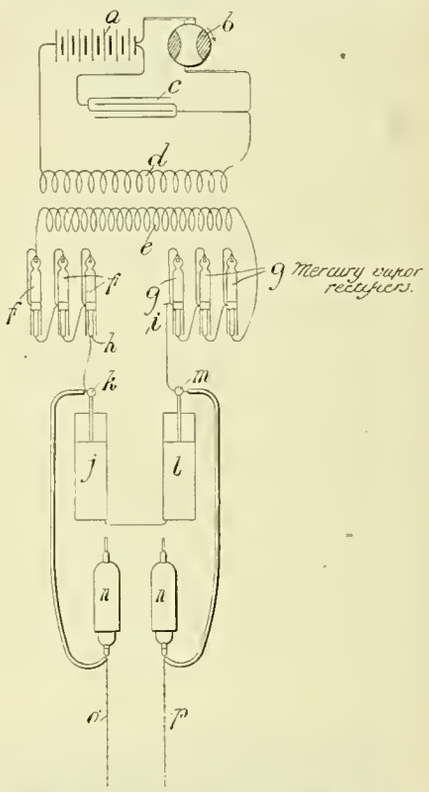
Heretofore the experiments with high-potential discharges for fog condensation were carried on by the aid of Voss or Wimhurst electrostatic machines, which apparatus is entirely too delicate for use on an extensive scale. The present invention consists in means whereby the current from a dynamo, either continuous or alternating, is so transformed and treated as to give a practically continuous high-potential discharge in one direction only.

Further, the invention consists in combining high-potential rectifiers sometimes arranged in quadrilateral groups of four or multiples of four, but always in such a way that instead of the reverse pulses being suppressed or non-existent, they are redressed to form the positive and negative discharging streams required for the deposit purposes.

Several arrangements are described in the patent. In the arrangement shown in the accompanying cut there is a battery (a) in circuit with an intermitter (b) and the primary of a large Ruhmkorff induction coil. A condenser may be placed in parallel with the intermitter. The secondary of the Ruhmkorff coil is connected through two series of high-potential mercury-vapor rectifiers, to the terminals (k) (m) of the insulated coatings of a pair of Leyden jars, whose outer coatings (j) (l) are in electrical connection. To the terminals are also attached the leads or discharging wires, which are supported by insulators (n).

If desired, a dynamo may be employed in place of the battery, and any form of intermitter used, as, for instance a revolving mercury break, a Mehnelt break, a trembling break, or hand break, and only one series of rectifiers, instead of two, may be employed.

Dischargers may be points, flames, or other means whereby a free discharge can be obtained. Parallel rows of barbed wire or a barbed-wire fencing or other metallic surfaces may be used, one of which may be insulated, while the other is earthed, or both may be insulated and placed facing each other beyond sparking distance in the place where the discharge is wanted. When the apparatus is used for the removal of smoke or the like, it is preferable to insulate both dischargers. When electrification of clouds to produce condensation and consequent



HIGH-POTENTIAL DISCHARGER FOR DISPELLING FOG.

rain is the object, one set of dischargers would usually be grounded and the other set arranged so as to be discharged skyward by well-insulated conductors.

In the operation of the apparatus the current generated in the battery or dynamo is interrupted by the intermitter and induces intermittent pulses of violently high potential in the secondary coil of the Ruhmkorff coil. These pulses are transmitted through the rectifiers, positive pulses through the series (f) and negative pulses through the series (g), to the insulated coats of the two Leyden jars. The object of each series of rectifiers is to transmit a current easily in one direction and to strongly oppose a passage of current in the opposite direction. By this means the intermittent supply from the induction coil is enabled to maintain the jar or jars steadily charged. The higher the potential desired the more numerous are the rectifiers required in each series. It has been found that six in each series is a convenient number to use where it is required to keep up a practically continuous discharge between the dischargers at a potential of about a quarter of a million volts.

Another form of the invention is so modified as to make use of the current from an alternating-current dynamo.

By a suitable arrangement of the discharging means the invention can be applied to various purposes, some only of which are indicated above, in which continuous high-potential discharge in one

direction is required. For instance, where it is desired to utilize the high-potential discharge in causing the deposit of lead fumes in the manufacture of white lead by furnace processes, a flue may be provided and a settling chamber through which the gaseous products containing the fumes are passed. The insulated dischargers are placed parallel to each other beyond sparking distance along the length of the flue, or only one discharging means may be provided, the other terminal leading from the Leyden jars or rectifiers being grounded. The particles in the fumes will thus be caused to coalesce and will be much more readily deposited on the walls of the flue than would otherwise be the case, and the metal thus deposited may be recovered in any suitable manner.

In some cases—as, for example, in depositing valuable factory dust—a combination of the electrical discharge apparatus and a centrifugal dust separator or quick centrifugal settling chamber may be utilized for the purpose of effecting quicker and better separation of the previously electrified dusty air, and for the more convenient collection of the dust deposited.

Commutator and Bearing Troubles.

The vital parts of a direct-current dynamo or motor are the commutator and bearings, and in the operation of such machines the elimination of sparking and excessive heating is the prime essential of good maintenance. Although great progress in the suppression of sparking has been attained by modern designers, it is always well for an operating engineer in charge of direct-current equipment to be on the watch lest violent overloads or other causes bring trouble at the brushes. The bearings of all generators and motors need regular inspection, also, even though the design be of the most approved self-oiling type.

Sparking at the commutator is very injurious, for it tends to limit the life of both commutator and brushes and also produces waste heat. All direct-current machines are liable to sparking troubles, and the principal causes are worth constantly bearing in mind. Few machines will not spark under excessive overloads, even though the makers guarantee that the sparking shall not be injurious at double the normal output, momentarily. The instantaneous output of a direct-current machine may represent 100 per cent. overload and the sparking be almost nil, as in railway service, but 50-per cent. overload is about as high as it is wise to go, unless a dynamo has been specially designed to handle very severe fluctuations.

When a dynamo or motor sparks noticeably it will often be found that the cause lies in a very simple disarrangement of its parts. Thus, the brushes may not be set exactly at the point of commutation. In such a case it is a simple matter to shift them until a point is found where practically no sparking occurs, when the rocker arm should be clamped in place securely enough to prevent traveling of the brushes as the machine vibrates and the commutator revolves. Again, the brushes may be wedged in the holder, or they may not fit the surface of the commutator with any accuracy. Anything which causes the circuit to be broken at the point of contact makes trouble, as a loose brush, insufficient brush pressure, brushes burned at the ends, a commutator with high or low bars, or a rough commutator. Sparking is liable to result from a dirty, oily or worn-out commutator, open circuits or loose connections within the armature itself. In the case of a motor operating on a constant potential circuit, any excessive friction, such as that produced by hot journals or the armature striking the pole-pieces has the same effect as heavy overloads in producing a flow of current too great for sparkless commutation. Hard mica between the commutator bars, which wears unevenly with the copper, is a fertile cause of sparking, as is the operation of a shaft loosely in the bearings. Weak fields, wrongly connected coils, especially in compound-wound machines, brushes of unusually high resistance and uneven air gaps are to be avoided in the service operation of both dynamos and motors.

Hot bearings may likewise result from a variety of causes. As in all revolving machinery, an ample supply of oil is imperative and there is little excuse for a shutdown through the lack of sufficient lubricant. In belted motors and dynamos excessive belt tension is a frequent cause of heated bearings, while in both belted and direct-connected units, rough bearing surfaces, the failure of the rings to revolve with the shaft, the presence of end-thrust through improper leveling, the use of a poor grade of oil, ocurrence of a bent shaft, improper alignment and the working of dirt or other other foreign particles into the bearings are all positive causes of trouble. Regular blowing out of machines by compressed air is a great help, and daily or weekly attention to such points as have been suggested in the foregoing will go a long way toward preventing shutdowns and the rapid deterioration which always accompanies neglect. Dynamos and motors are far more simple, mechanically, than the great majority of machines used in commercial and domestic industry, and if the commutator—including the brushes—and the bearings are kept free from trouble, long life and efficient operation should be assured. H. S. K.

The Gramme Monument.

In the Western Electrician of last week was given an account of the exercises at the unveiling of the monument in memory of Zénobe Gramme, erected at Liége, Belgium. Herewith is presented a picture of the monument, which was the work of the sculptor Vincotte and the architect Soubre. The stonework of the memorial is granite. In the center is a large pedestal bearing a half-length

STATUE ERECTED AT LIÉGE IN HONOR OF ZÉNOBE GRAMME.

bust of Gramme holding in his hands a model of his continuous-current dynamo as patented in 1869, which marked the beginning of the enormous electrical development of the present day. In close proximity is a fine female figure representing the Genius of Electricity, extending toward the inventor the palm of victory. On each side of the main pedestal is a subsidiary statue, the two representing "Labor" and "Science" co-operating for the progress of humanity. Labor, on the right, is typified by Gramme as a youth working as a carpenter, while Science, on the left, is represented by Gramme in middle age, meditating over his inventions.

International Waterways Commission.

It is the apparent intention of the International Waterways Commission to preserve and protect the interests of lake commerce as against all other interests, and power matters at the Soo have been made of secondary consideration. The commissioners granted a hearing to the lake interests and the power companies of the Soo in Buffalo on Thursday, November 9th, following which they held an executive session to formulate rules for the regulation of the use of the water of St. Mary's River for power purposes. While the text of the rules will have to be communicated to the governments of Canada and the United States before they are made public in their entirety, enough is known on which to base the statement that the level of Lake Superior will be maintained at 601.5 to 603 feet above mean tide at New York, and no more than 19,500 cubic feet of water per second will be permitted to be used at the Soo for power and other purposes. No further grants will be made for the use of the water for a period of more than 20 years. The engineers of the commission state that the use of 4,000 cubic feet of water per second by the power companies would lower the level of Lake Superior about one-fifth of a foot, and the use of 6,000 cubic feet per second would lower the level about one-third of a foot.

Among the interests represented at the hearing were: Michigan-Lake Superior Power Company, J. C. Shaw; Lake Superior Power Company, N. W. Rowell; Soo Edison Company, Alex Dow; Lake Superior Carriers' Association, William Livingston; Lake Carriers' Association, H. D. Goulder; Michigan vessel owners, Robert Grey; Buffalo vessel owners, Harvey Brown; Chandler-Dunbar Company, Prof. G. S. Williams.

The Dam Column at Niagara Tipped Over.

The concrete column built by the commissioners of Victoria Park in Niagara Falls, Ont., and which was described and illustrated in the Western Electrician of October 21st, was successfully tipped into Niagara River on November 9th in the presence of a large throng, many of them engineers, who had gathered to witness the event, the first of the kind on this continent. The column was seven feet four inches square and stood 50 feet high on a trestle that was 20 feet above the ground level. Its approximate weight was 200 tons, and extending through the center was a heavy chain to keep the sections together after the column had been broken into six parts by wooden wedges inserted every eight feet. The column was tipped by three jacks operated at the base of the trestle. It fell in good shape, broke as desired, and raised the water in the intake 10½ inches, which is believed to be sufficient for the needs of the city and the electric railway that use the intake jointly.

The Work of Watt.

Watt did not, of course, invent the steam engine, but he improved it so greatly as to become practically the father of modern steam engineering. He devised the separate condenser, the jacketing of the cylinder, the admission of steam to each side of the piston alternately, the steam-engine indicator, the ball governor, the poppet valve with beveled seat, the throttle valve, cross-heads and guides, the coupling of two engines together and the water gauge. He also suggested cut-off at quarter stroke as being the most economical. He found the steam engine of small power and limited usefulness owing to its disproportionate size and extraordinary consumption of fuel. He left it a complete machine, fit to be a potent element in the industrial development of the world.

This is the epitaph on Watt's monument in Westminster Abbey:

Not to perpetuate a name, which must endure while the peaceful arts flourish, but to show that mankind have learnt to honor those who best deserve their gratitude, the king, his ministers, and many of the nobles and commoners of the realm raised this monument to James Watt, who, directing the force of an original genius, early exercised in philosophic research, to the improvement of the steam engine, enlarged the resources of his country, increased the power of man, and rose to an eminent place among the most illustrious followers of science and the real benefactors of the world. Born at Greenock, MDCCXXXVI. Died at Heathfield, in Staffordshire, MDCCCXIX.

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DATES AHEAD.

Ohio Society of Mechanical, Electrical and Steam Engineers (annual meeting), Canton, Ohio, November 17th and 18th.

Automobile Club of America (annual exhibition), Sixty-ninth Regiment Armory, New York City, January 13th to 20th.

Chicago electrical exhibition (first annual exhibition of Electrical Trades Exposition Company), Coliseum, Chicago, January 15th to 27th.

No more interesting work is under way in Chicago at the present time than that on the elaborate system of freight tunnels underlying the central business district of the city. For several years the Western Electrician has kept its readers fully informed of the progress of this unusual undertaking. Indeed, it printed the first illustrated article on the subject, we believe, and since then has published a number of article and references showing the development of the enterprise. In a business sense the project has had a checkered career, but, technically considered, the work is of increasing interest.

In a nutshell the idea is to convey coal, ashes, earth from building excavations, freight, merchandise and mail matter in an elaborate system of tunnels underneath the central business or "downtown" portion of Chicago by means of narrow-gauge electric railways. On October 21, 1905, there had been completed 205,181 feet, or nearly 39 miles, of these tunnels, horseshoe-shaped and built of concrete in the most substantial fashion. At the same date 27 building connections had been made, in some cases by elevator shafts with basements, in others by direct lateral tunnel connections to unusually deep sub-basements. As yet, the tunnels are in use only to a limited extent, transporting excavated earth from building sites, ashes from office-building basements, mail and a little coal. But when their full carrying capacity is utilized they will relieve the congested streets above of a great deal of teaming, connecting, as they do, with all the great railroad terminals, and will work a decided and unique improvement in city life.

The present status of the engineering development of this important undertaking is shown by an illustrated article in this issue.

The baggage question is one to which interurban-railway managers are giving some attention. The steam railroads, of course, carry baggage to a limited amount with each first-class ticket, and some of the interurban lines do likewise, while others are opposed to the practice. The free-baggage men advocate the concession to meet steam-road competition and to increase passenger traffic. One of them is Mr. F. D. Norveil of the Indianapolis and Northwestern Traction Company, and at the latest meeting of the Indiana Electric Railway Association he described the free-baggage system on his road. Baggage not exceeding 150 pounds is carried free on each ticket costing at least 25 cents. Excess baggage is charged for at the rate of 25 cents for each 100 pounds or fraction thereof. But, in actual practice, owing to lack of weighing facilities at many stations, one piece of baggage is checked free and 25 cents is charged for each additional trunk or large suit-case. Much depends on the judgment of the agent or employe doing the work to do justice to the company and to be fair to the passenger as well. It is assumed that only four to six per cent. of the interurban passengers carry baggage that requires checking.

This policy has, of course, resulted in a decrease in the amount collected for carrying baggage, but the number of pieces handled has greatly increased, with, it is believed, a proportionate increase in the sale of passenger tickets. Mr. Norveil says: "We have no means of getting at the exact figures as to the increase in number of passengers carried, but as the general average is about 16 or 20 to one piece of baggage, it would seem fair to place the increase about five to one."

Figured in dollars invested, the fire-alarm telegraph system of a large city may not appear to be an institution as important as many others owned by the city or by private corporations. Considered from the viewpoint of its utility in the saving of life and property, the fire-alarm system fills a place which is second to none. In the face of this fact, however, the fire-alarm system in New York city has been allowed to drift along for years in a condition of decay, which, in addition to its original faulty design, renders it so far inadequate for the duty which it has to perform that an entirely new system is now necessary. It is possible that a similar state of affairs exists in other cities, to some extent; and for the reason that the system is out of sight, and the fire losses are not traced back to inadequate signal service, things are allowed to run on in a more or less haphazard fashion.

Elsewhere in this issue, under the title of "Fire-alarm Engineering," will be found some interesting facts relative to the New York system which were taken from a report recently made by Mr. Kempster B. Miller of Chicago to a committee of the New York Board of Fire Underwriters. After describing in detail in his report the condition of affairs now existing, Mr. Miller went on to lay out a plan for an entirely new system to be installed as soon as possible, the old system to be later dismantled and sold as junk. Mr. Miller has based his plan upon the supposition—which is rightly taken—that absolute reliability is the first requisite of a fire-alarm service; after that comes speed of transmission. To obtain this reliability he has recommended a system which will be an expensive one to build. Whether the city of New York will feel that it is justified in paying out the sum of money which will be required to build it remains to be seen. Mr. Miller, before recommending an entire new system, studied the condition of affairs long and laboriously, thoroughly testing out every part of the system. He did not need to do this to convince himself of the utter impracticability of trying to patch up the old system but to secure absolute proof that the radical step he recommended was the only feasible one. A study of his report will show that he found proof in plenty.

While the underwriters are not always reasonable in their demands, and while, as has been shown by the Illinois State Electric Association, their rates on improved electrical construction are absurdly excessive, yet their unceasing warfare against inferior equipment—inferior, that is, from the fire-hazard point of view—has undoubtedly been of much benefit to the electrical industry in helping to raise the standard of construction and operation. The Western Association of Fire Underwriters, for instance, has caused to be investigated, from its own point of view, the electrical conditions of many western cities and towns. These investigations do not take into account the many practical difficulties which the central-station manager of the average small city has to encounter, but they often reveal conditions which unquestionably call for improvement.

Thus in the report on electrical conditions of a small city in Western Tennessee—for the present purpose, the name of the place does not matter—it is alleged, and no doubt truthfully, that almost without exception equipments are in a poor condition.

The operating company furnishes primary service at 2,300 volts, transformed to 104 volts. This is used for lighting. In addition to the lighting circuit a 220-volt direct-current circuit is operated during hot weather for running fans and small motors. The pole lines carrying the 2,300-volt circuit are poorly constructed. Service wires are carelessly placed on fronts and rears of buildings, under awnings, porches, etc., while the 220-volt circuit is even in worse condition, being carried almost exclusively on the buildings and in imminent danger of crossing with telephone and alternating-current lines. Even more serious is the allegation that the superintendent of the operating company is not qualified to install wiring in accord with the rules of the National Electrical Code, while 54 buildings are cited as possessing defective electrical equipments.

This is no doubt an extreme case, and it is always to be remarked that the underwriters' men point out the shadows in the picture without reference to the bright spots. While an unnecessary hazard does appear to exist, we are not informed that electricity ever caused a fire in this particular town. Again, the benefits of the use of electricity in the town far outweigh the risk from fire which seems to be shown. But, after all is said in extenuation, electric-light companies owe it to their customers and themselves to do away with the careless and slipshod methods and obsolete equipment which subject them in some cases to deserved criticism. Financial reasons may make the actual renewal of material a matter of time, but, where needed, a reform in the spirit and methods of doing work should be brought about without delay.

Indiana Electric Railway Association.

About 60 members of the Indiana Electric Railway Association were taken to Rushville on November 9th, as the guests of the Indianapolis and Cincinnati Traction Company. The trip was made in two special cars which left the Terminal Station at Indianapolis at 9 a. m., sprints of 60 miles an hour being made for short distances. Members of the association have been anxious to inspect the Rushville line ever since it has been put in operation, as it is the only road in the state operating under the single-phase alternating current. Each car carries four 75-horsepower motors, geared to a high speed. When the line is completed to Cincinnati, and double-tracked all the way, it is proposed to place in service cars geared to 72 miles an hour, so as to make the run between Indianapolis and Cincinnati in three hours. The trolley voltage is 3,300. The current is sent out of the company's power house at Rushville at a voltage of 33,000. At the transformer stations, which are located at points 12 miles apart, this current is stepped down to 3,300, at which it enters the cars. Besides the economy in operation asserted for the single-phase current, it makes possible a great saving in the transmission of the power and number of employes. At the present some difficulty is experienced in starting the cars quickly, but the engineers say this will be readily overcome.

Upon arriving at Rushville, the power house was first inspected. This proved a revelation to the traction men, especially the fact that the generating machinery was all driven by natural gas for fuel. The general offices and telephone exchange used for operating trains and communication with the outside public were visited and found to be complete in every detail. After an excellent dinner at the Windsor Hotel, the meeting was called to order by President C. L. Henry in the Rushville Club rooms.

The first paper was presented by N. E. Graston, superintendent of the freight department of the Indiana Union Traction Company, on "Interurban Express and Freight Traffic." Mr. Graston's paper will be presented in a later issue of the Western Electrician. It was well received and brought out a full discussion. Mr. Henry said he could not indorse Mr. Graston's hope that the time would soon come when steam lines would be compelled to exchange freight business with the interurbans. "We are not ready for that, as we have all we can handle now, and to have the additional heavy steam-line business thrust upon us would be out of proportion to our present facilities." The discussion and consideration of the subject was fruitful of a plan for the heads of the freight departments of the Indiana traction companies to get together and compile a classification and schedule of rates and a uniform system for conducting the interurban freight business, and submit the same to the association for ratification.

F. D. Norveil, superintendent of the Indianapolis and Northwestern Traction Company, presented the second paper, which asked the question, "Shall baggage be carried free?" Mr. Norveil treated the subject in an interesting and practical way. He favored the free carriage of baggage. Mr. Norveil's paper excited considerable discussion, the majority favoring the plan of charging for carrying baggage. Those who advocate carrying baggage free said at least four passengers follow every piece of baggage checked. It was brought out that roads paralleled by steam lines were carrying baggage free, while those having no such competition were deriving quite a revenue from the baggage service.

The Question Box was opened, but for the lack of time the questions were not discussed. This feature promises to be interesting, since there is an apparent disposition to make it so. Secretary Paul H. White said the questions found in the box were exceptionally important and would be included in the programme for the next meeting.

Some of the more prominent interurban men attending the meeting were F. M. Fauvre, president of the Indianapolis and Eastern; A. W. Brady, president of the Indiana Union Traction Company; Will G. Irwin, general manager of the Indianapolis and Columbus Traction Company; C. L. Henry, president of the Indianapolis and Cincinnati line; Paul H. White, superintendent of the Indianapolis and Martinsville line; C. E. Carpenter of the Indiana Union Traction line; A. J. Spillman of the Indianapolis and Northwestern; F. D. Norveil of the Indianapolis and Northwestern; S. E. Fletcher of the Indianapolis and Eastern. S. S.

Foreign Electrical Societies Invited to Visit England.

The Institution of Electrical Engineers of Great Britain is arranging to entertain in Great Britain members of kindred institutions in Europe and America. The idea is to show appreciation for the hospitality and kindly receptions tendered the British organization when visiting away from home in previous years. The foreign guests will, it is hoped, arrive in Great Britain the last week in June next year, and the visit is to last two weeks or more. About a week will be spent in the vicinity of London and another visiting the principal industrial centers in the United Kingdom, according to the preliminary programme. Official invitations have been sent by the Institution to the American Institute of Electrical Engineers, the Canadian Electrical Association, the Associazione Elettrotecnica Italiana,, the Elektrotechnischer Verein, the Verband Deutscher Elektrotechniker, the Schweizerischer Elektrotechnischer Verein and the Société Internationale des Electriciens.

Efficiency of Illuminants.

By F. B. Badt.

Dr. Feuerbach, superintendent of one of the largest incandescent lamp factories in Europe, is authority for the first table. The figures in the second were given by Sir James Dewar in a recent lecture on "Flame" before the Royal Institution in London.

	Percentage of Energy Expended in the Production of Light.	Percentage of Non-luminous Energy.
Incandescent lamps	1	99
Cuban firefly	99	1

	Percentage of Light.	Non-luminous Energy.
Candle	2	98
Oil	2	98
Coal gas	2	98
Incandescent lamp	3	97
Arc lamp	10	90
Magnesium lamp	15	85
Cuban firefly	99	1

In spite of the great progress made in other fields and considering the great efficiency of electrical generators, for instance, our electric lamps show a very low efficiency. The double transmutation of electrical energy into heat and from heat into light seems to offer an almost unsurmountable barrier against higher efficiency. Even the latest departures in lamps, while showing an increase in efficiency, leave still a large margin for improvements.

The following figures may illustrate this:

	Watts Per Spherical Candle Power. Approximate.
Ordinary incandescent lamp (carbon filament)	3 to 4
New "metallized" filament	2½
(Nernst) Glower lamp	2½
Tantalum lamp	2¼
Osmium lamp	1½
Open arc lamp	1½
Enclosed arc lamp	2
Mercury-vapor lamp	½

Newton Harrison, in Electricity, comparing the various sources of light gives the following approximate values:

	Horsepower Per 16 C. P.
Torch of resinous wood	1
Candle Wax, Paraffin	3/4
Kerosene lamp	5/8
Illuminating gas lamp	1/2
Welsbach mantle	3/8
Electric incandescent lamp	1/10
Vacuum tube lamp	1/9
Arc lamp	1/100

According to Harrison the above figures are arbitrary, but they represent a relative view of the amounts of energy consumed to give light. The horsepower given for arc lamps seems too small; one-twentieth horsepower per 16 spherical candlepower would seem to be more nearly correct than one one-hundredth. The latter figure seems to refer to "nominal" candlepower.

	Per Cent.
Calling the energy of the coal pile	100
Then we recover in a first-class engine	13
Assuming the efficiency of the electric generator at 95 per cent., we have	12.35
The electrical energy supplied to the incandescent lamp is about 90 per cent., hence	11.11
And the luminous energy being 1 per cent., or	0.11

In other words, the luminous energy of the incandescent lamp represents only one-tenth of one per cent. of the energy stored up in the coal. It would therefore seem that from the point of efficiency the ordinary incandescent lamp is much better adapted for generating radiant heat than for giving heat. For instance, Dr. Kellogg's electric-light bath utilizing the radiant heat of electric lamps is a comparatively efficient device.

There seems to be still a wide field open to inventors as to an efficient electric lamp.

Chicago Branch of the Institute.

"Fire-alarm Telegraph Systems in Great Cities" was the subject for discussion at the meeting of the Chicago branch of the American Institute of Electrical Engineers, held November 14th. Mr. Kempster B. Miller gave a talk upon this subject which was based upon the report which he recently made to a committee of the New York Board of Fire Underwriters upon the fire-alarm telegraph system of the Borough of Manhattan. Further mention of this report is made elsewhere in this issue, together with extracts from Mr. Miller's talk and the discussion which followed.

Chairman H. R. King presided at the meeting. He said that the executive committee, recognizing the fact that all the papers read at the New York meetings may not directly interest members of the Chicago branch, had decided to have some original papers presented at the Chicago meetings. Though the dates have not been set, one evening will be devoted to the steam turbine and another to the gas engine, both live subjects to the electrical engineer.

Electrical Section of the Western Society of Engineers.

Subjects of popular interest were presented at the second meeting of the Electrical Section of the Western Society of Engineers, which was held in Chicago on Friday evening, November 10th, the occasion being "ladies' night." The assembly room of the Western Society was well filled when Chairman S. G. McMeen called the meeting to order.

First upon the programme, as announced, was a lecture by Prof. P. B. Woodworth of Lewis Institute upon the mercury-vapor lamp. Professor Woodworth was, however, unable to be present, but Chairman McMeen rose to the occasion admirably, and from his general knowledge of the subject, gave a talk which covered the ground thoroughly.

By the courtesy of the General Electric Company two mercury-vapor arc lamps were mounted and wired in the room ready for the lecture. One of these lamps was of the open variety, with vertical tube and reflector above, and supplied with a frame which made it appear not unlike the familiar arc lamp. The peculiarities of this light were well shown by its effect upon various pieces of different-colored tissue paper hung upon the wall, which effect was quite startling to those in the audience who were unfamiliar with the properties of this form of illuminant. The other lamp was of the "compensated" type invented by C. P. Steinmetz. This lamp consists of a mercury-vapor lamp and a number of incandescent lamps enclosed in a large Holophane globe. The incandescent lamps furnish the necessary red rays to make the light agreeable to the eye, the combined light approaching very near to daylight in its properties.

Feeling that perhaps he had not covered all the points, the chairman called upon Peter Junkersfeld to add what he could from his knowledge. Mr. Junkersfeld in a general way compared numerous other illuminants, such as the incandescent, Nernst and carbon arc lights with the mercury-vapor light, giving the particular field for which each is adapted.

Prof. C. E. Freeman of Armour Institute of Technology was the third speaker of the evening, and he said that in casting about for a subject it had occurred to him that the ladies present would probably be interested in the "talking" arc. This apparatus, which has never been put to practical use, is of much scientific interest, and Professor Freeman's talk, illustrated by the actual apparatus, was very entertaining. The speaking arc was set up in the assembly room, while the transmitting apparatus, operated by Prof. George W. Wilder, was located in the library in another room.

Briefly described, the speaking arc operates upon the principle of rapid changes in the current strength in the circuit of a carbon arc. These fluctuations, for some reasons not fully explained, produce sounds at the arc, which may be magnified by a funnel similar to that used on a graphophone. The most plausible explanation of the phenomenon is that the current variations cause a drawing in and spreading out of the arc, causing wave fronts in the air which result in the sounds. The arc is said to respond readily to current variations only one ten-thousandth of a second in duration.

Current variations are obtained in the arc circuit by an induction coil, the primary of which is affected by variations produced by a transmitter which is similar to a telephone transmitter, only of greater strength. Speaking into the transmitter the fluctuating currents produced are magnified by the induction coil, and the arc circuit is affected in a corresponding manner. Words spoken by the arc were readily distinguished, and musical notes, produced by whistling into the transmitter were reproduced with remarkable accuracy.

In closing the programme the chairman remarked that, although the talks had been very interesting, it was not to be thought by visitors present that the society amused itself at each meeting by scientific toys and strings of pretty tissue paper on the walls. The real business of the society in the future meetings would be to discuss more solid and substantial subjects from an engineering viewpoint.

After the meeting was adjourned luncheon was served, and the remainder of the evening passed in social intercourse.

A recent magazine writer, in an "Edison story," says: "I happened to be chatting with Thomas A. Edison in his laboratory at Orange, N. J., one night while he was working on his most recent creation, the intensified dynamo, and heard him discuss thoroughly the injustice that is done inventors in the United States." Truly, "intensified dynamo" sounds good, but what does it mean?

Fire-alarm Telegraph Engineering.

One thing of vital importance to a large city is the fire-alarm telegraph system. Such a system which is faulty in original design or has been allowed to fall into a state of decay which makes its operation unreliable, impairs to a great extent the efficiency of the fire department, and will lead in the end to the loss by fire of thousands of dollars worth of property annually, and possibly human lives. More and more it is realized that money invested in the fire-alarm service is money invested for large returns, and this feeling is not confined to the United States. Thus in the article in the Western Electrician last week under the title of "German Fire-alarm Cable Systems" it is shown that a large proportion of fire-alarm systems in that country are constructed with underground cable systems of approved character.

New York city, as far as its fire-alarm telegraph system goes, is greatly in need of radical changes. The system has been neglected and has reached such a stage of inadequacy that the committee on fire-alarm service of the New York Board of Fire Underwriters, of which Cecil F. Shallcross is chairman, employed Kempster B. Miller of Chicago, consulting engineer and telephone and telegraph expert, to make an exhaustive study of the system and report as to the best means of remedying the existing conditions. Mr. Miller recently handed in his report, which was the result of about six months' study of the condition of the system, and it contains many things which will be of interest to other cities besides New York, where conditions are no doubt nearly as bad.

Faulty in original design and construction, the plant in New York has deteriorated and has been patched and repaired in its various parts as they from time to time became unworkable. The system long ago reached the stage where it cannot be transformed into permanent, proper working order by any further patching or even by radical repairs.

After due deliberation and after consultation with another consulting engineer and with the insurance experts, Mr. Miller satisfied himself that the only remedy for the present state of affairs is to establish in the Borough of Manhattan a new fire-alarm system, separate and distinct from the present one; and that when the new system has been established and is in working order the old one should be abandoned and dismantled.

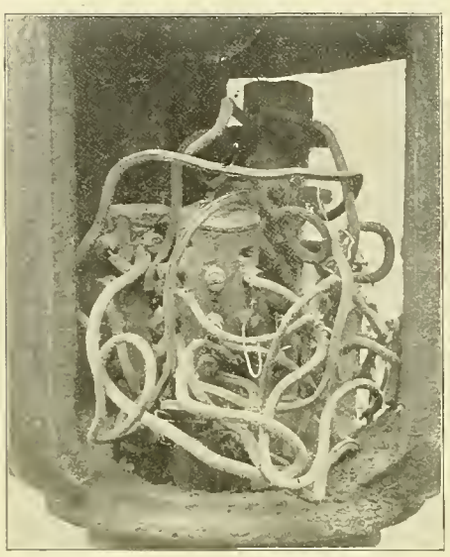
In the report of Mr. Miller existing conditions are described, though words are hardly adequate to do justice to the chaotic state in which the cables, boxes, manholes, etc., were found. The accompanying pictures will give some idea as to the conditions prevalent in the box connections. After "showing up" the system as it now is, Mr. Miller went on to give an elaborate plan for a complete new system which is here briefly outlined.

The solution of the problem presented is to install in the Borough of Manhattan a fire-alarm system having a single central office. This would require that a special building should be erected solely for the purpose of fire-alarm headquarters, and that this building should be located in an open space of such area that the headquarters would be safeguarded against every reasonable contingency growing out of an extensive fire in the neighborhood.

The extent of the open space which should be left around this building is a matter that can be determined only by a consideration of the exact location. Inasmuch as the matter of obtaining such location, should these plans be adopted by the city, may involve purchase or condemnation of real estate, it is obviously a matter which can be finally dealt with only by the city authorities. For this reason no attempt is here made to define exactly the best possible location.

A suitable building to contain the central office fire-alarm apparatus should be about a story and a half high and about 75 by 100 feet in horizontal dimensions. Furthermore, nothing of a combustible nature should enter into its construction. It should not contain any gas pipes, boilers or other sources of explosive hazard. The floor or floors containing the electrical apparatus and exposed wires should be built at such a height above the ground that no possibility of a flood, due to a cloudburst, the breaking of a water main or other cause would be present.

After the central-office building and its location have been determined upon, the next point to be considered is the subway approaches that will be required to connect the building with the subway system in the streets. Eight such approaches to the central office are planned for. This number may possibly be varied when working plans are made after the central office is definitely located. The number of approaches to the central office are made as many as are practicable in order to avoid the danger of total interruption which has been shown to exist in the case of the present central office, where all of the circuits enter the building by one route, and pass to the operating room through one shaft. This idea of subdividing the routes, making each carry a minimum number of circuits, was followed throughout in planning the cable system. The cables should be carried as far as possible in the low-tension subways which carry exclusively low-tension telegraph, telephone and signaling wires, thus avoiding the hazard which now exists in the case of many miles of the cable in the present fire-alarm system, which are in the high-tension subways. By the use of non-interfering successive boxes it has been found practicable, and in every respect possible, to locate the fire-alarm boxes upon each circuit contiguous to each other and to limit the number to 10. The wires leading from fire-alarm headquarters to the restricted areas occupied by the boxes of the various circuits are contained in cables, which are termed "feeder" cables. The wires in these feeder cables, in order that they may be protected in the greatest possible degree, appear above the ground only at the point at which they branch out to reach the different groups of box circuits in the restricted area. At such points terminal boxes or posts are placed for the purpose



AN EXAMPLE OF CONNECTIONS IN A NEW YORK FIRE-ALARM BOX.

of housing the cable ends and to allow access to the wires for the purpose of testing or of connecting them to other wires. These terminal posts contain facilities for affording access to the wires of the feeder cables, and for connecting these wires to the wires leading to the groups of alarm boxes peculiar to the neighboring box-circuit areas.

In a fire-alarm telegraph system constructed in accordance with proper engineering designs, wires should proceed by the most direct routes in feeder cables to the distributing posts adjoining that restricted area in which 10 or fewer boxes peculiar to a circuit are located, and from these points the distributing wires should lead by routes necessarily somewhat circuitous to connect the different boxes into a complete chain of boxes extending between the posts. By these means the necessity for bringing a circuit to the surface at a large number of intermediate points to serve boxes there located, as is done in the present plant, is avoided. Material gain is made not only in the economic construction and maintenance of the plant, but, what is of more importance, the possibility of interruption has been enormously reduced.

Wires in the cables of the system should be insulated with the best type of rubber insulation known to the art, these rubber-covered wires being bunched together in sufficient number and enclosed in a substantial lead sheath. The conductors should be of uniform size, of soft copper of standard purity and not smaller than No. 16 B. & S. gauge. gauge.

Distributing cables should be of the same type but of smaller numbers of conductors. In the case of those cables extending from station to station between the terminal posts, however, the number of spare wires should be greater in proportion than in the case of the feeder cables. No cable having a smaller number of conductors than four wires should be used.

The greatest care should be taken in the leading of the cables through the manholes in order that the greatest possible degree of protection may be afforded them. As the fire-alarm cables will in general be smaller than the telephone and other cables in the subway system, they will be more flexible and more readily stowed away in the manholes. Wherever possible they should pass behind heavier cables in extending from duct to duct in the manhole, and they should be afforded the additional protection of a suitable extra covering in their exposed portions through the manhole in order to guard them against mechanical injury.

Terminal posts in which the feeder cables end and the distributing cables begin should afford ample room for the termination and proper arrangement of all of the conductors leading to and from them. A suitable rack or partition should be provided for securely holding in place the cable ends and cable terminals, and facilities should be provided for the systematic arrangement of the jumper wires leading between the various conductor terminals.

Fire-alarm boxes of the system recommended should possess those features as to non-interference and succession that characterizes the most modern boxes. The successive feature should be such that with boxes of approximately the same length of signal, as many as four boxes on the same circuit could be pulled simultaneously without any of the signals being lost or in any way confused. All of the break contacts in the box should be of platinum, mounted on springs of sufficient strength and flexibility to assure permanency of adjustment. Instead of the ordinary tap bell, a substantial telegraph sounder should be employed similar to the type used in the ordinary Morse telegraph.

The signaling mechanism at the apparatus houses by means of which alarms and other signals are received by the fire-fighting companies should be in duplicate, the two sets being on different circuits. The gongs of both sets should be of the quick-acting type and the entire mechanism of the greatest possible simplicity, both as to function and mechanical arrangement. This apparatus should in itself be as nearly fireproof as possible, no woodwork being employed in its construction. It should be mounted on slate or marble slabs so arranged as to give immediate access to the various parts of the mechanism and wiring. All wiring should be done with the best grade of rubber-covered wire, protected throughout its entire extent in such manner that no ordinary fire would reach it.

Those circuits over which alarms are first received should have no other mechanism included in them at the department houses than the signal-receiving devices. The circuits over which the confirmation of alarms are sent to the department houses may be used as combination circuits and may be provided with suitable Morse apparatus. Automatic registers for both the initial and confirmation alarm circuits should be provided at each apparatus house, upon which will be recorded all alarms received over each of these circuits.

Central-office apparatus should be characterized by its simplicity, its substantial construction, and its fireproof mounting. The apparatus of the present fire headquarters is of an antiquated type, and is mounted in such a way as to invite its destruction by fire rather than to prevent it. The mounting of the apparatus for the new system should be of slate or marble, supported on steel framework, as is now the general practice with respect to power switchboards in central stations in other lines of electrical industry. There is one feature of special importance which should be mentioned in particular. In the present system most of the circuits are in trouble most of the time, and as a result the fire-alarm telegraph operators spend the greater portion of their time in work upon these circuits, which is brought about by their faulty condition. In the system herein recommended, if properly maintained, a condition of trouble on a circuit will be an abnormal one, and arrangements will be provided at the central office for indicating automatically and at once when any circuit is either grounded or open. Apparatus will be provided for each circuit by means of which

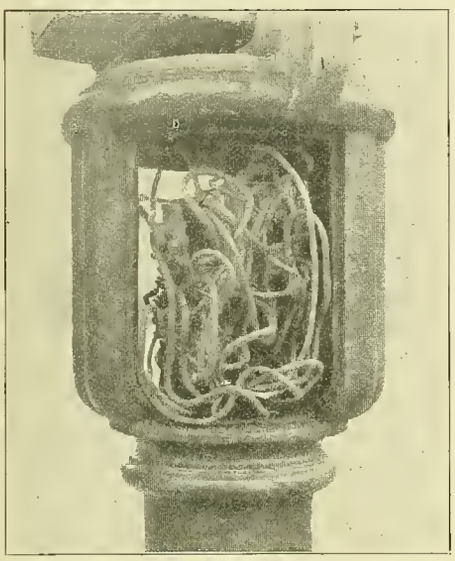
AN EXAMPLE OF CONNECTIONS IN A NEW YORK FIRE-ALARM BOX.

a line that gives this indication of trouble will be at once disconnected by the operator from the regular board and switched to special apparatus at what may be called a wire chief's board. This board might be called untechnically a "hospital" board, since it would have to deal only with those lines that are not in good condition and with the location and removal of the trouble on such lines. By this means the wire chief would have charge of all lines that are in trouble, and therefore would be able to direct the operations of all the troublemen, thus relieving the regular fire-alarm operators from the burden of this work, which should form no part of their duties. This wire chief's board, besides being provided for the reception of alarms from those lines terminating on it, should be

equipped for making complete tests on the lines for the purpose of locating trouble or ascertaining their general condition. As soon as a line was again placed in good condition it could be immediately switched back to the regular board and thus be under the jurisdiction of the operator. Such an arrangement as this, while probably not practiced in the fire-alarm telegraph business so far, would in a large system of this kind afford a remarkable increase of efficiency, particularly with respect to the ease with which trouble on lines could be located and repaired.

All current for the operation of the system should be supplied from suitable storage batteries, and these in turn should be charged from dynamos at least in duplicate. There should be at least two entirely separate sources of power for these dynamos, so that a complete breakdown of the charging plant would be an impossibility.

The batteries should be so located with respect to the central office building that there would be



AN EXAMPLE OF CONNECTIONS IN A NEW YORK FIRE-ALARM BOX.

no danger of their fumes or fluids coming in contact with any of the other fire-alarm apparatus or wires.

Leaving out the cost of obtaining the necessary real estate, but including the cost of the central-office building, the new fire-alarm system could be constructed and placed in operation for about $1,400,000. This figure, it should be understood, is an approximate estimate, and only provides for a system having the present number of stations. The general cable system and central office, however, are so planned that a large margin for growth is allowed, so that additional boxes may be added to the proposed cable system without other expense than that for apparatus and for connecting it to the general underground system.

The added expense thus involved in the purchase and placing of about 500 additional box stations, bringing the total number of boxes in the Island of Manhattan up to about 1,500, is about $225,000, thus making the total cost, exclusive of the necessary ground for the central office, about $1,625,000.

At the first meeting for the season of the Chicago branch of the American Institute of Electrical Engineers on November 14th Mr. Miller gave a talk upon "Fire-alarm Telegraph Systems in Great Cities" which was confined almost entirely to the results of his experiences in New York. He illustrated his address by the use of lantern slides which showed better than words could express some of the "horrors" of the system as it there exists. Indeed, after listening to Mr. Miller's description of the system, it seems almost inconceivable how an alarm signal, by accident even, could leak through the mass of wires and reach its destination. Where the insulation resistance might reasonably be expected to reach several hundred megohms per mile it in many cases, as shown by Mr. Miller's tests, was only a few ohms.

The speaker said that he had great admiration for the troublemen who worked on the system, who were really very competent men. He said that they often cleared a piece of trouble in two or three days. How they ever found the trouble at all is a mystery, judging from the facts presented by Mr. Miller, for there are absolutely no cable records, and the way the cables double back on themselves and dodge about for blocks and blocks where they are of no use whatever, would put the tricks of a hare-and-hounds runner to shame.

That the task which Mr. Miller undertook when he agreed to make the report was a great one may be understod when it is known that he first had to locate all the cables and circuits, for there were no records, as stated before. Then he had to test out the circuits, and this had to be done without interfering with the operation of the system. Of course, in testing a circuit, it would have been entirely possible and perhaps probable that in breaking in on it he could not hurt it much anyway. But still he said it would be just his luck to happen to get in on a good circuit and have a fire break out in the neighborhood. So his method was to cut each circuit up into sections and ground the main portion at each cut, so that the operating portion could work over ground—a long and tedious task.

S. G. McMeen was called upon to discuss the paper. One of the many points which he brought out and emphasized was the fact that the source of energy employed in the system consists in long strings of gravity batteries—thousands of them. This seems strange when there is no plausible reason why a fire-alarm telegraph system should not be operated from storage batteries, as in the case of a modern telephone plant.

Another speaker was A. C. Rideout of Evanston, Ill., a veteran who was identified with the telegraph business in the early days. He said it was a fact, though most unaccountable, that the telegraph and its allied branch of engineering, the fire-alarm telegraph, seemed to have been lost sight of by engineers in general as a field for real engineering work. So many other applications of electricity have come up to take the attention of engineers that the first application—the telegraph—seems to be of general interest no more.

Others discussing the subject were Messrs. Carl Wiler, Davis, R. F. Schuchardt, Chairman H. R. King, Professor C. E. Freeman and Professor P. B. Woodworth.

Convenient Adjustable Fixture Hanger.

Pipe outlets for electric fixtures are, as a rule, hard for the wireman to install and do the work so that the fixture support will hang plumb from the ceiling and at the same time be perfectly solid. The support, being so long, any slight deviation of the base from the horizontal will throw the

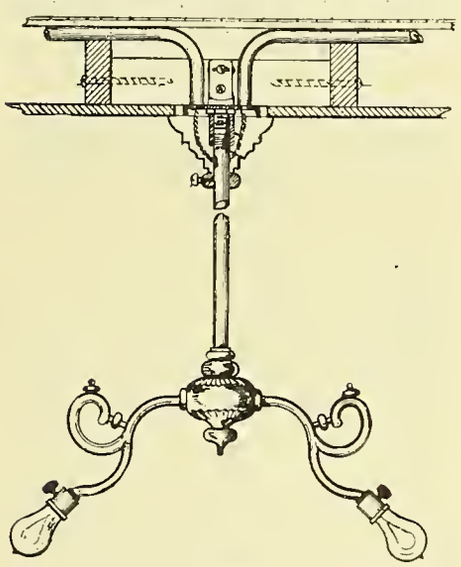


FIG. 1. CONVENIENT ADJUSTABLE FIXTURE HANGER.

support entirely out of the perpendicular. It will often be found that in trying to adjust the ordinary fixture to the perpendicular, after it is once in place, the small screws which hold the box will pull out or strip, and after wasting considerable time and patience, the whole thing will be loose and shaky.

Necessity, therefore, impelled John Kuhlemeyer of Chicago, a practical wireman, to design a hanger which would be convenient to install and which, when in place, would be solid and hold the support perpendicular. This device he has had patented and the illustrations here given show its essential features.

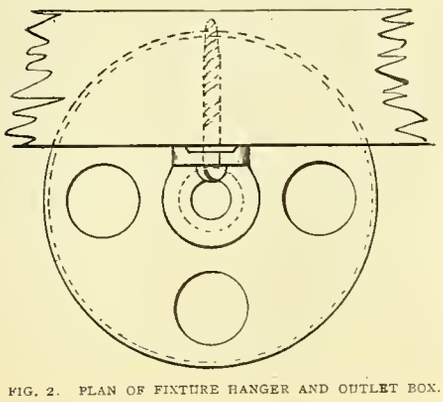


FIG. 2. PLAN OF FIXTURE HANGER AND OUTLET BOX.

Referring to Fig. 1, it will be seen that two screws of moderate size are all that are required to fasten the hanger. These are driven through two holes in the hanger, which is screwed on the upper end of the tubular fixture support. The screws are driven into a piece of two-by-four-inch scantling, which is fastened between two adjoining joists. In Fig. 1 the joists are shown in section, and through them come the pipe conduit carrying the wires, the ends of the pipe being bent down to enter the outlet box on the upper side through two of the three holes in the upper part of the box, as shown in Fig. 2.

In Fig. 3 a side view of the hanger is shown as it is screwed to the supporting two-by-four. The outlet box is fastened to the support and up against the ceiling by a lock nut. Adjustment is obtained by having a slot instead of a hole for the upper

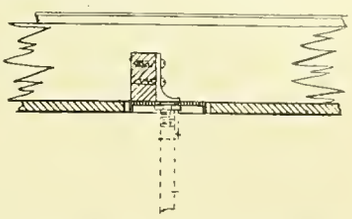


FIG. 3. SIDE VIEW OF FIXTURE HANGER.

screw of the hanger, as seen by a close inspection of Fig. 1. This allows of considerable lateral play to the support, which may readily be brought to a perpendicular position.

In many hangers difficulty is encountered in fitting the pipe to the outlet box. In the one here described the fact that the outlet box has three holes on the upper side and may be turned around at will, considerably simplifies this part of the work.

As will be noted in Fig. 3, there is an offset to the hanger, which amounts to three inches. This will always bring the three holes clear of the supporting two-by-four, so that no cutting whatever has to be done.

The hanger is not only applicable for pipe work but for mill construction and open work as well. A hole may be tapped through the upper part of the box down into the tubular support, as shown at the center in Fig. 2, for the insertion of a socket nipple. A stock company has been formed for manufacturing the hanger and other devices upon which Mr. Kuhlemeyer has secured patents.

Chicago Electrical Show.

Nearly one-half of the available 38,000 square feet in the Coliseum has already been taken by prospective exhibitors at the Chicago Electrical Show, which is to be held on Monday, January 15th, to Saturday, January 27th, inclusive—a period of two weeks. The exhibition will be of an educational nature, with special days for technical students and school children. There will be many interesting features. For one thing, the Swedish-American Telephone Company promises to show that it is possible to hear the queer noises of the heavens. This company will send large kites, covered with gold leaf, high above the Coliseum. Each kite will be equipped with a strong and sensitive transmitter, with telephone wires connecting with receivers in the Coliseum. Experiments already made give the listener on earth a queer sensation. There are moans and howls at times, then there are whispers that seem to lull a tempest. The Frank S. Betz Company of Hammond, Ind., will show, it is said, the biggest static apparatus ever made. This company is now constructing two special electrodes and a special coil for this purpose. The spark will dart across the Coliseum, from time to time, creating possibly the most brilliant and startling artificial lightning flash ever produced.

Among the concerns already assigned to space are the following-named:

Chicago Edison Company, Allis-Chalmers Company, Chicago Telephone Company, Frank S. Betz Company, American Steel & Wire Company, Guarantee Electric Company, Electric Appliance Company, Roth Bros. & Co., American Electric Company, Vesta Accumulator Company, Crane Electric Company, Chicago Battery Company, Electric Storage Battery Company, Overbaugh & Ayers Manufacturing Company, Sam J. Gorman & Co., Miller Anchor Company, Crocker-Wheeler Company, Mark Manufacturing Company, H. E. Cobb, Western Electric Company, General Electric Company, Westinghouse Electric and Manufacturing Company, Swedish-American Telephone Company, C. H. Thordarson, Monarch Electric and Wire Company, J. L. Schurman & Co., Reynolds-Dull Flasher Company, Haller Machine Company, Sprague Electric Company, J. Lang Electric Company, Fort Wayne Electric Works, Osborne Flexible Conduit Company, Federal Electric Company, Peru Electric Manufacturing Company, Central Electric Company, H. T. Paiste Company, Universal Electric Storage Battery Company, McFell Electric Company, George W. Conover.

Samuel Insull is president of the company giving the show, and T. R. Mercein of 464 Monadnock Building, is the general manager.

On a recent Sunday evening the electric light at the Drive Wesleyan Church, St. Annes, England, went out owing to the fusing of a wire. The congregation was asked to remain seated, and a hymn was sung, while a member of the congregation went home for a piece of wire and re-established the connection.

Question Box of American Railway Mechanical and Electrical Association.

One of the most important features of the programme of the American Railway Mechanical and Electrical Association at the recent meeting in Philadelphia, Pa., was the "Question Box." Many practical hints which will be found useful not only to those connected with the mechanical end of street-railway operation but to others engaged in electrical and mechanical pursuits are found therein. The following are some of the questions, together with the most concise answers:

Storage-battery Working.

Does a storage battery working in conjunction with a power house with moderately fluctuating loads show an ultimate economy?

The advantages of a storage battery working in conjunction with a power station with moderately fluctuating loads depends to a great extent upon the total capacity of the station. If the plant is small and has but a few generating units, a battery is sometimes very useful for carrying the peak and light loads, and can also be used as a standby in case of accident to any of the generating apparatus. If the station is a large one the principal use of a storage battery is to take the momentary fluctuations, but when these fluctuations are small as compared with the size of a generating unit the first cost and maintenance of a battery having sufficient capacity to carry the peak load or to be of use as a standby is usually too great to warrant installation. When greater capacity is needed in a large station having a moderately fluctuating load it is usually found advisable to install additional generating aoparatus instead of storage batteries. Frequently the battery is useful as an insurance against interruption to service, due to its ability to supply sudden demands in case of breakdown to generating units or cables, and the value of this as an insurance may entirely outweigh the question of first cost and economy.—William Pestell, chief engineer, San Juan Light and Transit Company, New York, N. Y.

Motor Operation.

What is the most common cause of flash-overs on small four-pole motors?

There are several causes for this: Weak fields, due to insulation rotting from the wires, causing them to come together and shortening the field; brush-holders not spaced to cover the exact number of bars on the commutator or placed to one side. The holders should point exactly to the center of the armature shaft; otherwise, as the commutator wears down they will throw out of line, covering the wrong bars on the commutator. Proper care should be taken in winding armatures to get the commutator bars perfectly lined with the slot in the armature core and the proper lead from the coil to the proper bar in the commutator; otherwise with the coil lead one bar either way you will have the same effect as with the brush-holders a little to one side, causing the brush-holders to flash over. —T. M. Du Bois, master mechanic, Syracuse Rapid Transit Company, Syracuse, N. Y.

What is the best method of inspecting motors for low bearings?

1. By going over the motor shell carefully immediately after coming in from service and feeling of it on all sides; should one side be warmer than the other it would denote that the armature is crowding that side and touching slightly. By careful inspection it may be discovered in this way before doing any injury to the armature.—T. M. Du Bois.

2. Most motors are now designed with a removable cover on the bottom shell at the commutator end, whereby free access is obtained to guage the air-gap between the armature and bottom field pole. A simple gauge for this purpose, consisting of a piece of spring brass about one-thirty-second inch thick with a width of three-quarters inch, and long enough to reach the full length of the pole, has been used to advantage. By riveting a small piece of brass on each end the gauge can be used in inspecting the standard as well as the minimum air-gap allowed.—W. Wallerstedt, engineer of car equipment, Interborough Rapid Transit Company, New York.

3. Cars should be run over the pit at least twice a month and the clearance between armature and pole-pieces inspected by removing the clearance cover from the lower half of the motor casing. All bolts and the condition of grease boxes should be examined at the same time. On an interurban road motors should be inspected as often as is possible, but must not be allowed to run over one week without inspection.—J. L. Sullivan, master mechanic, St. Francois County Railway Company, Farmington, Mo.

4. G. E. 58 motors can oftentimes be satisfactorily inspected by taking a "candle look" through the hand holes. If in doubt, however, the clearance may be ascertained by taking a narrow strip of fiber and moving it between the pole-piece and armature. By keeping the shells tight in the boxes better results are obtained than if they are put in loose, as I have seen some do. The shaft should be kept true to get the longest wear from the bearings.—E. E. Franklin, master mechanic, Portland Consolidated Railway Company, Portland, Ore.

How often should motors be overhauled; if on a mileage basis, how many miles?

1. This should be left to the judgment of the man in charge, as it depends greatly on the design of the motors and on the conditions under which they are operated. Our cars are ordered in for general overhauling about every fourteenth month, the maximum mileage of the motors during this period being 65,000, the average 52,100 and the minimum 43,500.—W. Wallerstedt.

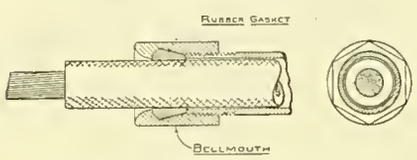
2. Motors should be overhauled according to inspection, as the mileage basis will not apply equally to city and interurban service.—T. M. Du Bois.

3. This depends upon the condition of armature and field coils, pinion, commutator and bearings. Usually only the last two conditions are taken into consideration when the word "overhauling" is used. The style of motor, methods of lubrication, quality of babbit in bearings, quality of copper in commutators, kind of brushes used and service conditions vary widely. On two-motor G. E. 1,000 equipments, 10-ton single-truck cars, an average of 10,000 miles is considered right in one western city. On four-motor G. E. 1,000 equipments, 20-ton double-truck cars, 14,000 miles is considered right in the same city. On four-motor G. E. 800 equipments, 16-ton cars, 9,000 miles is all that can be gotten in the same city.—F. F. Bodler, master mechanic, United Railroads of San Francisco.

Wiring and Circuit-breakers.

How shall we do away with the breaking of motor leads where they leave the iron conduit recommended by the Board of Underwriters?

1. A bellmouth should be used at the end of the iron conduit, so designed as to hold the leads firmly to prevent any possible chafing. A cleat should then be used at a distance of about six inches from the bellmouth, with a second one about 13 inches from the first, allowing the connector to come between the two cleats. This



METHOD OF SECURING MOTOR LEADS.

method has been used and found satisfactory. The accompanying sketch (see cut) shows the designs of bellmouth and method of securing the leads.—W. Wallerstedt.

2. Bring the cable leads out from the center of bolster to the motor, if motor is outside hung. Carry the motor leads over the center of the motor to the cable leads and connect, leaving just enough slack to curve well. We have very little trouble with broken wires in this way.—E. E. Franklin.

3. Where wire leaves the conduit we wind friction tape around the wire and then screw a T. & B. bushing, which is bell-mouthed, on to the end of the pipe. The bushing squeezes tight on to the tape and thus avoids chafing of the wire. We have had no trouble with work done in this manner.—E. T. Munger, master mechanic, Metropolitan West Side Elevated Railway Company, Chicago.

Do you consider it good practice to depend entirely upon car circuit-breakers, or do you use a fuse box also?

1. For ordinary city service circuit-breakers should be sufficient if equipment is properly taken care of. For heavy suburban or interurban service one circuit-breaker for all motors and independent fuses for each motor is better practice.—F. F. Bodler.

2. It is not good practice to depend entirely upon circuit-breakers. They are a complicated piece of apparatus, subject to mechanical as well as electrical failures. It is necessary, therefore, to use fuses in addition to the circuit-breakers.—W. Wallerstedt.

3. An automatic circuit-breaker can be depended upon if properly inspected and kept in close adjustment and well lubricated.—T. M. DuBois.

4. For interurban service, where stops are made at infrequent intervals and the controllers are of ample capacity for the work, circuit-breakers seem to be sufficient for the protection of wiring and car equipment. On cars operated in city service, where stops are made at frequent intervals, more chances for trouble occur incident to opening of circuits at the controller, and it seems to be good practice to employ fuse boxes in series with circuit-breakers. In case of a short-circuit either at the controller or in the car wiring, sufficient current may flow to badly burn the controller or car body without opening the circuit-breaker. If the short-circuit is maintained, however, the fuse will soon burn out, as it will not stand an overload for any length of time. In case of a sudden short-circuit to ground, the circuit-breaker will open before much damage is done, and the fuse may not be burned out owing to the time limit of fusing.—William Pestell.

5. Use both fuse box and circuit-breaker. Without the fuse box a continued overload would heat the motors and may not trip the circuit-breaker, where, if the fuse is used in connection with the circuit-breaker, you will have some protection from a continued overload.—J. L. Sullivan.

6. I do not think a circuit-breaker is safe without a fuse box, as I have had cases where they did not cut off the arc on a heavy ground and burned the controller badly and scorched the vestibule. We therefore use a fuse box in addition to the circuit-breaker.—E. E. Franklin.

Design and Operation of Cars.

How shall the interurban car of the future be designed, with or without platform; and where shall the entrance be, in the center or at the ends? How shall they be operated, in trains or singly? If in trains, shall all be equipped with motors, or will one be a motor car and the balance trailers?

1. The interurban car should have platforms and entrances at the ends. The number of people getting on and off at any one point is not large enough to warrant side entrances. Side entrances involve structural weakness in the car, which it is expensive to overcome, and they are difficult to operate, except by station platform attendants, or by expensive mechanism for operation by the conductor. Interurban cars should be provided with doors, so that passengers and conductor can pass from one car to another when cars are operated in trains. All cars on up-to-date roads should be provided with some form of multiple control, so that they may be operated in trains where the service warrants doing so. It is practically impossible to operate cars at high speed at more frequent intervals than one every half hour in each direction on a single-track road, and the ability to operate the cars in trains when the traffic requires doing so will frequently remove the necessity of building a double track where the traffic requires the operation of single-car trains at more frequent intervals. Preferably all cars should be equipped with motors, as the modern interurban road high-speed car generally has an equipment but little in excess of the requirements for propelling itself, and is therefore apt to be overworked if required to haul trailers. In most cases it would not pay to equip all cars with sufficient power to haul trailers. If it can be foreseen that the traffic of the road will require the operation of trains during the major portion of the time, it is probable that the equipment of two out of three cars in each train, or a like proportion with larger trains will be satisfactory. The number of cars which should be equipped with motors in each train will depend largely upon the acceleration desired, the grades, frequency of stops and other conditions encountered. —William Pestell.

2. It is a difficult matter to design a car that will meet the requirements of all interurban roads, as there are various conditions to be taken into consideration: conditions that may be characteristic for certain roads only. The length and width of the cars should be as great as the streets would permit in cities through which they may be required to pass. In determining the size of cars the density of traffic must also be taken into consideration. The cost of operating and maintaining a number of large cars is smaller than that of a greater number of small ones. As an up-to-date interurban service demands a high speed, the cars should be built with steel sub or floor-framing so as to minimize possible injuries to passengers in case of collisions or derailments. Seats should be provided for all passengers, if possible, especially if the cars are intended for long runs. The greatest seating capacity is obtained by the use of cross seats with a center aisle. Cross seats are, besides, more comfortable than longitudinal seats. This is especially true in case a high rate of acceleration and retardation is required. If platforms are not adopted it will be necessary either to provide the stations with platforms raised to an elevation corresponding to that of the car floor or to provide the cars with steps, which undoubtedly would project considerably beyond the car body. In either case it would prohibit the running of the cars on streets. Therefore it seems advisable to build interurban cars with platforms. If this is a fact, they should also be designed with end side doors. These should not be less than 40 to 48 inches wide. The platforms should accordingly be wide and of the vestibule type. The number of passengers handled at any one time at stations on an interurban line would hardly warrant center side doors. The greatest number of passengers would undoubtedly be taken on inside city limits, where side doors could be of no advantage, as the use of such would necessitate raised station platforms, which would not be permissible in the streets. As to the question if the cars should be operated singly or in trains, this would depend on the distance over which they are to run and on the density of the traffic. For short hauls, where stops are frequent, it would seem that single cars would be more economical and efficient. For longer hauls, when stops are not too frequent, trains made up of two or more cars can be used to advantage during rush hours or for handling

excursion parties. All cars should in such case be equipped with motors, as it would otherwise be impossible to maintain the schedule. All cars should also be equipped with air brakes. In determining the type of control to be used the greatest safety to passengers, the reliability and flexibility of control, the size of cars, and if run singly or in trains should be considered. If cars are run in trains it necessarily follows that a multiple-unit control should be adopted. In case small cars are used equipped with small motors with a comparatively small power consumption, a straight hand control can be used with economy and safety. When large cars are considered, with necessarily large motors, a multiple-unit control should be decided upon as being better adapted for handling heavy currents. Besides the flexibility of such a control in case it is desired to run cars in trains, it has the great advantage that all apparatus and cables carrying heavy currents can be placed underneath the floor framing, thus minimizing possible panics in case of a burn-out in the cables or control.—W. Wallerstedt.

On a city, suburbon and interurban service, can cars weighing 26 tons complete, equipped with four 50-horsepower motors, maintaining an average speed of 20 miles per hour, make a daily mileage of 300 miles without seriously impairing the electrical equipment?

1. This would entirely depend on the design of the motors and the profile of the road.—W. Wallerstedt.

2. The conditions named in this question have been met with in a western city with no bad results to electric equipment. Not a single armature or field has been lost through baking or burning out. Close inspection is required. The climate is decidedly favorable in this instance.—F. F. Bodler.

3. Four 50-horsepower motors on a car weighing 26 tons complete should easily make an average speed of 20 miles an hour for 15 hours per day without seriously impairing the equipment, providing the number of stops, grades and length of time on slow schedule in the city do not require the car to make a maximum speed in the country of over 35 miles an hour. If the previously mentioned conditions made it necessary to gear the car to a higher speed than 35 miles per hour on a level, it is quite probable that heavier motors would give a better service.—William Pestell.

Shop Practice.

What is the best type of construction for car-body hoists; should they be operated below or above the car-house floor?

In shops with a single floor an overhead traveling crane can be used to great advantage. Besides being economical, it leaves the floor space between cars unobstructed, which facilitates handling of material. If at the same time space for handling trucks and motors is provided for at one end of the shop, this same crane can be used in replacing trucks on any car. Enough headroom must then be provided for to permit of carrying the trucks over the cars. In shops with two floors, where on the upper one car-body repairs are carried out and where the lower floor is intended for the repairs of motors and trucks, the installation of an elevator will facilitate the jacking of cars as well as the handling of trucks and motors.—W. Wallerstedt.

Which is the more economical for the general lighting of shops and car houses, arc or incandescent lamps?

1. The most economical means for general lighting of shops and car houses, whether by arc or incandescent lamps, depends upon a number of factors. The location of shops and car houses relative to the power house or source of supply and the amount of copper connecting them; arrangement of space for storage, working, etc. Where extreme fluctuations of pressure are common it is not advisable to use arc lamps, as they will give considerable trouble and cost a large amount for maintenance, besides giving very poor light, so that in all cases where extreme fluctuations of pressure are encountered, incandescent lamps should be used—in clusters for illumination of large areas and as single lamps located with special reference to the work in shops and other places. Where there is no trouble due to fluctuation of pressure, arc lamps may be used for lighting large areas and incandescent lamps in shops, located with special reference to the work.—William Pestell.

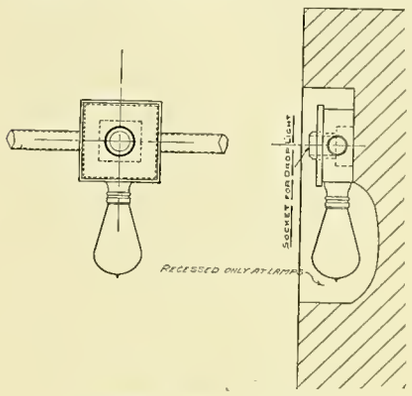
2. Incandescent lamps would appear to be more economical for the lighting of shops and car houses than arc lights, principally in consequence of their allowing us to distribute the light among such places as it is needed. Then, again, the incandescent lamps do not require the attention of electricians so frequently, and in case of a burn-out any car house employe can substitute a new lamp, whereas with arc lights the trimming should always be done by electricians. In car houses no great amount of light is required, except in special locations, such as in the pits or over work benches. It is, therefore, the practice in the borough of Manhattan to so arrange rows of incandescent lights between tracks that there will be one light for each car: in other words, the lights in each row will be two car lengths apart.—William Boardman Reed, engineer maintenance of way and buildings, New York City Railway Company.

3. We use both arc and incandescents for lighting our shop and believe that combination is the most economical.—E. T. Munger.

What is the best method of pit lighting?

1. In our shops we have found incandescent lamps located on both sides of the pits and spaced about 10 feet apart the most satisfactory method of lighting pits. Each lamp should be put in a recess (see cut) to prevent breakages. The wires should be carried in iron conduit pipes and a potential of not more than 120 volts should be used.—W. Wallerstedt.

2. The best method of lighting pits is by the use of incandescent lamps, the wires being placed in



RECESSED LIGHT FOR CAR PITS.

iron conduits, with the outlets spaced at intervals of about five feet, either side of each pit. For a careful inspection of the underbody of a car a lamp can be removed from socket and a portable light substituted.—William Boardman Reed.

Miscellaneous.

How large a trolley wheel can be used to advantage on high-speed interurban lines?

1. The size of the trolley wheel is limited by the difficulty in sustaining weight at the end of a trolley pole. By reducing the wearing cross-section of the wheel (which may confidently be done, owing to the slower speed due to larger circumference, hence less wear), the weight of the wheel may be considerably reduced. A six-inch wheel so constructed gives very satisfactory service on high-speed interurban lines. The spring in the trolley base, however, should be of proportionate strength. Wheels used in this service should be made of very clear, hard metal, of high conductivity, and should be subjected to the greatest care in construction and maintenance. The practice of allowing a groove to wear one side of the wheel and flat surfaces to form is the cause of the majority of broken trolley wires. New wheels should be properly milled, and wheels in service which become unequally worn should be immediately removed and, if possible, remilled. Bearings should be graphite bushing of ample size running on hard steel pins, the pins being so attached to the harp as to prevent any lost motion at this point. The common practice of tying the rope around the pole adjacent to the harp should not be allowed. This is a frequent source of trouble, preventing the trolley pole from slipping through frogs, etc., when wheel leaves wire. A metal loop at least six inches long should be fastened in an eye in the throat of the harp, to which loop the trolley rope should be spliced; no loose ends of rope must be allowed in the joint, as the arc caused by the trolley leaving the wire frequently ignites these loose ends, burning off the rope.—P. J. Mitten, superintendent overhead construction, Milwaukee Electric Railway and Light Company.

2. We find a four-inch wheel for city service and a six-inch wheel for suburban cars to be entirely satisfactory.—E. E. Franklin.

3. A six-inch trolley wheel for high-speed interurban.—J. L. Sullivan.

What is a good cleaner for slate switchboards, where burned around the circuit-breaker?

First, clean off with sandpaper; then give one coat of any good filler that will not carry current. When dry, putty up all uneven surfaces, using good, hard-drying putty. Rub down with rock pumice stone, clean off and give one or two coats of color, give two coats of japan varnish; after thoroughly dry, polish in the usual way. A good polish can be made from butter of antimony and raw oil.—E. T. Munger.

What is an economical figure for lubrication (per mile) of a 20-ton car equipped with four 40-horsepower motors?

1. A figure showing good economy would be 19½ to 20 cents per 1,000 miles.—W. Wallerstedt.

2. This is a hard matter to determine. Very few roads are able or will give any data as to the cost of lubrication. From data of our own at hand, we would judge that 18 cents per 1,000 miles, with oil at 20 cents per gallon, should be the maximum with cars equipped with four 40-horsepower motors, designed for oil lubrication and air brakes with independent motor compressors. This figure should cover all the oil used about the car. There is no doubt in our minds that this figure could be reduced to 12 cents or less with close attention. We have found that the latest type of motors only require oiling every 10 to 15 days, and the cost of our oil on this type of equipment is not above 11 cents. We have not the exact data, as we operate cars equipped with the syphon lubricator on the same division, and the cost per 1,000 miles is figured as a whole.—G. J. Smith, master mechanic, Metropolitan Street Railway Company, Kansas City, Mo.

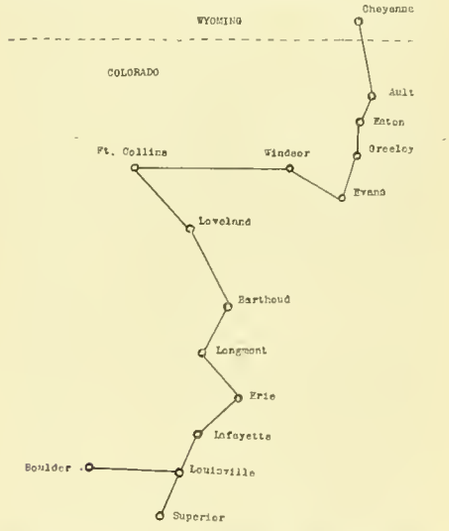
3. About 28 cents per 1,000 car-miles.—W. H. McAloney, superintendent rolling stock, Denver City Tramway Company.

4. Eight cents per thousand car-miles for all oil and grease used.—E. T. Munger.

Long Steam Power Transmission for Colorado.

To "centralize" the electric-light and power supply of certain cities in Northern Colorado and Southern Wyoming, a steam power-transmission company has been formed, known as the Henry Electrical Company, it being named for its chief promoter, Joseph J. Henry, of Denver. This company will install a 5,000-horsepower steam plant at Lafayette, Colo., which, by means of a transmission line, will supply the cities and villages whose relative locations are shown on the accompanying sketch map. The line will extend up as far as Cheyenne, Wyo. It is the intention of the company to buy outright over 40 per cent. of the electrical plants on the line of transmission, obtaining thereby control of the power situation. The scheme is expected greatly to enhance the value of mining and manufacturing enterprises.

The new plant will be equipped with the most



SKETCH OF PROPOSED TRANSMISSION LINE IN COLORADO.

up-to-date machinery, including steam turbines, and it is expected that power can be supplied to mills, mines, factories and plants of all kinds at an expense much less than that to which they are now put to haul coal the long distances required. A sum of $1,000,000 will be involved in the initial investment.

Mr. Henry has been connected with enterprises of the same sort in other parts of the West, most recently at Deadwood, S. D., where his plant lights and furnishes power for the entire Black Hills district.

The towns affected are: Boulder, with population of 10,000; Superior, 500; Louisville, 1,000; Lafayette, 1,000; Erie, 800; Longmont, 4,000; Berthoud, 1,000; Loveland, 3,000; Ft. Collins, 8,000; Windsor, 600; Greeley, 5,000; Eaton, 400; Ault, 600; Evans, 400, and Cheyenne, 16,500.

Mayer Dunne of Chicago has submitted his new gas ordinance to the City Council providing for a maximum charge of 75 cents per 1,000 cubic feet. The ordinance, on motion of Alderman Snow, was referred to the committee on gas, oils and electric lights. In his communication to the council the mayor exhorts the aldermen not to take any action that would tend to jeopard the rights of the gas consumers to sue for the recovery of $13,700,000, the amount claimed to have been paid by consumers in excess of 75 cents per 1,000 cubic feet since the approval of the former ordinance four year ago.

Chicago Street-railway Situation.

At the meeting of the City Council this week Mayor Dunne presented another municipal-ownership plan, called the "city plan," by which to acquire the street-railway systems pursuant to the Mueller law. He submitted a message, an ordinance and a request that the council order a referendum at the spring election to authorize the city to operate as well as own the street-car properties. His new scheme means condemnation proceedings and a final test of the rights of the traction companies under the 99-year act. The message and ordinance were sent by the council, without debate, to the committee on local transportation, which does not favor municipal ownership.

The ordinance submitted by the mayor is in brief as follows: Section 1 authorizes the issuance by the city of street-railway certificates not to exceed $75,000,000, which is to be the maximum price to be paid for the systems. Section 2 provides that the certificates shall be used for acquiring by purchase or construction street railways upon every street now occupied by street railways in Chicago. Section 4 provides that the certificates shall not be an obligation on the city, but payable solely out of the income derived from street-railway properties. Section 5 provides for a sinking fund.

Section 7 provides for renewals and extensions to be made out of the earnings. Section 8 contains a form of deed of trust. The certificates are numbered from 1 to 141,000, inclusive, aggregate $75,000,000 in amount, and are of six series, the denominations being $1,000, $500, $100, $50, $20 and $10. All of the certificates mature in 20 years and bear interest at the rate of five per cent.

Other sections provide for various legal technicalities. Section 13 provides that the question of the approval of the ordinance shall be submitted to a popular vote at an election to be held April 3, 1906.

The Mueller law provides as well for municipal operation of the street-car systems of Chicago as for municipal ownership. But under that law municipal operation cannot be adopted by the city authorities until it has been authorized by a three-fifths vote of the people. In view of this the mayor submitted a supplemental ordinance providing for submission to the people of the question of authorizing the adoption of municipal operation of the street cars. This also went to the hostile committee.

For the use of the local transportation committee of the Chicago City Council, Bion J. Arnold has submitted estimates of the financial results likely to be realized if the proposed 20-year franchise is granted to the Chicago City Railway Company. In only one instance Mr. Arnold includes in his figures the Union Traction Company. He estimates that the total gross earnings of both systems for the 20 years would be $546,851,000. At the rate suggested in the proposed ordinance the compensation to the city on this basis for both companies would be $40,622,250. If the compensation money would be put into a sinking fund, Mr. Arnold says, and compounded at four per cent. at the end of 20 years it would amount to $53,870,280, sufficient to buy a good street-railway system.

There are some interesting figures in Mr. Arnold's estimates which have reference only to the system of the Chicago City Railway Company. The present physical property he finds is worth $13,192,231; reconstruction to comply with the ordinance will cost $16,560,077, and extensions later will cost $10,000,000; thus, aside from renewals, at the end of the 20-year period the physical property will be equal to $39,752,308. He places the value of the franchise at the company's own figures, $25,000,000, and shows that its liquidation in 20 years would require an average annual sinking-fund payment of $750,250, compounded at five per cent., or a total in payments of $15,005,000.

The total gross earnings of the Chicago City company for the period would be $240,111,000; the maintenance at 60 per cent. of gross earnings, $144,067,000, and the net earnings $96,044,000. Interest at five per cent. on the cost of reconstruction and extensions would be $18,076,000 and taxes $7,203,000.

The amount of compensation which the city would get from the Chicago City company for the 20 years is given as $17,836,000. This is based on the offer of the company to pay three, five, seven and 10 per cent. of gross earnings for varying periods of the grant, an average of 7.4 per cent. for the 20 years.

After proper deductions, including interest on investment, there would be left to the company an amount sufficient to pay a dividend of 1.4 per cent. on the estimated present market value of the plant and franchise, or $38,000,000.

The city has won two points before Judge Dupuy in the case whereby it is trying to test the "99-year rights" of the companies by quo warranto proceedings. The court held that the proceedings were rightly brought, and then refused to postpone the hearings on the facts until after the federal Supreme Court had heard the appeal from Judge Grosscup's decision on the same subject.

Parshall on Alternating versus Direct-current Traction.

To the controversy on the relative merits of direct versus alternating current for railway work, with which are involved questions like third-rail versus overhead contact and locomotive versus multiple-unit operation, H. F. Parshall contributes an interesting letter to the London Times Engineering Supplement under date of October 26th. Mr. Parshall is an American engineer domiciled in England. He says:

"It is not my intention to enter the lists as a champion of either the high-tension alternating current or continuous-current systems for the propulsion of trains. I fully recognize that under given conditions either system may be the more advantageous. I may, however, take exception to the arguments advanced in favor of the universal use of alternating-current motors. Broadly speaking, the advantages and disadvantages of each system are very largely of a commercial nature. I was among the first to employ alternating current in traction work, but I stopped short of using it in the distribution system. The limitations which then seemed present still exist, and, under identical working conditions, prevail to the same extent.

"There is no doubt that an alternating-current train system can be made as reliable as a continuous-current system. However, where runs are short and the greater part of the work to be done lies in accelerating and maintaining speed rather than running at fixed speed, the motors required for the alternating-current system are much heavier than for the direct-current system. In the extreme case of acceleration to which continuous currents are applicable, the weight of the alternating-current equipment is prohibitive. The main question to be decided in all cases is the balancing of additional cost of train equipment against diminished cost in transmission and transformation. The difference in electrical efficiency may be taken as unimportant. With the same general transmission system the lower power factor and lower efficiency of the alternating-current train equipment may be taken to offset the energy losses of transformation in the continuous current as commonly used in the heavier class of railway work.

"A great deal has been said as to the objectionable features of the commutator of the continuous-current machine. It has, however, been found to be practically impossible to develop an alternating-current motor suitable for traction work without a commutator similar, but larger, than that employed in the continuous-current system. Furthermore, a high-tension transformer is necessary to secure the full advantages of the alternating-current system.

"Referring more specifically to Prof. Silvanus Thompson's recent letter, I may point out that the limiting feature of the alternating-curren system, apart from that of the motors under acceleration, is the drop in the return circuit if uninsulated. This drop is several times greater in the alternating-current system, per ampere, than in the continuous-current system. In heavy working an insulated return or its electrical equivalent becomes a necessity. Experiments have shown the impracticability of working a heavy train service by alternating currents with track return in any locality equipped with systems of telegraphs and telephones.

"As regards first cost, the third rail is much cheaper than the ordinary overhead system; but this, however, is not the determining factor. As regards reliability, experience is clearly in favor of the third rail. As regards the danger of the third rail, experience shows that, even when unprotected, accidents are very rare. In a specific case in London an overhead system, installed under the best auspices for heavy haulage over a complicated network of tracks, was found to be a failure, and was replaced by the third-rail system, which was found to be entirely safe and reliable.

"While I am in no way interested in the District railway installation, I would point out that the particular cables to which Prof. Thompson alludes are for alternating-current transmission and are not incident to the use of the third rail. Were the alternating system used throughout, the number of these cables would have to be greatly increased.

"I do not for a moment suggest that there are not conditions under which I would apply alternating current generally in a traction system. I have investigated the conditions under which this alternating current has been applied on the Continent and in the United States. For the lighter class of railways, working over considerable distances with moderate acceleration and moderate tonnage, a single-phase system possesses certain commercial advantages. The New York, New Haven and Hartford railway is a locomotive installation. Hence the acceleration is limited and a class of apparatus is permissible that is entirely unsuited to motor-car working. In my opinion the relative applicability of the two systems is wholly one of degree, and there is no general prescription which can be safely or reliably applied in the economical propulsion of trains.

"I have heretofore pointed out that in an electrical system the third rail is the most reliable and the least troublesome element in the whole traction system, as either the evidence of the Board of Trade or the responsible officials of the different electrical railways will confirm. The third rail has been singled out as the evil peculiar to continuous-current systems. When the same conditions are met in an alternating-current system it remains to be seen whether it can be dispensed with.

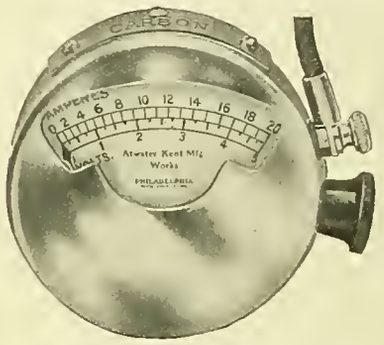
"It has been suggested that the third rail was not the creation of an electrician. I believe that Hopkinsons first suggested this form of conductor. Considering that it has been adopted, practically universally, for heavy traction by the engineers most responsible for the advanced state of the art, it cannot be lightly put aside and superseded by something yet to be proved suitable for the same class of work.

"In conclusion, I may point out that the broad problem before electrical engineers is to demonstrate, from experience gained in electrical working, the conditions under which electricity may profitably compete with steam. The solution of this problem is not so self-evident that time-tried inventions can be casually set aside."

Automatic Volt-ammeter.

An automatic volt-ammeter with a dead-beat needle which assures quick and accurate reading is one of the latest products of the Atwater Kent Manufacturing Works of Philadelphia.

The instrument illustrated herewith is adapted for any work where primary batteries are used. Every meter is guaranteed to be accurate, hand calibrated to standardized apparatus and thoroughly tested. A neat hand-sewed leather case is furnished with each meter. The instruments are made in two sizes—0-5 volt 0-20 amperes and 0-10 volt 0-20 amperes.



AUTOMATIC VOLT-AMMETER.

Voltmeters and ammeters, which are the same in appearance as the automatic volt-ammeters, are also constructed by this company, but without the button attachment. They have, however, the excellent feature of the dead-beat needle. Meters with special readings up to 30 volts and 30 amperes are made to order. These instruments are convenient and complete battery testers.

Large Gate Valves for Duluth.

The Lake Shore Iron Works of Marquette, Mich., is building for the Great Northern Power Company of Duluth four hydraulic gate valves which will be the largest of their kind in the Northwest. The valves are 20 feet in length, 12 feet high and have an inside diameter of 60 inches and weigh 15 tons each. They will be operated by electricity and motors will be installed for the purpose. The normal working pressure is 110 pounds to the square inch (shop test, 220). The company for which they are being made will have a plant with an ultimate capacity of 80,000 horsepower. Power may be transmitted to the mines of the Mesabe and Gogebic ranges.

Books Received.

"Practical Pattern Making." Edited by Paul N. Hasluck. Published by David McKay, Philadelphia.

"Modern Locomotive Engineering." By Calvin F. Swingle, M. E. Published by Frederick J. Drake & Co., Chicago.

"Entwurf von Schaltungen und Schaltapparaten" (Design of Wiring and Switching Apparatus). Volume I. By Prof. Robert Edler of Vienna. Published by Dr. Max Jaenecke, Hanover, Germany.

"La Séparation Électromagnétique et Électrostatique des Minerais" (The Electromagnetic and Electrostatic Separation of Minerals). By Désiré Korda. Published by L'Éclairage Électrique, Paris.

Electric Plant at Tientsin, China.

The electric-light plant installed at Tientsin, one of the larger cities of China, not long ago is said to be a paying enterprise. The plant was installed by Arnhold Karberg & Co., a German firm of Shanghai, and is described in a recent consular report.

The buildings comprise an engine room 60 by 30 feet, a boiler house 60 by 37 feet, together with a suite of offices for the resident engineer and his assistants. The buildings are constructed of brick, and space has been provided for additional machinery. The chimney is of wrought iron, four feet in diameter and 85 feet high.

The generators are direct-coupled to high-speed engines and consist of three sets. The smaller set is capable of developing 40 kilowatts at 550 revolutions, and the two large sets 80 kilowatts each at 400 revolutions per minute. Each set is capable of carrying an emergency load of 25 per cent. excess for two hours without injury. The engines are provided with steam-pressure gauges and forced lubrication, the latter being supplied by a pump driven from the engine shaft and supplied at a pressure of 15 pounds per square inch. A speed indicator also driven off the shaft indicates the revolutions.

The main switchboard is of white marble, enclosed in a polished wooden frame, supported by an iron framework. The panels, one for each dynamo, are provided with all the latest improvements, including switches, voltmeters, ammeters and general gear. Each feeder or trunk line is supplied with a lightning arrester properly grounded. The engine room is spanned by a traveling crane capable of lifting five tons.

The pipes connecting the boilers with the engines are of lap-welded mild steel, and the condensing and exhaust pipes are of cast-iron.

The two boilers are of the water-tube type (Babcock & Wilcox), each capable of evaporating 4,200 pounds of steam per hour at a pressure of 120 pounds per square inch. Each boiler is provided with a soot-cleaning apparatus, the tubes being cleaned by means of a steam jet. The boilers are capable of working up to full pressure in approximately 30 minutes. In the main flue to the chimney an economizer is provided for raising the temperature of the feed water by means of the waste gases, and the water thus reaches the boiler at a temperature of from 150 to 250 degrees. This effects a saving in coal of from 15 to 20 per cent.

There are two duplex feed pumps, each capable of pumping 500 gallons an hour against a steam pressure of 160 pounds per square inch. These pumps draw their water from an overhead tank holding 1,000 gallons. Connected with the pumps is an appliance peculiarly necessary in China, known as a filter, and a water softener is also an absolutely essential feature in all steam-construction work. The Tientsin plant is also provided with a surface condenser capable of condensing 7,000 pounds of steam per hour.

The three-phase system is used, and pilot lines laid back from feeding points to the switchboard indicate the attendant pressure. The street lighting for Tientsin comprises about 250 32-candlepower lamps, the distributing feeders of which are connected to their own system of mains and are controlled in groups.

House-installation work will be carried on by native labor under the supervision of a foreign engineer and in accordance with the rules laid down by the Institution of Electrical Engineers.

British Manufacturers and the Milan Exposition.

A special appeal is being made to the British electrical manufacturing companies to take advantage of next year's international exhibition at Milan in order to advertise their products throughout Italy; but it does not appear probable that anything in the shape of an imposing display can be organized. Those leading companies in England which are of transatlantic parentage are not free to seek business on the Continent, inasmuch as that territory is already allotted to undertakings with which they have either an alliance or a cordial understanding. There are, again, firms domiciled in England which are of German origin with similar restrictions, and there are yet others which have friendly relations with continental manufactures. To the few remaining, which are strong and independent, British companies are not as yet able to set forth such samples of our design and workmanship as may be distinctly superior to the products of Germany, Switzerland and Austria, the countries which are most favorably situated for obtaining Italian business. There is, indeed, nothing in the appeal of the Milan exhibition to induce British manufacturers of heavy electrical plant to depart from their policy of preferring at their present stage of progress to exploit the colonial and neutral markets of the world rather than incur heavy expenditure in utilizing the Milan exhibition as a foothold for the invasion of Italy.—London Times Engineering Supplement.

Efficiency of the Steam Turbine.

Concerning the efficiency of the steam turbine, says Indian Engineering, a great deal of unnecessary confusion is caused by the custom of tabulating a multitude of different so-called efficiencies; two are quite enough. The real efficiency of the machine as a prime mover is represented by that fraction of the available heat in the steam supplied which it converts into work. Since, however, different forms of prime movers permit us to deliver steam at different temperatures and pressures and permit our working down to different exhaust pressures, we require something more than this when our object is to compare the relative merits of different prime movers. The actual efficiency of the heat engine as a whole is measured by that fraction of the heat produced by the combustion of the fuel which is delivered as useful work. This includes the efficiency of the boiler and other accessories, but all its use entails is simply that in calculating this efficiency we must assume a steam-producer efficiency of a fair practicable value and adhere to that assumed value in all our instances for comparison. The efficiency of the turbine today is not widely different from that of the reciprocating engine, and since the former is but now being evolved in detail, while the latter has apparently reached its highest stage of development, this doubtless implies a considerable ultimate superiority on the part of the steam turbine.

Electric Plant for Venice.

A recent issue of l'Electricien gives a description of the electric plant for Venice, current for which is generated by turbines supplied with water from the Cellina River. The water is impounded by a cofferdam 14 meters in height and 33 meters long. It is drawn off through a tunnel cut in the rock, which is more than one kilometer long, and thence by an aqueduct 4.3 kilometers to the generating station. There are six turbines contemplated, four of which are now in service. The effective head on the wheels is 58.64 meters, which, with a discharge of 20 cubic meters per second, gives 15,600 horsepower. Each turbine develops 2,600 horsepower It is directly connected to a three-phase alternator. The exciters, of 130 kilowatts, are operated by seperate turbines. The generating pressure of 3,600 to 4,800 volts is raised by 15 single-phase delta-connected step-up transformers to the transmission voltage of 30,000 to 36,000. The line drop is such that the current is received at 27,800 volts at the sub-station of San Giobe in Venice, 90 kilometers distant, where it is lowered to 6,000 volts, and finally to 205 for distribution. The transmission line consists of four groups of three wires, 52 square millimeters cross-section, supported on poles which are grouped in pairs across the lagoons. Aerial wires supported over the canals by brackets are used for distribution within the town.

Rejuvenated Sons of Jove.

The order of the Rejuvenated Sons of Jove held its fourth Jovian congress at Dallas, Texas, on October 14th. The organization is a fraternal one, and is made up of those engaged in the advancement of the science of electricity. The following-named officers were elected: Jupiter, C. A. Newning, Houston, Texas; Neptune, L. G. Reed, Sandusky, Ohio; Pluto, W. M. Brooke, Dallas, Texas; Vulcan, J. H. LaRoche, Cohoes, N. Y.; Mercury, C. B. Roulet, Dallas, Texas; Hercules, P. R. Boole, Chicago, Ill.; Mars, F. C. R. Spence, Marshall, Texas; Apollo, J. P. Tufts, Dallas, Texas; Avrenim, W. G. Handley, Cincinnati, Ohio.

It is the intention of the present Jovian congress to hold rejuvenations at the next annual convention of the National Electric Light Association, the National Electrical Contractors' Association, the National Electric Jobbers' Association and the Southwestern Electrical and Gas Association, at which time candidates are requested to present themselves for rejuvenation. Application blanks and other information may be secured by addressing the office of C. B. Roulet, Wilson Building, Dallas, Texas.

Electric Lights for a Cave.

Some years ago Congressman E. W. Martin of Deadwood, S. D., succeeded in having Congress pass a law creating Wind Cave National Park, 12 miles from Hot Springs, S. D. Mr. Martin is now endeavoring to secure from Congress an appropriation to build an electric-light plant in the park to light Wind Cave; also to construct an electric railway from Hot Springs to the park. Wind Cave is said to be one of the largest and most beautiful in the world. It has been explored for about 100 miles, and it is estimated that there are at least 900 miles of passages and chambers in the cave. These Mr. Martin wants to illuminate with electric lights. The cave is described as having eight levels, the lowest being 400 feet below the surface.

Varied Forms of Incandescent Electric Lamps.

In a popular lecture at the Olympia Electrical Exhibition in London on October 6th James Swinburne, the well-known electrical engineer of that city, showed the advantages of lighting houses by electricity. Following is a résumé of what he had to say about recently brought-out lamps:

Within the last few years several improved forms of incandescent lamps have been put on the market. The first of these was the Nernst lamp. In this lamp zirconia is used as the basis of the conductor to be heated by the electric current; its high melting point renders it possible to raise the conductor to a much higher temperature, and therefore to obtain light which is both more economical and more like sunlight. The worst thing about these lamps is that they give a good deal of trouble. When switched on they do not light up at once, since a current has to be sent through a heating coil in order to raise the temperature of the glower to the point when it becomes conducting before the electric current can pass through the glower. This is sometimes very annoying. For instance, a man goes down to his wine cellar, where a Nernst lamp is in use; he turns on the switch and nothing happens, when he probably says something and lights a match, gets what he wants and goes away. Afterward the lamp lights up and burns until someone again visits the cellar. On going into a dark room you will probably have to wait a quarter or half a minute before you can get a light. In the latest types of Nernst lamps small carbon-filament lamps are provided, which become luminous when the Nernst lamp is switched on, while when the Nernst lamp lights up the subsidiary lamps are switched out automatically.

One of the latest forms of electric incandescent lamp is the tantalum lamp. Tantalum is a metal which is not in general very well known. It is nearly, or quite, as hard as the diamond, and rather stronger than steel. The German firm of Siemens & Halske has succeeded in shaping this metal into very fine filaments, and making these into lamps. The high melting point of tantalum renders it possible to raise the filament to a much higher temperature than would be practicable in the case of carbon filaments, and thus greater economy is effected. In addition the resistance of tantalum increases with the temperature, while the resistance of carbon remains stationary, and under certain circumstances decreases with the rise of temperature, with the result that an accidental rise of pressure that would destroy a carbon filament has no harmful effect on a tantalum filament. Were it not for the high price of tantalum lamps, carbon-filament lamps would no longer have a chance against their latest rival, but when a carbon-filament lamp can be obtained for a few pence, people are loth to pay three, four or five shillings for a tantalum lamp, however great its advantages may be.

The osmium lamp was invented by Auer von Welsbach, the inventor of the gas mantle. Osmium is about as rare as tantalum and about as difficult to work. The osmium lamp is a very promising lamp, indeed, but the difficulty is to obtain a filament long enough and thin enough to possess a sufficiently high resistance for the ordinary pressure at which electricity is supplied. However, lamps have been made to withstand a pressure of 110 volts, and two of these may be coupled in series across 220-volt mains. The osmium lamp has the further advantage that very efficient lamps can be made from it to run at very low pressure, even below 50 volts. Portable osmium lamps lighted by means of a secondary battery have been supplied. These should be very popular, as they can be turned on at an instant's notice wherever they happen to be wanted.

The Cooper Hewitt lamp utilizes the light emitted when an electric current passes through mercury vapor. In its original form it was unsuitable for domestic lighting, since the color of the light emitted is something between green and blue, and would render the most beautiful lady's complexion hideous. It is, however, excellent for use in drawing offices, and it is being used with great success in photography. It has a very high efficiency—that is, it dissipates very little power in proportion to the light which it emits. Mr. Bastian has invented an improved form of mercury lamp specially arranged for domestic lighting. A carbon-filament lamp is run at so low a pressure that it only emits red light, and this combined with the blue and green light from the incandescent mercury vapor forms a very good light indeed. This lamp brings the cost of electric light down to that required in the case of gas without taking into consideration the deleterious effects of the latter.

The sale of the Washington Electric Light Company of Washington, N. J., which had been pending for some weeks, was consummated on November 1st. The transfer was effected through the Gas and Electric Development Company of Philadelphia and New York. Extensive improvements will be made to the property, under the supervision of the Development company.

Indiana Telephone Items.

The Monticello Telephone Company of Monticello has made a deal with the Bell Telephone Company for toll connections. The Bell lines will come in over the local company's system, and all of the Bell company's booths in the city will be removed and long-distance instruments installed when desired.

A second telephone system, as proposed by the Pocket Telephone Company, is being opposed by the citizens of Evansville. They would be glad to have the Independent telephones of the state connected with Evansville, but not through the medium of a second system, involving the increased cost of maintaining two telephones.

Checks for the payment of the November dividend have been mailed by the Indianapolis Telephone Company to holders of stock in the New Telephone Company. This dividend was temporarily withheld, due to the great amount of work necessary to effect the change in ownership of the properties.

An important meeting of the entire boards of directors of the Indianapolis Telephone Company and the New Long-distance Telephone Company was held in Indianapolis on November 11th. Much of the time was taken up in discussing and considering proposed improvements in equipment, service and extension of lines. C. E. Stinson, the new acting general manager and consulting engineer, spoke of the rapid development and substantial condition of the New Long-distance lines, and said the new management had received many assurances of support and welcome from the Independent telephone companies of Indiana. Still larger exchanges and greater toll service must follow from the introduction into the state of the financial strength and telephone experience of the St. Louis and Ohio interests that have purchased jointly of the shares of the New Long-distance and Indianapolis companies. Those who attended the meeting were president H. C. Stifel, Vice-president C. M. Forster, Breckenridge Jones of St. Louis, James S. Brailey, Jr., of Toledo, A. F. Ramsey, M. B. Wilson, J. H. Holiday, Louis Holwegg, A. Bauer of St. Louis and C. E. Stinson. It is understood that plans were agreed upon at the meeting to go ahead with the construction of the new exchange building as planned by Mr. Sheerin previous to his death.

The Indianapolis and Cincinnati Traction Company has just completed a double metallic circuit (four-copper wire) telephone line between Indianapolis and Rushville, one of which is used exclusively by the train dispatcher. Each car is provided with a telephone by means of which the conductor can talk with the train dispatcher at fixed points. The other line is used for general company business. Jack boxes are placed on the poles at intervals of 2,000 feet. All of the telephone wires are carried on porcelain insulators on cross-arms near the top of the trolley poles, being thus far removed from the high-tension wires. The wires are transposed every 500 feet, in order to avoid disturbance from the electric current. A private exchange connected with the Rushville telephone system is also maintained in the company's general offices in Rushville. S.

Ohio Telephone Notes.

Circular letters have been sent to the bondholders of the Cuyahoga Telephone Company by a syndicate headed by Breckenridge Jones of St. Louis asking for an option on all first-mortgage bonds at 90, and interest, good until February 10th. Most of these bonds are held by individuals and syndicates in Cleveland. For some time people have speculating as to what move the men interested in the United States Independent Telephone Company would make toward Ohio properties. This would indicate that they will bring them into closer relation in some way, but still no detail is known regarding their intentions.

The Morrow County Telephone Company has reduced its rates to country subscribers. The Bell is completing a line from Marion to Mt. Vernon, and indications are that there will be a warm contest between the two companies.

The Columbus Citizens' Telephone Company has declared its regular quarterly dividend of one per cent.

The Newark Telephone Company of Newark will list the issue of new preferred stock on the Columbus Stock Exchange. Besides earning eight per cent. on the common stock, the company is also clearing six per cent. on the preferred. C.

The Telephone in Mexico.

The telephone system at Celaya is to be extended and greatly improved. George Herbert is general manager.

A new telephone system is being installed at Mazatlan by Arthur Cina.

Good progress is being made by the New Telephone Company in laying its underground system in the City of Mexico. This system is owned by L. M. Ericsson & Co. of Stockholm, Sweden. Axel Bastrom, president and general manager of the company, has arrived from his home in Sweden to take active charge of the work. K. W. Peterson is chief engineer. It is stated that the company will be ready in about five months to give its subscribers service. It will start business with about 3,000 subscribeers. The work of constructing the new exchange building for the company has been started. The building will cost about $85,000.

The Mexican Telephone and Telegraph Company has resumed the work of laying its underground telephone system, under the direction of W. B. Hale, its new general manager. When the underground system is further advanced the work will be commenced of taking down the overhead wires within the portions of the city for which the company holds a concession to put down its conduit system. The company expects to have the work of improvement completed by the middle of next May. The new switchboard has been ordered from Chicago. H.

Telephone News from the Northwest.

The local telephone system at Crookston, Minn., has been purchased by A. F. Cronquist of that city.

It is reported in Northwestern Minnesota that the Northwestern Telephone Exchange Company has purchased the system of the Iron Range Telephone Company, with which it has had close relations for some time.

The city of Albert Lea, Minn., has been enjoined from interfering with the Albert Lea Telephone Company in making repairs to its exchange. An ordinance is in effect which requires all telephone companies to connect with each other, and this has never been accepted by the Albert Lea Telephone Company nor its successor, the Northwestern Telephone Exchange Company. It is on this ground that the city seeks to stop the work of improvement, saying that the company has no rights in the city.

The Gregory Home Telephone Company and the Nebraska Interstate Telephone Company have merged and will build lines through Western South Dakota.

A new company is projected at Prentice, Wis., to install an automatic telephone system.

The Minnesota Central Telephone Company will build two copper toll lines from Ortonville to Minneapolis.

The bill of the Northwestern Telephone Exchange Company for service for June, July, August, September and October has been disallowed by the county board at Grand Forks, N. D. In May last the company was notified that no more bills would be allowed, but the telephones were not ordered out of the courthouse.

The Interstate Telephone Company has sold its toll lines from Dyersville, Iowa, to Manchester, Delaware, Delhi and Hopkinton to the Delaware County Telephone Company.

The Mississippi Valley Telephone Company has purchased the Dallas City (Iowa) telephone system with connecting toll lines.

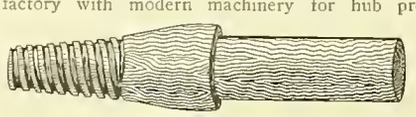
The Independent Telephone Company has begun work on a new two-story brick exchange building at Council Bluffs, Iowa.

G. W. Smith has sold his telephone exchange at Brighton to the Mutual Telephone Company.

The LeRoy (Iowa) Telephone Company has purchased the exchange at Riceville from the Northern Iowa Telephone Company. R.

Birch Telephone and Telegraph Cross-arm Pin.

To supply the large demand existing among wagon manufacturers for a birch hub, which is of such well established good reputation for durability, the Maine Hub and Manufacturing Company of St. Marys, Pa., about a year ago purchased a large tract of birch timber in Maine and there equipped a factory with modern machinery for hub production. This factory has been running on wagon hubs for over a year with great success. But from the fact that birch as a material for hubs has been so well tried for years by the world's largest manufacturers and has proved so reliable in arduous service, and under the severest climatic conditions, the Hub company was led to the conclusion that birch is a wood from which durable telephone and telegraph insulator pins could also be produced.



BIRCH CROSS-ARM PIN.

The Maine Hub and Manufacturing Company is, therefore, now entering the field with this new birch pin, confident that it is equal in every respect to the best locust pin in the market. The company's large mill in the Maine woods is fully equipped with modern pin-producing machinery and the Maine Hub company is now ready to make quick shipments to any part of the United States. This birch pin has been tested as to tensile strength, etc., and a critical inspection of samples, which will be furnished on application, will reveal its merits.

T. W. Butler, manager of the local business of the Minnesota Central Telephone Company at Sleepy Eye, Minn., has resigned and will go to Alexandria, Minn.

New Independent Association for Vermont and New Hampshire.

Representatives of the Independent telephone companies of Vermont and New Hampshire held a meeting at Hotel Wentworth, Woodsville, N. H., on November 2d, which resulted in the forming of an organization to include the two states and to be known as the Vermont and New Hampshire Independent Telephone Association. Like similar organizations in other parts of the country, the purpose of the association is to promote uniformity of operation, maintenance and construction and to secure co-operation among the Independent interests to decide all questions to the best interest of the companies, the Independent movement and the people.

There was a large attendance from all parts of both states. Speakers at the meeting said that the new organization has been needed, and they expressed the belief that the time is not far off when their systems will be connected by Independent trunk lines with all other parts of the United States. The association adopted the national emblem adopted by the National-Interstate Telephone Association in Chicago last June.

The first officers of the association are: President, H. W. Buchanan of Barton Landing, Vt.; vice-president, C. D. Eastman of Woodsville, N. H.; secretary and treasurer, G. W. Buzzell of St. Johnsbury, Vt. Twenty other vice-presidents were elected, who constitute the committees charged with future arrangements for the association. Arrangements for other meetings in the near future were made.

Clearing House for Texas Independents.

At a meeting of the members of the Texas Independent Telephone Association held at Dallas on November 7th and 8th, steps were taken to complete the organization of the clearing house recently established for the purpose of handling all of the business of the Independent telephone companies in the state and to provide for toll charges to apply on all messages on the Independent toll lines. The following-named officers of the clearing house were elected: President, Cecil L. Simpson of Dallas; vice-president, E. P. Butler of Gainesville; secretary and treasurer, E. W. Dunaway of Paris. It was decided to hold the next meeting at Waco at such time as the executive committee shall decide to call it.

NEW COMPANIES.

The Star Independent Telephone Company has been incorporated under the laws of the state of Idaho. The purpose of the company is to establish long-distance telephone connections with lines from Boise, Nampa, Caldwell, Pearl, Emmett and Payette, Idaho. The capital stock of the company is placed at $10,000.

Among recently incorporated telephone companies are the Farmers' Mutual Telephone Company, Weatherford, Okla.; Caldwell Mutual Telephone Company, Exline, Iowa; Walnut Grove Telephone Company, Venus, Neb.; Star Independent Telephone Company, Star, Iowa; Earl and Tyronza Telephone and Telegraph Company, Little Rock, Ark.

MANUFACTURERS AND DEALERS.

The Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y., reports having closed contracts for switchboards for Friendly, W. Va.; Sisterville, W. Va.; New Matamoras, Ohio; Laclede, Mo.; Long Lake, Minn.; Eureka, Utah; Payson, Utah; Richmond, Utah; Tooele, Utah; Preston, Ida.; Lowville, N. Y.; Louisville, Ky.; Attica, Ind., and Rochester, N. Y.

The Sandwich Pole-changer Company of Sandwich, Ill., has issued a small booklet describing its pole changer and also a direct-reading ohmmeter or trouble-finder for use in telephone work. The ohmmeter is made in two styles—one with a galvanometer and one with a telephone receiver. Another device described is the Illinois duplexer, which practically makes two complete telephone circuits with one pair of wires, or three circuits with two pairs.

At the Business Show at Madison Square Garden, New York, this month the Stromberg-Carlson Telephone Manufacturing Company, represented by James S. Gibson and James O. Oliver, installed a central exchange, with 75 connections, for the use of the exhibitors and the general public all over the garden, using 15,000 feet of wiring to accomplish this result. The Stromberg-Carlson people are looking for business in New York in connection with the pending invasion of New York by the Independents. The Kellogg Switchboard and Supply Company of Chicago exhibited a full line of its intercommunicating telephones, and its representative reported having done good business in the upper part of New York state. The DeVeau Telephone Manufacturing Company of New York also showed its wares, and several other concerns displayed various telephone supplies.

GENERAL TELEPHONE NEWS.

The Pioneer Telephone Company will rebuild its telephone exchange at Ada, I. T.

William Widman and others are about to establish a telephone exchange at Bigelow, Minn.

C. F. Langley has been elected manager of the Rhinelander (Wis.) Mutual Telephone Company.

B. H. Rand, Bascom Lynn and D. A. Lynn of San Angelo, Texas, have incorporated as the Dixie Telephone Company with a capital of $10,000.

The Colquitt Telephone Company of Colquitt, Ga., has been organized by C. C. Bush, N. L. Stapleton, W. I. Geer, W. C. Dancer, J. S. Bush and associates to construct a telephone system.

It is said that a movement is on foot to consolidate all the Independent telephone companies of West Virginia. The Charleston Telephone Company, according to the report, is to be used as the basis of the consolidation.

Plans for the new building of the Southern Bell Telephone and Telegraph Company in Atlanta, Ga., have been completed, and call for a seven-story building. Only three stories will be built at present. Equipment for 10,000 telephones will be installed.

The New York Telephone Company reports that during October there was a net gain of 5,015 instruments installed in Manhattan and the Bronx, making a total service of 233,999 telephones now in operation. The net gain during the 10 months of 1905 has been 27,000 connections.

William Thomas, representing the Home Telephone Company of Alamedea County, Cal., has filed application with the council for a franchise to construct and operate a telephone system in Oakland, and bids for the franchise will be received by the city clerk up to 8 p. m., December 4th.

Articles of incorporation of the North Shore Telephone Company of Deep River, Wash., have been filed with the secretary of state of Washington. The object of the company is to construct a line from McGowan's cannery, via North Shore, Knappton, Deep River, Grays River, Skamokawa and Cathlamet, Wash., to connect with the Pacific States system. The incorporators are W. N. Meserve, William Anderson, P. J. Brix and A. Olsen.

The Canadian inventor Neill is negotiating with the French government for a concession to install his automatic telephone system. One of the main objections made to his automatic device is that it would deprive 2,000 French telephone girls of employment. To offset this objection Mr. Neill is said to have made a proposal to Director Barard to send the girls to Canada and the United States, where he undertakes to find husbands for them.

The stockholders of the Charleston (W. Va.) Home Telephone Company held their annual meeting recently. The annual report made to the stockholders showed the company to be in an excellent condition, and the stockholders expressed themselves as greatly pleased with the progress of the last year. The company proposes to add largely to its equipment in Charleston both in the toll and local lines. After the business meeting an informal banquet was served. Dwight E. Sapp was the toastmaster.

C. C. Conroy, president of the Beaumont Northwestern Telephone Company, says that he will institute proceedings in court to recover possession of the property of that company from the hands of the receiver, J. W. Mackey. The Beaumont Northwestern Telephone Company's property consists of 16 exchanges in East Texas and more than 500 miles of wire. It was under lease to the Lone Star Telephone Company at the time it was placed in the hands of a receiver. Mr. Conroy says that if he recovers possession of the property important improvements and extensions of the system will be made.

The Independent Telephone Company of Yankton, S. D., has commenced construction work on its extension of long-distance telephone lines from Gayville to Sioux City connecting with the toll lines of the New State Telephone Company and the Sioux City Telephone Company's new automatic exchange just completed and owned by the business men of Sioux City. The construction work and material of the new lines is of the best standard grade and the circuits will be of copper wire. With the Sioux City connections the Independent telephone system of South Dakota will cover the greater part of the south half of the state with a total investment of $250,000, and which is owned by the three Independent companies, the Yankton company, owning the lines from Yankton to Sioux Falls and west from Yankton to Tyndall; the Missouri River Telephone Company of Geddes, the lines through the counties west from Tyndall to Bonesteel, Chamberlain and Mitchell, and the Citizens' Telephone Company of Sioux Falls, to Canton, Salem, Dell Rapids and Worthington, Minn., and connecting with the Twin City system.

Broken Bow, Neb., is considering the establishment of an electric-light plant.

CORRESPONDENCE.

Great Britain.

London, November 1.—The supply of electric power in London will most probably once more occupy parliamentary and public attention during the forthcoming session. It may be taken for granted that the $25,000,000 scheme will be revived, while there are strong possibilities that a counter scheme promoted by the London County Council will also be brought forward. A suggestion has been made by a committee of the London County Council that a conference of that body and all the London borough councils should be held, with a view to coming to some decision as to the promotion of a bill in the forthcoming session by the County Council, giving it authority to carry out the precise works contemplated in last year's bills, viz., the supply of electricity in bulk generally, and especially to large consumers, such as railways, tramways, docks, canals, etc.

Apart from the fact that Mr. Merz and his co-engineers displayed considerable ingenuity and originality in the handling of their bill last year, and that the London County Council is apparently intending to coolly adopt the results of these efforts, it is interesting to speculate how the local authorities will justify such a volte face as will be the case should an agreement be come to at the suggested conference. In the first place, only six months ago a suggestion made at a conference of local authorities only, that a bulk-supply scheme should be inaugurated by the London County Council, was almost howled at by the delegates. Again, the present scheme contemplates the supply to docks, canals, railways, tramways, etc., all of which the local authorities were strenuously opposing in last year's bill. Further, it was continually dinned into the ears of the committee of Parliament that the whole basis of the scheme last year was false, but, from the hints thrown out so far in connection with the proposed London County Council scheme, it would appear that very much the same lines will be followed. However, much depends upon the borough councils' attitude at the suggested conference.

The conversion to electric traction of the one or two lines contiguous to the Inner Circle, and now worked by steam, with a consequent interference with the electrical service, is being gradually brought about. On the one hand, there is a steam service of trains running between Willesden and Mansion House, and thus partly upon electric and partly upon steam roads. As the company owning these trains does not contemplate the early conversion of its lines to electric traction, it has been decided by the District company to detach the steam locomotives at the point where the electric road is touched, and to haul the trains to the Mansion House by electric locomotives. On the other side of the Inner Circle there is a line branching to Hammersmith, but this is now being equipped for electric traction, and before many months no steam trains will exist upon the lines owned or run over by the Metropolitan and District companies.

The Brighton corporation has had in hand for a long time the erection of a new additional generating station consequent upon the great expansion of its electric-supply business and the demand for energy by a number of local villages roundabout. A large part of the plant has been supplied by the Westinghouse company, and this has recently been certified as satisfactory. Brighton is one of the pioneers of electric supply in Great Britain, and is the home of the maximum-demand system of charging, its late resident engineer and present consulting engineer having invented this.

The Mersey Railway Company, which was the first steam railroad in Great Britain to adopt electric traction, has arranged for the issue of tickets upon a penny-in-the-slot method, in order to facilitate the traffic. It would not be surprising to hear that the system has failed.

Probably in no part of Great Britain has tramway intercommunication been carried to such limits as in and about South Lancashire. The system of the South Lancashire Tramway Company is in itself a considerable one, runs of over 30 miles being possible, while in addition intercommunication between various towns is a common thing. The latest is the decision to lay down a connecting link which will bring Liverpool and Manchester into connection, a distance of 30 miles.

The Torquay corporation is certainly not in a dignified position with regard to the tramway question in that town. Originally a policy of condescension, and by virtue of its veto, gave its consent to the tramway company's proposal on the condition that an agreement was made that the corporation should supply the necessary energy. I have previously related how the Local Government Board has refused to sanction the raising of the necessary money to equip the plant to provide this supply, and the temporary deadlock that has arisen in consequence. Although the council is still endeavoring to raise some money to erect a temporary plant, there appears to be a desire to retire from its parliamentary bargain to give a supply, for a suggestion by the tramway company to modify one of its lines was met with a negative, unless, as an equivalent, the council were relieved of the obligation to give a supply. The interest in this matter is enhanced by virtue of the fact that the tramways are on the surface-contact system. A Local Government Board inquiry into the latest proposal of the council will be held shortly. G.

New York.

New York city, November 11.—All municipal-ownership questions are in abeyance pending the outcome of a recount of the votes of last Tuesday's election. The municipal-ownership candidate for mayor, W. R. Hearst, was defeated by about 3,200 votes, but has since taken active steps to prove that he was "counted out" by Tammany election officials.

Chief Engineer Nicholls, reporting to the Board of Estimate and Apportionment yesterday, recommended that for the franchise applied for by the Port Chester electric railway the charges to the company should be $18,000 a year for 10 years and $35,000 a year for the next 15, besides a tax of 10 cents a lineal foot of track.

The state commission on gas and electricity will hold an inquiry into conditions in New York city, beginning on November 20th.

The September quarterly statement of the Brooklyn Rapid Transit Company, issued on Tuesday, showed an increase in gross earnings of $549,000 and an increased surplus of $570,000. This means that the ratio of operating expenses to gross earnings has been decreased from 59 to 53 per cent. The Brooklyn Rapid Transit has not yet paid its special franchise taxes, which now amount to $2,359,096.

The Long Island railroad having elevated its Atlantic Avenue tracks now proposes to run a fast trolley service along the avenue, using a protected third rail. Local feeling is very much against the scheme, which will stultify the benefits of the recent costly improvements.

Glen Cove, L. I., has now a trolley connecting with the Oriental Hotel. This is the first of some new feeder lines built by the Long Island railroad. Power is supplied from the large power house at Long Island City.

The Catskill Mountain and Mohawk Valley Railway Company, with a capital of $2,000,000, has been organized and incorporated to operate a 70-mile electric railway from Cairo, N. Y., to Oneonto, with a spur to Stamford, Conn. E. C. White, G. C. Kendall, H. S. Lounsberry and E. E. Billings are the directors of record.

A survey by United States government engineers demonstrates that the Niagara River develops waterpower equivalent to 9,000,000 theoretical horsepower. Between Lakes Erie and Ontario the Niagara River falls 627 feet in a course of 27 miles and discharges 230,000 cubic feet of water a second.

Thirteen eastsiders, traveling on a Brooklyn trolley car on July 13th last, were put off the car for alleged refusal to pay the 13 fares. They brought 13 damage suits against the company this week and lost the verdict in each of the 13 cases.

The National Electric Signaling Company has obtained a perpetual injunction against the De Forest Wireless Telegraph Company and others for using a space-telegraph device described as "an improvement in receivers for electromagnetic waves." The De Forest people say that the adverse verdict will not affect them, because the device is no longer in use.

J. H. Allen of Brooklyn and business associates have incorporated the John H. Allen Company of New York as electrical and mechanical engineer. The capital of the concern is $15,000.

The Western Union Telegraph Company commenced last evening a system of hourly flashes from the roof of its Broadway office. Each flash will start precisely on the hour, after dark, and will last 10 seconds, so that mariners in the harbor can set their timepieces.

It is estimated, optimistically, that the Marconi people have spent $500,000 so far on their plants in the United States and Canada. D. W. W.

Southeastern States.

Charlotte, N. C., November 11.—The town of Bamberg, S. C., has selected a committee on public works to have charge of the new electric-light plant to be erected shortly by the town.

An important new development is the plant of the Lynchburg (Va.) Traction and Light Company which has just been put in operation, costing about $150,000. It is located on the James River and develops 4,000 horsepower.

The charter of the High Point and Winston (N. C.) electric interurban railway has been granted. The capital is $450,000. Officers has been elected as follows: President, J. H. Mills of High Point; vice-president, C. C. Yetter of Bloomsburg, Pa.; secretary and treasurer, Frank A. Chaplin of Philadelphia.

Secretary Cooper of the Atlanta Chamber of Commerce has taken up the matter of securing for that city if possible the 1906 convention of the American Street and Interurban Railway Association, which met last in Philadelphia.

Great interest is being taken in the Appalachian Park movement in the southern section of the country, not only on account of the forestry considerations but on account of the claim that unless some-

thing is done to prevent the cutting of timber and the consequent floods of the streams the water-powers along the various rivers rising in the Appalachians will finally become worthless on account of the variation in the water flow and the damaging floods that have been experienced of late years.
L.

Texas.

Austin, November 11.—John C. King of Gainesville, vice-president of the Gainesville-Whitesboro-Sherman interurban electric railway, announces that the contract has been let for constructing the road. The power house will be located at Gainesville.

The City Council of Waxahachie has granted a 35-year franchise over the streets of the city to J. S. Daugherty and associates for the proposed interurban electric railway that is to run from Dallas to Waxahachie. The persons who obtained this franchise propose to extend the road beyond Waxahachie to Ennis. The survey for the road is now being made. It will be about 35 miles long.

The Houston Electric Company has perfected plans for important extensions of its electric railway lines in Houston and for other improvements. New barns and repair shops will be erected at a cost of about $80,000.

A local company has been organized for the purpose of installing an electric-light plant at Killeen.

Stone & Webster have not yet submitted their proposition for the rebuilding of the large dam across the Colorado River at Austin to the City Council. The engineer of the company recently made an exhaustive investigation of the feasibility of the proposition and it is said that his report was favorable.
H.

Mexico.

City of Mexico, November 10.—It is announced that the American company headed by Eugene Davis has made all necessary financial arrangements for the construction of a large electric power plant to supply the Parral mining district with power and electric lights. The initial power plant which is to be installed at Zona, about 51 miles from Parral, will consist of six units of 500 horsepower each. The first transmission line will be built to Parral. It is stated that several times the amount of power which the initial plant can produce can be sold to advantage.

Regaciano Felguenes of Zacatecas heads a company which is installing a new electric-light and power plant at Fresnillo. The state government has granted the company a liberal subsidy.

The city of Cananea will obtain its electric-light and power supply from a plant which is to be installed by the Cananea Consolidated Copper Company. The plant will also afford lights and power for the mines. The new plant will be an addition to the existing plant, which is inadequate to the demands of the town and mines.

The formal inauguration of the new electric-light plant at Huichapan recently was made the occasion for a notable celebration. Governor Rodriguez was present and participated in the ceremonies.

It is announced that the Compania Electrica de Zacatecas, organized to install an electric-light and power plant in the city of Zacatecas, has awarded the contract for the entire installation to the Schoendube & Neugebauer Company of the City of Mexico. The electrical machinery and equipment will be manufactured by the Allgemeine electrical company of Berlin, Germany. The plant will be equipped with gas engines of about 200 horsepower each, to be built by the Koerting Works of Hanover. The power house will be located about a mile from the center of the city.

The federal government has granted a concession to Canuto Reyes to install an electric power plant on the Atoyac River near Galeana. The electrical energy will be transmitted to towns and mining camps of that section.

La Electrica is the name of a company organized at Vera Cruz to provide electric light and power for private consumers, factories and other industries. The company will install a large plant.

The Guanajuato Electric Light and Power Company, which supplies electric current to the Guanajuato mining district, is installing additional machinery at its hydro-electric plant at El Duero, increasing the capacity from 10,000 to 20,000 horsepower. The company is supplying current to the cities of Leon, Irapuato, Guanajuato and La Barca as well as to the mining camps throughout the district. Practically all of the 10,0000 additional horsepower has been contracted for. The cheap power is causing wonderful activity in mining operations.

Luis Gomez Daza and Joaquin Pita will install an electric power plant in the Zacatlan district. They have obtained a concession from the federal government for the purpose.

Gustave A. Lilliendahl has obtained a government concession to install a large electric power plant in Santiago, state of Nuevo Leon. The water of the San Juan River will be used to generate the electrical energy.

The new power house of the Hydro-electric Company at Queretaro is completed and the machinery is being installed. The plant will probably be ready for inauguration in January. The old electric-light plant at San Antonio which has been supplying the city with light is worn out and has been shut down.

Juan D. Alegria and Manuel Morales will install an electric power plant on the Sabinas River, near Sabinas Hidalgo. Power will be furnished factories which they own.

Thomas Young, who is said to represent Boston capitalists, has been quietly investigating the situation at Monterey with the view of installing an electric-light and power plant there.

The rebuilding of the consolidated street-railway system of Monterey and its conversion into electric transit lines by MacKenzie & Mann of Toronto, Canada, the new owners, is now in progress. The new owners are also preparing to construct complete and modern systems of waterworks and sewers in Monterey. Dr. F. S. Pearson is chief engineer in the public works.
H.

Ohio.

Cleveland, November 13.—The re-election of Tom L. Johnson as mayor of Cleveland, according to statements published from him, insures the continuance of three-cent fares in this city. The mayor has made low fares the issue for the third time, and now feels that he should keep it up. He also advocates municipal ownership. The people of Cleveland, however, seem to think more of good street-railway service than they do of either a lower fare or municipal ownership. Mr. Johnson says that he will demand of the Legislature that the law preventing the city from establishing three-cent fares without the danger of injunction be repealed. He will also ask the Legislature for authority to make competitive grants to street-railway companies, and that a law be enacted requiring the approval of the people of all grants, including those companies that agree to operate on a three-cent basis. With his home-rule ideas, he would also take the railroads under control.

The Superior Court at Cincinnati has held that the traction companies whose cars enter the city over the lines of the Cincinnati Traction Company must issue transfers to and honor those from connecting city lines.

President Horace E. Andrews of the Cleveland Electric Railway Company has submitted figures to the Board of Public Service, showing that on an average of 42,367 transfers are collected at the Public Square daily. This is 13.6 per cent. of the number of persons carried daily. Along Wilson Avenue 34,126 transfers are collected, and 24,726 at other points. The board desired this information before taking action on the recommendation of the Chamber of Commerce that certain changes be made to facilitate travel, rather than build underground roads. President Andrews seems to favor a subway in the business part of the city as the only way to solve the problem.

The Cincinnati, Milford and Loveland Traction Company has added $650,000 preferred stock to its $1,000,000 capital stock to take up a bond issue of the same amount.

Frank S. Monnett, former attorney-general, has announced that he will ask the next Legislature to revoke all the perpetual franchises granted between 1861 and 1878. In the latter year the law limiting the life of franchises to 25 years was passed. Some time ago a case to oust a company from a perpetual franchise was filed and taken through to the Supreme Court, where it was decided that the authority to revoke a franchise was with the Legislature and not with the courts.

Fire destroyed the power house and car barns of the Fremont Street Railway Company at Fremont a few days ago. Several cars were also damaged. The fire is said to have started from an explosion. The loss is about $7,500.

The people of Cleveland voted in favor of giving the Bradley Electric Light and Power Company a franchise to furnish light, heat and power in Cleveland, in competition with the Cleveland Electric Illuminating Company. Whether the council will complete the grant to Mr. Bradley or not depends upon the attitude of the Legislature toward a home-rule law for Cleveland.

The United Electric Tool Company of Cincinnati has been incorporated with a capital stock of $25,000 to manufacture electric tools. It will take over a business that was established in that city almost a year ago. William A. McAllam, D. J. Hauss, J. A. Smith and others are the incorporators.
O. M. C.

Indiana.

Indianapolis, November 13.—Farmers of Jackson Township, Tippecanoe County, have contributed amounts of $200 and more to a fund to assist the projectors of the Fountain-Warren Traction Company's extension from Danville, Ill., to Lafayette, Ind., in the purchase of a right-of-way. The line would pass through Odell and the people of that town are eager for its coming.

Mayor William A. Odum of Peru has signed the franchise permitting the Winona Interurban Company to enter the city. The franchise now is just about as the interurban company desired.

The company which is proposing to build an interurban railway from Fort Wayne to South Bend has taken offices in the Elektron Building, Fort Wayne, where C. F. Knowlton of Indianapolis and Samuel T. Roberts of Muncie, two of the principal stockholders, will be found. The announcement is made that the company has let the contract for the construction of the road, which will be 80 miles long, over a well-populated district.

The Model Gas-engine Works of Auburn, Ind., has been awarded a contract for furnishing the government engines for the Panama Canal. Other shipments are being made to New Mexico. It has become necessary to enlarge the plant, and R. A. Edwards and R. H. Bouslog of Peru, this state, who have become interested in the concern with Messrs. John W. White and Fisher Bros. of Fort Wayne, have accepted a bonus of $20,000 and will move the plant to Peru. A new factory building is being erected there and the entire business of the company will be transferred to Peru by March 1st.

The Indiana Union Traction Company began last week to build a $150,000 terminal station at Muncie. The foundation is being put in for a six-story building complete in all the modern appointments.

A special car has been run from Terre Haute to Farmersburg over the Sullivan interurban line, now building by the Terre Haute Traction Company. The distance is about 16 miles and cars will be running regularly in two weeks.

The Louisville and Indianapolis Traction Company, proposing to build from Jeffersonville to Seymour, has obtained franchises in Clark and Scott counties.

The report is again circulated that the Pennsylvania lines will put on either electric or gasoline motor cars to compete with the interurban lines between Columbus and Indianapolis and Columbus and Cambridge City.
S. S.

Michigan.

Detroit, November 11.—The Commonwealth Power Company of Kalamazoo will complete its Ceresco dam about December 15th. Next to the company's dam at Allegan this will be the largest in the state. The power derived from it will be used to run several electric roads in that section of the state as well as furnish power for near-by cities and villages. The dam will cost about $150,000.

J. P. Clarke, manager of the Detroit, Ypsilanti, Ann Arbor and Jackson electric line, is president of a company just formed for the manufacture of a flexible mesh rail bond. The factory will be located at Ypsilanti.

It is stated by one in authority that work on the new electric railway between Detroit and Jackson will commence in 10 days. This road will parallel the Hawks-Angus line and will ultimately become a part of the Kalamazoo and Jackson electric railway. The roadbed of the new line is constructed as far as Dexter, east of Jackson.

Contracts have been let for the construction of the Grand Rapids and Ionia, Grand Rapids, Belding and Greenville, Ionia and Owasso, and Owasso and Pontiac electric railways. Work of grading on these four lines will be begin at once and continue all winter. Saranac will be headquarters for construction work.

A contract has been awarded for a sub-station in Muskegon by the Grand Rapids-Muskegon Water-power Electric Company. The building is to be completed January 1st.

Chief Engineer Hubbel of the Manistee and Northeastern Railway Company, has located a site on the Manistee River for the location of a power plant for the Manistee River Power Company one mile northeast of the village of Sherman. The bed of the river at this point has bluffs on either side 50 feet in height. The dam will be 50 feet high and 200 feet long. William Douglas of Manistee is president of the power company. It is the plan of the company to furnish electrical power to the near-by villages as well as Traverse City, Cadillac and Manistee.
C. G. W.

Northwestern States.

Minneapolis, November 11.—The Sioux Falls Interurban Electric Railway Company has filed a plat of its proposed line from Sioux Falls, S. D., to cross certain state lands near Sioux Falls, and asks for the right of purchase to about 15 acres of the tract for railway purposes.

The council of Waseca, Minn., has voted in favor of substituting incandescent lights for arcs for street lighting.

The Carroll Lighting and Heating plant at Carroll, Iowa, has been placed in the hands of a receiver.

It is stated that the Chicago, Rock Island and Pacific Railway Company plans the organization of a subsidiary company to take over under a lease the present railroad from Des Moines, Iowa, to Indianola and to operate it as an electric or steam interurban.

The council at Belle Plaine, Minn., has decided to grant a 20-year franchise for an electric-light system and will receive bids until November 27th.

The Electric Light and Power Company of Leeds, N. D., has secured a site for a plant and the construction work will be started immediately.
R.

Pacific Slope.

San Francisco, November 10.—The Redwood Manufacturers' Company has closed a contract with the National Electric Company for a 250-kilowatt three-phase generator, which is to be belted to a Hamilton-Corliss engine at the power house of the company's plant at Black Diamond, Cal.

The Parkside Realty Company will apply to the supervisors for a new street railway to be built near Golden Gate Park, San Francisco, so as to tap a big tract of land which it has just opened as a residence district. Back of the venture are Charles E. Green, W. P. Cope and Joseph O'Brien.

The Ocean Shore Railway Company is showing great activity, having men at work along its entire route from San Francisco to Santa Cruz. Including the feeders within the city the double-track line will be 88 miles in length, making 176 miles of trackage. A large contract for cars has been placed in San Francisco. The power plant and substation machinery has been ordered and will be delivered at Halfmoon Bay next spring. Construction trains are being operated over six miles of track at the Santa Cruz end and also at Ocean View, the base, a few miles south of San Francisco.

A party has started the survey between Gallup and Clifton, N. M., for the proposed power-transmission line from Gibson to Clifton, and current will be transmitted to the mines and reduction works at Clifton and Metcalf.

The San Jose Railroad Company's entire plant, including power house, car barns and every car owned by the company, was burned to the ground early in the morning of November 9th. The company's main line was operated on First Street and there were a number of branches, making the system the largest in the city. The property was owned by the German Savings and Loan Association of San Francisco, and the fire damage is estimated at $136,000. The insurance is about $75,000. The belief is prevalent that the fire was of incendiary origin, as there was a heavy explosion shortly after the fire started. New cars will be purchased and the car barns rebuilt.

A. G. Wishon of Fresno, Cal., who has been inspecting the electric-power construction of the San Joaquin Electric Power Company in Crane Valley, reports the work on the big projects is progressing rapidly. In less than 20 days the reservoir for plant No. 3 will be completed, in about the same time the power house will be built, and in 10 days all the trestles and steel frames on the new flume will have been completed. When this plant is in operation it will give 3,500 horsepower additional. As soon as No. 3 is completed the crews will be transferred to the Tule River plant, which will have a capacity of 6,000 horsepower. It will take eight or nine months to complete the project.

A complete electric-railway system will be installed at San Pedro, Cal., before the end of this year. The Huntington syndicate has a large force at work on the lines, and it is hoped that some will be in operation by the end of November. Nearly three miles of standard-gauge road is being built and equipped. A.

PERSONAL.

Edmund G. Vaughan, president of the National Bank of Havana, Cuba, has been elected president of the Havana Electric and Gas Company.

Capt. W. M. Talbott, formerly superintendent of the Red Telefonica of Havana, Cuba, has been elected vice-president of the Havana Subway Company.

W. C. Fuchs, the well-known X-ray operator of Chicago, is recovering from severe burns about the hands, sustained in several years' practice of his vocation.

Robert McF. Doble, consulting engineer, of San Francisco, has severed his connection with the Abner Doble Company, in order to resume his individual practice.

Leonard Eastman of Marinette, Wis., who has been touring Europe since last summer, has secured an appointment as special agent by Consul-general Chester at Budapest, Hungary. His duty will be to report to the government upon the progress made in electricity.

John H. Raymond of the Chicago office of the Fort Wayne Electric Works was married in Chicago on November 1st to Miss Kathryne O'Donnell. Mr. and Mrs. Raymond are now at home to their friends at 4331 Vincennes Avenue, Chicago. Mr. Raymond is an esteemed member of the electrical fraternity and will receive hearty congratulations.

Friends of George S. Searing of Chicago—and they are many—general western representative of the Hart & Hegeman Manufacturing Company, Hartford, Conn., and the Star Porcelain Company, Trenton, N. J., will learn with pleased interest of his recent marriage to Miss Sara Bostwick Hall of Chicago, which took place at the home of the bride's sister, Mrs. W. S. Russell, of Wallingford, Conn., on October 31st. Elaborate preparations were made for the wedding, which was held at four o'clock, and the house was decorated beautifully for the occasion. Mr. and Mrs. Searing will be at home after January 1st at 1319 Lawrence Avenue, Chicago. They will be heartily welcomed.

C. E. A. Carr, until recently manager of the London (Ontario) Street Railway Company, has accepted the position of general manager of the street-railway system in Helena, Mont.

Norman Malcom, formerly of the engineering department of the Chicago Telephone Company, is in Havana in connection with the new electrical subway system of the Havana Subway Company. He is one of the engineers on the staff of George M. Painter, the contractor, of Chicago and New York, who is installing the system.

Bernard E. Sunny has been appointed by Governor Deneen one of the members of the forthcoming Chicago charter convention. Mr. Sunny is, of course, one of the most prominent of the electrical men of Chicago, and his appointment is a deserved recognition of his public spirit and activity in civic affairs as well as of the industry he represents.

Joseph L. Friedman of Paducah, Ky., has been chosen president of the Paducah Traction Company and the Paducah Light and Power Company. These two companies were incorporated following the recent merger of the light and traction interests in Paducah, brought about by the sale of the street-railway, gas and heating properties to Stone & Webster.

ELECTRIC LIGHTING.

The Pikeville (Ky.) Electric Light Company has been incorporated with a capital stock of $50,000.

Springdale, Ark., has granted a franchise for an electric-light plant to Spencer Owen of Belgrade, Neb.

The American Electric Light Company has secured a contract for five years to light the town of Oakdale, Ky.

The Chickasha Light, Heat and Power Company of Lincoln, Neb., has been incorporated with a capital stock of $125,000.

The Common Council of Grand Rapids, Mich., has been given authority to purchase a new electric elevator for the City Hall.

W. W. Whipple has secured a franchise to construct an electric-light and gas plant and telephone system in Astoria, Oregon.

With headquarters at Doublin, Texas, the Doublin Gas and Electric Company has been incorporated with a capital stock of $50,000.

The Texas-Mexican Electric Light and Power Company of Eagle Pass, Texas, has increased its capital stock from $40,000 to $80,000.

The council of Rockvale, Colo., has granted the Arkansas Valley Electric Light Company a franchise to construct and operate an electric-light plant.

John W. Howell, Joseph G. Branch and others of St. Louis, Mo., have applied for a franchise to construct and operate an electric-light plant in Fort Smith, Ark.

The Pike County Light and Power Company of Bowling Green, Mo., has been incorporated with a capital stock of $7,000. Noah H. Ledford is among the incorporators.

Gleaves & Co. of Lynchburg, Va., propose to construct and own waterworks and an electric-light plant at Williamsburg, Ky., to cost about $45,000. J. A. Gilman is the engineer.

A charter has been granted at Muskogee, I. T., to the Fort Gibson Light and Traction Company, incorporated with a capital of $25,000. J. H. Nakdimo of Fort Gibson is president.

A waterworks and electric-light plant will be constructed at North Little Rock, Ark. C. J. Humphreys, 104 East Fourth Street, a member of the Waterworks Commission, has charge.

W. P. Bullock is engineer in charge of the construction of an electric-light and gas plant for J. B. Dickinson at Davis, I. T. Mr. Dickinson has a 20-year franchise for furnishing electric lights and gas.

The contract for public lighting at Newport, Ky., will expire within a short time, and the City Council is considering the matter of renewal. The Union Heat and Light Company has had the contract for some years.

Whitesboro, Texas, has granted a franchise to M. P. Kelly of Gainesville, Texas, for the installation of a waterworks system. As soon as the installation is completed, Mr. Kelly will begin the construction of an electric-light plant and sewerage system.

An eastern syndicate is reported as contemplating the consolidation of the La Crosse (Wis.) City Railway Company, the La Crosse Gas and Electric Company, the Wisconsin Light and Power Company and the proposed La Crosse and Black River Falls electric railway. It is proposed, it is said, to transmit the necessary electric power from a large water plant near Black River Falls on Black River.

The City Council of Melbourne, Australia, has sanctioned the expenditure of £69,000 for the immediate extension of the electric-light plant. Further works are to be undertaken which will bring the total outlay up to £72,400.

Sealed bids will be received at the county clerk's office in Galesburg Ill., until November 20th for the complete installing of an electric-light plant and all necessary wiring in connection therewith for the lighting of the Knox Couty Courthouse and jail in the city of Galesburg.

The Roberts & Abbott Company of Cleveland, Ohio, has been engaged as supervising engineer for the Streator Gas and Light Company and the People's Light and Railway Company of Streator, Ill. As the two properties have been combined, the power plants will be merged in such a manner as to effect a large saving.

A Pittsburg broker states that the Philadelphia Company of Pittsburg has passed into the control of the United Gas Improvement Company of Philadelphia, which purchased the control from Brown Brothers, bankers of Baltimore. The Philadelphia Company has lighting and street-railroad franchises in Allegheny County.

ELECTRIC RAILWAYS

The Gas Belt Interurban Railway Company has been granted a franchise in Paola, Kan.

Citizens of Carthage, Mo., have pledged $200,000 toward building an electric railway from Carthage to Purcell, a distance of 10 miles.

A company has been incorporated for the purpose of building an electric railway connecting Fairmont and Morgantown, W. Va., and another between Fairmont and Fairview.

The General Service and Development Company of St. Louis, which controls most of the electric-light plants of St. Louis County, Missouri, outside of St. Louis, contemplates building a suburban electric railway.

It is reported that Thomas Nevins & Son of New York and Denison, Pryor & Co. of Cleveland are to build the proposed electric railway from Kansas City to St. Joseph, Mo., with branches to other points.

An effort to provide better theater service on its lines is to be made by the Chicago City Railway Company. The closing hours of the various performances will be ascertained each week, and plenty of cars will be gathered in the downtown loop to conform with the closing time of the various playhouses.

The Brooklyn Heights Railway Company has recently placed an order for a substantial addition to its present equipment, consisting of 300 Westinghouse direct-current railway motors and 150 sets of controllers. The order for motors is in addition to one placed some months ago for 600 motors of the same type.

According to the report of the Mexico Electric Tramways of the City of Mexico for last year, there is considerable work yet to be done in the matter of improvements, extensions and converting existing mule lines into electric transit. The net profits of the company were £53,900, as compared with £35,500 for the preceding year.

A plan to electrify its suburban system is being given serious consideration by the Chicago and Northwestern railroad, it is said. The Aurora, Elgin and Chicago electric road has built up an extensive patronage in the territory, and if the Northwestern changes its motive power it will be with the view of heading off further loss of business to the third-rail line.

Cornell students have been cleared of the suspicion of being the ones who greased the track of the Ithaca Street Railway Company on a curve, as mentioned in the Western Electrician last week. Nine boys about 15 years old confessed having done the act. They said they soaped the tracks to see the cars have difficulty in getting around the curve while going up hill, and did not think of what might have happened to a car coming down.

It is reported in the Elgin (Ill.) News that the Illinois Central railroad has recently made arrangements with the Aurora, Elgin and Chicago Electric Railway Company for handling its freight to and from the watch factory in Elgin. A spur has been built from the third-rail line into the factory yards. This gives the Illinois Central an inlet into Elgin, and it is said that freight is transferred with considerable dispatch.

The annual report of the Chicago and Oak Park Elevated Railroad Company to the Railroad and Warehouse Commission covering the year ended June 30th shows gross earnings of $842,944. This is an increase of $22,986, but there was a gain of $27,498 in operating expenses, which reduced the net earnings to a decrease of $9,486 compared with the previous year. The increase in operating expenses was due mainly to the increase in general expenses, due to the settling of

long-standing and current personal-injury suits. Including added interest on notes given the Chicago and Oak Park Railway Company on account of reorganization the deficit for the year from direct operation of the road was $58,125, compared with $87,447.

Good progress has been made on the work of the Washington, Baltimore and Annapolis electric railway. The grade has been widened for a double track, many of the culverts have been put in and other portions have been graded. The Baltimore Terminal Company has been organized with a capital stock of $1,200,000 for the purpose of building the terminals and giving an entrance to Baltimore. The railway interests also own the stock of this company.

Directors of the Lake Shore Electric Railway Company of Cleveland have given instruction to the officers to secure estimates on 10 new cars and one additional unit for the power house at Beach Park. The new equipment is desired by next March. E. G. Tillotson has resigned from the directory and W. H. Price was chosen to fill his place. It is now stated that Warren S. Bicknell will retire as president of the company the first of the year, in order to take the management of the Cleveland Construction Company, which now has a number of contracts that require attention

Steel rails can be bought in Spain and laid down in the United States, according to the New York Times, at a less cost than the prevailing quotations at United States mills. Cable advices were received in New York last week from Bilbao to the effect that 21,000 tons of rails had been ordered from the Altes Hernes de Viscaya mills for use in the construction of a California railroad. The contract price for the rails delivered to the Pacific Coast, including $4 a ton import duty, says the Times, is around $27 a ton. The existing price for American rails is $28. This is said to be the first contract for steel rails that has ever been placed in Spain for American use.

Current for the operation of the electrical zone of the New York and Hudson River railroad is to be generated by two power stations, one at Yonkers and one at Port Morris, N. Y. Thirty thousand kilowatts will be generated in each plant and work is now progressing on the two power houses. The generators are to have a capacity of 5,000 kilowatts each, with three-phase windings for 25-cycle 11,000-volt operation. The generators will be driven by steam turbines of the Curtis five-stage vertical type. Switch houses will be provided separate from each of the stations and all high-tension connections and apparatus will be located in the basement of the switch house.

POWER TRANSMISSION.

The Black Hills Traction Company of Spearfish, S. D., is building a canal 5½ miles long, which will have a fall of 103 feet, and furnish from 1,000 to 1,200 horsepower. The dam to receive this water is almost completed. An electric-light and power plant will be built to furnish power for mining companies and also for the trolley line which the Black Hills Traction Company intends to build from Spearfish to Deadwood and afterward to extend to various other points in the Black Hills.

The development of a large hydro-electric plant is being undertaken in Davidson County, N. C., five miles from Salisbury. D. Hartley of Yadkin College, J. H. Swicegood of Tyro Shops and Prof. J. M. Bandy of Greensboro are among those who head the movement. The plan is to dig a canal 11 miles in length from a point on the Yadkin River at Yadkin College to a suitable location near Linwood, through which the current of the Yadkin River will be turned. The canal is to be 80 feet wide at the base and will average about 15 feet feet in depth. It is estimated by the engineers that not less than 30,000 to 35,000 horsepower will be available at one point when the canal shall have been completed.

TELEGRAPH.

A night clerk for the Western Union Telegraph Company at Norfolk, Va., is said to have been dismissed because he refused to accept an unpaid message from President Roosevelt to his wife at Washington. The message was received by space telegraphy at the Norfolk navy yard from the cruiser West Virginia, while the president was at sea after his southern tour. The clerk refused to accept it, saying that he knew the president was not at the navy yard, and that it was against the rules of he company to accept unpaid messages.

PUBLICATIONS.

An entirely new line of small and medium-sized motors and generators is now manufactured by the Sterling Electric Motor Company of Dayton, Ohio. This line of machines is described effectively in a new bulletin which is now being distributed.

The first bulletin of the Lincoln Electric Manufacturing Company of Cleveland, Ohio, has just come to hand. It describes the Lincoln variable-speed motor having a speed range of 5 to 1 and a constant horsepower output at all speeds. The motor is especially adapted to lathe drive and no controller is used.

A large and complete catalogue devoted to electrical supplies has been issued by the George R. Worthington Company of Cleveland, Ohio. There are 182 pages, 8½ by 11 inches. Electrical supplies and fixtures of all kinds are illustrated and briefly described, with the prices of each given. This catalogue is very creditable to the company issuing it.

A small folder from the F. Bissell Company of Toledo, Ohio, is descriptive of the two-balls adjuster which places the light just where required, and even when centrally located can take the place of bracket lights. The adjuster is useful in factories and offices, or wherever electricity is used in lighting, or nicety in location is beneficial, desirable or necessary.

Sampling plants and equipment are described in a new catalogue from the Allis-Chalmers Company of Milwaukee, Wis. The large variety of machinery and appliances necessary in works of this kind is thoroughly described and profusely illustrated in the catalogue. Some other literature which is being sent out treats of portable rock-crushing plants, Bennett's pouring spoon and forged steel balls for ball mills.

Now that winter is coming on and water pipes will again persist in freezing up, it is time to get the electrical apparatus in shape to combat the work of Jack Frost. Recognizing this fact, the Pittsburg Transformer Company of Pittsburg, Pa., has prepared a little booklet showing the practicability of its thawer outfit. The booklet contains principally a number of enthusiastic testimonials from customers who are using the outfit to advantage.

A carefully prepared bulletin from the Crocker-Wheeler Company of Ampere, N. J., illustrates and describes the company's belt-type direct-current machines for general power purposes and small lighting plants. This line of machines includes a large number of sizes and ratings from 10 to 275 horsepower in the motors and nine to 225 kilowatts in the generators. In many cases these machines may be used for direct connection by means of couplings.

The Hutchison Acoustic Company of New York has issued a pleasing booklet describing the acousticon and massacon. Of these two instruments, the former is a modification of the telephone to amplify articulate sounds to enable the partially deaf to hear, while the latter is a device to apply "phonetic massage" to the ear in the hope of curing or relieving deafness. The company has an office at 1422 Masonic Temple, Chicago. Mrs. C. S. Saxton is manager.

Alternating-current generators for attachment to waterwheels are manufactured extensively by the National Electric Company of Milwaukee, and by studying bulletin No. 360, issued by the company, a good knowledge of this line of machine may be obtained. The alternators are of the revolving-field type, the armature being easily accessible. The company is also mailing a card which illustrates one of the two National machines built for the Wausau Electric Company of Wausau, Wis. It is of 350-kilowatt capacity and of the waterwheel type.

The Stanley-G. I. Electric Manufacturing Company of Pittsfield, Mass., has issued new bulletins on arc lamps of the 100 to 125-volt multiple direct-current type, and watch-case volt and ammeters. It is also calling attention through a mailing card to Wright indicators, and it says that one lighting company recently made the statement that it had over 35,000 of these instruments on customers' installations. These customers pay a given rate per kilowatt-hour for a certain number of hours' use of their maximum demand (maximum load at any one time) per month, and the balance they get at a low rate. This brings the station good customers.

The Live Wire is a bright, well-illustrated monthly paper published in the interest of the Wesco Supply Company of St. Louis. In its October issue it publishes an appreciative sketch of Mr. Nelson J. Roth, a traveling salesman for the Wesco company. Mr. Roth boasts of weighing 280 pounds, and thereupon The Live Wire tells this story: "An old dealer in a small city in Roth's bailiwick was wakened by the earthquake last summer, and, jumping from his bed, began a wild scramble for pen and ink. His wife became alarmed and tried to learn the trouble. All the reply she could get was, 'Roth, Roth's coming; I've got to make out an order for Roth.' She concluded he was crazy and could not be convinced to the contrary until he made a full explanation and confirmed it by presenting Roth on his next call."

The American Wire Rope News for November, published by the American Steel and Wire Company of Chicago, is entertaining and instructive even to the general reader who is not particularly interested in wire rope and its applications, although of course the use of wire rope is the thing brought out most pointedly in each article. Wire rope is an important element in the "skyscraper." Without wire rope the elevator could not well be operated to great heights, and without the elevator the very tall building would be impracticable. Included in the pages of the publication are numerous illustrations of some of the finest office buildings in Chicago and elsewhere. An interesting description is also given of the highest passenger-elevator hoist in America, the one in the Washington Monument, together with much data of interest concerning the monument. Altogether the Wire Rope News makes interesting as well as valuable reading.

SOCIETIES AND SCHOOLS.

E. P. Burch, consulting electrical engineer, is giving a course of four lectures on "Heavy Electric Railroad Work" before the senior engineers at the University of Minnesota. These lectures, which supplement the regular classroom course in electric railways, are based upon the investigations made by Mr. Burch for some of the western railway companies which are investigating the feasibility and desirability of electric traction upon certain divisions on their main lines.

The proposed Technical High School, which will soon form a part of the public school system of Newark, N. J., will be built to resemble a large workshop, where the pupils will have a chance to get a practical knowledge of all branches of mechanics. There will also be a commercial course. The plans for the new structure will call for machinery and foundry plants, carpenter and joiner departments, plumbing, gasfitting and heating shops and other mechanical departments, including electricity.

President Blood has appointed T. C. Martin as editor of Progress, to report to the twenty-ninth convention of the National Electric Light Association next year. Mr. Martin has for the last three years made to the association very comprehensive reports on the progress made during each year in the various branches of the art in this country and abroad, and these reports have proved very valuable for reference purposes, as they contain data on many subjects of vital interest to central stations.

The electrical exhibition to be held in Russia next year will be in Kew and will last three months. It will be placed under the patronage of the Association of Engineers of Russia and of the Municipal Council of Kew. Twelve sections will be included as follows: (1) Boilers and other apparatus for the production of steam; (2) dynamos, alternators and other generators; (3) electrical machines; (4) electro-chemistry and electro-metallurgy; (5) electric lighting; (6) transmission of motive power; (7) telegraphs, telephones and railway signals; (8) apparatus for measuring electric power; (9) electricity for medical purposes; (10) miscellaneous applications of electricity; (11) technical education. Foreign goods will be exempted from the payment of duty, and exhibits not sold within three months after the closing of the exhibition will be, in case of their return to the country of origin, transported free on Russian railways.

MISCELLANEOUS.

A laboratory is being equipped by the Department of Agriculture in Washington for the purpose of conducting experiments in the growth of plants by the aid of electricity.

W. L. Haag of Haag Bros. is seeking a franchise to furnish power and heat within the city of Lansing, Mich. The firm generates electricity at its mill at the head of the North Lansing mill race.

The factory building of Withington & Cooley at Jackson, Mich., which was destroyed by fire, has been rebuilt, and nine electric motors will replace the 350-horsepower engine which formerly furnished the power.

A German newspaper says that the new main railroad station at Leipsic now being constructed will be the largest in the world in covered space, the area being 920,518 square feet. It will have 26 tracks. The first place is now occupied by the St. Louis Union Station (32 tracks); next come the South Station in Boston (28 tracks), the St. Lazare at Paris, then the stations at Frankfort-on-Main, Dresden, Boston (North), Cologne and Munich. The Union Station now being built in Washington will have 33 tracks, but there will be no train shed, umbrella sheds over the platforms being used instead.

Achievements in few other lines of activity are equal to the advance made by railroads in luxurious fittings and conveniences for comfort and safety on the fast trains of today. Proof of this may be found in the new equipment that has just been received from the Pullman shops for the Northwestern Limited, the Chicago and Northwestern Railway Company's fast train to St. Paul and Minneapolis, which includes a number of features that are new to the traveling public. The electric-lighting arrangements are especially good, and they are only one feature. In the buffet-smoking and library car beautiful lamps shed a softened flood of light through delicately tinted art glass. In the sleeping car each berth, compartment and drawing room is equipped with individual reading lamps, and in the chair cars and day coaches spe-

cial attention has been given to the subject of lighting, with a row of incandescent lamps on either side of the car, in addition to the usual center lights. The interior decorations of the entire train are in green and gold, with olive-green plush upholstery and rich panelings of vermilion mahogany. This color effect is particularly attractive in the dining cars, where electric candelabra furnish the light.

In an address before the Lincoln Center Club of Chicago Franklin MacVeagh, one of Chicago's most successful business men, presented in an able manner a strong plea against the municipal ownership of street railways. He said that "the only feasible solution of the traction problem is that of the intelligent control by the city of the private street-railway systems."

Gates across Kingsway, the great London thoroughfare recently officially opened by the king and queen, are operated by electricity, and the king himself put in operation the motor-control apparatus which swing the gates. A pair of simple motor winches were used, and controlled by solenoid switches and rheostats placed in a pavilion. As soon as the king turned the key in the golden ball before him the magnet switches brought the motors up to speed, and the gates were drawn across the road by steel ropes wound on the winches. The gates, at the extreme limit of their movement, closed a relay circuit which shut the current off from the motors.

Concrete is an excellent material for the construction of power houses, and a typical example of such construction is presented by the new power house of the Baltimore Electric Company. This plant covers an area 72 by 180 feet, and is considered absolutely fireproof. Instead of the ordinary steel rods for re-inforcing, an electrically welded fabric is used for the floor slabs between the I-beams, so that the re-inforcement is made continuous the whole width of the building. The thickness of each slab is but six inches. Water is supplied to the condenser bay through five-foot concrete conduits a distance of 600 feet. The entire circumference of the conduits is reinforced by a continuous steel fabric.

TRADE NEWS.

The Northern Electrical Company is about to open an electrical supply establishment at 327 Hennepin Avenue, Minneapolis.

No. 10 Thacher Street, Boston, is the new address of the Couch & Seeley Company. The offices are located in the Vermont Building, which bears this number.

The Chicago Compound Battery Company has been incorporated by B. J. Blameuser, N. Kribs and W. J. Bauerle. The capital is $10,000, and the company intends to manufacture electric batteries.

The Hatch Accumulator Company of 60 State Street Boston, announces that it has been reorganized and will push its products more energetically than ever in all fields of storage-battery work. George E. Hatch is the president and George F. Dinsmore the treasurer.

Sealed proposals will be received at the depot quartermaster's office, 39 Whitehall Street, New York, until November 20th for furnishing and delivering, f. o. b. factory, 55,000 incandescent electric lamps, more or less. Specifications, blanks for proposals and full information will be furnished upon application to the office of G. S. Bingham, major and quartermaster, U. S. A.

The United States civil-service commissioners announce for November 22d, at Brooklyn, an examination for the appointment of six electrical assistants in the Signal Service at a salary of $75 a month. On November 29th there will be an examination at the same place for an electrical inspector for the quartermaster's department at $1,500 per annum. On the same day also there will be an examination for a telegraph operator for the naval station at Port Royal, S. C., at $2 a day.

A test was made last week of the new single-phase self-starting alternating-current motor, perfected by J. J. Wood of the Fort Wayne Electric Works. The test was satisfactory in every respect and the new motor will soon be placed upon the market. The new motor has many merits. It is made in sizes varying from one to 10 horsepower and specially adapted for establishments which do not need large power units. One of these merits is that it does not require an experienced person to start or stop it.

BUSINESS.

Switch bases made by Pass & Seymour of Solvay, N. Y., carry the assurance of their makers that they are built in compliance with Code rules and of material that is the best. They can be used in concealed, open and molding work, and will fit any standard-make single or double-pole five or 10-ampere snap switch.

The William J. Oliver Manufacturing Company of Knoxville, Tenn., has decided to establish a plant for the building of electric cars, and the contract for erecting the necessary buildings is about to be let. It is expected that from $100,000 to $150,000 will be invested in the plant. Complete cars will be produced.

Copley-Senior carbon brushes, manufactured by the Copley-Senior Carbon Company of New York city, are of carbon so made that all parts are uniform, which the company asserts to be a feature original with this brush. The brushes are thoroughly and permanently self-lubricating. George W. Copley of New York is president and general manager of the company, and has had sufficient experience in this line of business to make his name well known in the carbon-brush trade.

The Westinghouse Electric and Manufacturing Company will have a new line of ceiling and floor column fan motors on the market the coming season, both direct and alternating current. These fans will have four blades and ball bearings and be finished in black enamel and oxidized copper. The same company also reports a heavy demand for its alternating-current motors of the CCL type. The favor with which these motors have been received has surpassed the expectations of the company. A large marble plant has recently been equipped, and although the motors have been operating under overloads and under conditions which require the strongest mechanical construction, their operation, it is said, has left nothing to be desired.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) November 7, 1905.

803,539. Block-signal System. Charles E. Bennett, New York, N. Y. Application filed June 10, 1905.

At each end of a block is a signal included in the primary of a separate transformer. Subsections within the block have connections from the transformers whereby the secondary of the transformer for either signal is short-circuited by a train entering the other end of the block.

803,540. Block-signal System. Charles E. Bennett, New York, N. Y. Application filed July 11, 1905.

Connected with a block-signal system is a transformer having a primary adapted to operate home and caution signals, and to simultaneously actuate a telltale signal in a manner opposite to that of the first-named signals by current variations therein. Means are supplied for varying the loads on the transformer.

803,543. Electrolytic Process Using Insoluble Anodes. Anson G. Betts, Troy, N. Y. Application filed February 16, 1905.

Oxidizing an ingredient of a solution substantially free from halogenions is done by electrolyzing the solution with an insoluble anode, at the same time producing relative motions between the anode and solution sufficient to materially facilitate the continuous oxidation of the ingredient by the liberated anions, and to continuously prevent the evolution of oxygen-containing gas at the anode.

803,544. Apparatus for Refining Lead by Electrolysis. Anson G. Betts, Troy, N. Y. Application filed March 18, 1904.

Apparatus for refining metal by electrolysis contains a cathode, an anode and an electrolyte adapted to dissolve metal from the anode and electrodeposit it. A containing vat has its inner surface formed of a metal capable of being dissolved in the electrolyte, and of a potential intermediate that of the cathode and that of the anode.

803,676. Telephony. Francis W. Dunbar, Chicago, Ill. Application filed November 12, 1904.

Each subscriber's station is equipped with two conductors in bridge between the sides of the line, a receiver being subject to current in one conductor. The other conductor including a high-resistance transmitter, and a switch hook serves operatively metallically to connect and disconnect the sides of the telephone line at the subscriber's station and to connect the transmitter with and disconnect it from the telephone line.

803,684. Instrument for Converting Alternating Electric Currents into Continuous Currents. John A. Fleming, London, England, assignor to the Marconi Wireless Telegraph Company of America. Application filed April 19, 1905.

Combined with of a vacuous vessel are two conductors adjacent to but not touching each other in the vessel, with means for heating one of the conductors. A circuit outside the vessel connects the two conductors, and an induction coil has its secondary winding in the circuit and its primary winding connected to an aerial wire and earth. Means for detecting a continuous current in the circuit are provided. (See cut.)

803,686. Fluid-pressure Controller. George W. Furbeck and Albert N. Carver, Chicago, Ill. Application filed March 10, 1900.

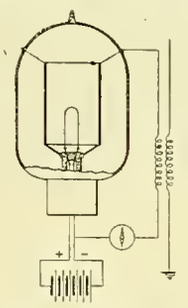
The valve of the controller is operated by an electrical device in circuit with the thermostats of the system.

803,704. Telegraphic Sounder. Frank H. Miller, Washington, D. C. Application filed February 18, 1905.

In combination with the sounding post are contact screws and jam nuts of an ordinary relay and a sounding box fitted over the post. This has notches to receive the contact screws and is clamped in engagement with the post by the jam nuts.

803,795. Electric-heating Device. George E. Stevens, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 15, 1904.

Resistance ribbon is wound edgewise to form the resistance unit, and has successive turns in close mechanical relation to an insulating film. An insulating support forms a permanent part of the unit adapted to be attached to a rheostat or heater frame.



NO 803,684.—ALTERNATING-CURRENT RECTIFIER.

803,797. Watchman's Time Recorder. Jesse Summers, Indianapolis, Ind., assignor to the Indianapolis Watchman Clock Company, Indianapolis, Ind. Application filed November 9, 1903.

Details of an electrically operated clock are described.

803,803. Brush Holder. Norman C. Bassett, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 20, 1902.

The first claim reads as follows: "In a brush holder, the combination with a stationary support, of a brush carrier, resilient arms connecting said carrier with said support, said arms being in a plane substantially at right angles with the axis of the commutator, and an automatic spring feeding device for the brush mounted on the carrier."

803,816. Insulating Material. William L. R. Emmet, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 24, 1900.

An electric insulating material is composed of multiple layers of an absorbent refractory insulating material united by films of vegetable oil, each of the films being baked hard on one of the layers.

803,817. Circuit-breaker. Michael B. Field, Sevenoaks, England, assignor to the General Electric Company, Schenectady, N. Y. Application filed March 17, 1903.

A shunt in parallel to the switch terminals is associated with a pair of diverging conductors, a moveable contact normally bridging their proximate ends. An operating handle is provided for the switch, and a lost-motion connection is between the operating handle and the contact whereby the contact is shifted to form an arc between the conductors after the switch terminals have separated. (See cut on next page.)

803,819. Bracket Arm for Incandescent Electric Lamps. Hiram L. Getz, Marshalltown, Iowa. Application filed May 17, 1904.

The arm is constructed to hold the lamp in a horizontal position, and is provided with means for holding the surplus lamp cord out of the way.

803,825. Trip Coil for Circuit-breakers. John D. Hilliard, Jr., Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 13, 1902.

Means for increasing the calibration range of an automatic switch are specified, which consist of a core carrying the actuating magnetic flux having a section more easily saturated than the rest and an adjusting device for increasing the reluctance of the trip magnet for large current values.

803,827. Railway-switch-stand Contact Box. William J. Hughes, Levis, Canada. Application filed May 5, 1905.

A protecting box for the contacts of electrically operated railway switches is described.

803,832. Motor-operated Switch. Wesley E. Laird, Pittsfield, Mass., assignor to the Stanley Electric Manufacturing Company, Pittsfield, Mass. Application filed February 16, 1904.

A weight is arranged to be raised by the motor and thereby to store up the power delivered by the motor. A switch member has connections with the weight by which a number of operations of the member are obtained by the descent of the weight.

803,834. Control System. Carl W. Larson, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed April 17, 1905.

A motor, a controller comprising a rotable member having lock-controlling and motor-controlling contacts, co-operating contacts so arranged that the lock circuit is closed before the motor circuit, means for normally preventing the controller from closing the motor circuit, and means controlled by the lock for rendering the controller operative to close the motor circuit are the essential features.

803,836. Vapor-electric Apparatus. Alexander D. Lunt, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed May 12, 1904.

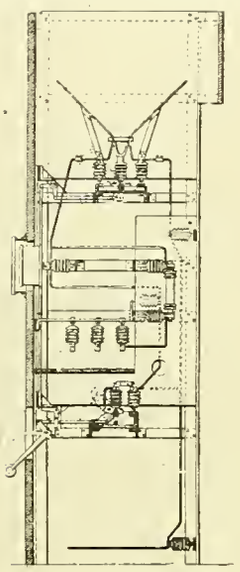
A vapor electric apparatus embodies a container, electrodes therefore, and a filament connecting the electrodes and adapted when the container is moved to break connection with the electrodes dissimultaneously.

803,853. Brush holder. Henry G. Reist, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 26, 1904.

A current-collecting or contact device comprises a number of brush-holder units connected together end to end, each of the units being angularly adjustable with respect to its neighbor.

803,856. Telephone System. William A. Robinson, South Kortright, N. Y. Application filed February 18, 1904.

Combined with the main line and suitable telephones thereon are a secondary line and devices to break the circuit between the main line and the telephones. A lever carries means to complete the circuit between any two of the telephones and the secondary line and simultaneously lock the intervening telephones from connection.



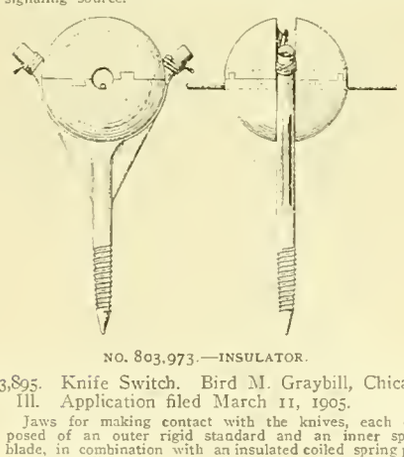
NO. 803,817.—CIRCUIT-BREAKER.

803,872. Signaling on Railways, Tramways, Etc. John Brown, Dunmurry, Ireland. Application filed October 4, 1901.

An indicating device is placed on each car of the train and also one on a car standing at the station which the train is approaching. A main electrical supply conductor and a conductor of high resistance are arranged adjacent to each station and extending in both directions. A series of contact shoes is electrically connected with each of the high-resistance conductors while a return conductor or rail and brushes connect the indicating device on each car with the high-resistance conductors and the main supply conductor.

803,890. Telephone Night-watch System. William Geckler, Rochester, N. Y. Application filed October 17, 1904.

Combined with a telephone line leading from a subscriber's station to a central exchange are signaling apparatus located at the subscriber's station and means to connect the signaling apparatus across the telephone line independently of the subscriber's telephone instrument. A signal-recording device is placed at the central exchange and also a relay controlled by the signaling apparatus and normally energized by current from the line-signaling source.



NO. 803,973.—INSULATOR.

803,895. Knife Switch. Bird M. Graybill, Chicago, Ill. Application filed March 11, 1905.

Jaws for making contact with the knives, each composed of an outer rigid standard and an inner spring blade, in combination with an insulated coiled spring pressing outwardly against the blades of both jaws are the features of novelty.

803,898. Electric Switch. Arthur E. Handy, Providence, R. I., assignor to the Rhode Island Elevator and Machine Company, Providence, R. I. Application filed October 20, 1904.

Provided with main contact strips and a smaller auxiliary contact strip is a cylinder within a casing. Means for rotating the cylinder are supplied, also lugs mounted in the casing in juxtaposition with the strips. Contact fingers are pivotally mounted in the lugs and means automatically disengage the auxiliary contact strip from its contact finger.

803,936. Electric Pump. John C. Stokes, Mansfield, La. Application filed February 28, 1905.

Reciprocatory motion of the solenoids of two electromagnets actuates the piston of the pump.

803,947. Controlling Apparatus for Suspended Ships' Berths and Analogous Devices. Walter Whitehouse, London, England. Application filed August 31, 1904.

An electrically operated brake, which is normally inoperative, upon closing of its circuit acts to hold a swinging berth in a stationary position.

803,973. Insulator. George M. Bemis, Readsboro, Vt. Application filed June 11, 1904.

The insulator is cut in two similar parts which carry between them the conducting wire and which are held together by a binding wire. (See cut.)

803,980. Telephone Holder. Charles H. Borden, Stamford, Conn. Application filed March 1, 1905.

Mechanical features are described.

804,040. Electrically Operated Door-opening System. William T. Platt, St. Louis, Mo. Application filed March 7, 1904.

Electro magnets control the tripping mechanism which normally holds the door in a closed position.

804,045. Electric-welding Clamping Device. Adolph F. Rietzel, Lynn, Mass., assignor to Thomson Electric Welding Company, Lynn, Mass. Application filed November 16, 1903.

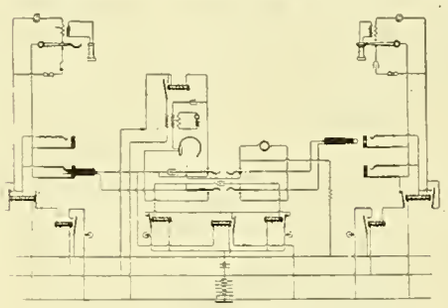
Mechanical features of a clamping device for use in electric welding are the basis of the patent.

804,070. Electrical Fuse Plug. George B. Thomas, Bridgeport, Conn., assignor to the Bryant Electric Company, Bridgeport, Conn. Application filed May 22, 1905.

An insulating casing carries external contact terminals, and a clip piece is secured to the inner end of the casing, adapted to engage a fuse cartridge. Associated with a cap to cover the end of the casing are means therein adapted to remove the fuse from the casing when the cap is removed.

804,077. Telephone-exchange System. Harry G. Webster, Chicago, Ill., assignor to Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. Application filed May 7, 1903.

A cut-off relay has two differential windings permanently included in an electrical path from one of the line limbs to a grounded terminal of the source of current. A line relay is serially included in a path from the second line limb to a second 30-volt terminal of the source of current, a line signal, being controlled by the relay. A line jack having a tip spring permanently connected to the common terminal of the differential windings of the cut-off relay and a sleeve-contact permanently directly connected with the second line limb is provided as are suitable cord devices. (See cut.)



NO. 804,077.—TELEPHONE-EXCHANGE SYSTEM.

804,082. Electric Clock. Leopoldo Agostinelli, Terni, Italy. Application filed July 31, 1903.

Pawl and ratchet mechanism in the escapement of the clock is operated by electromagnets.

804,114. Electrical Rosette. Gilbert W. Goodridge, Bridgeport, Conn., assignor to the Bryant Electric Company, Bridgeport, Conn. Application filed November 21, 1904.

A rosette comprises an insulating base and insulating cap, the latter having a central passage for the wires and on opposite sides of the passage coinciding vertical recesses in the cap and base, with clips in the recesses in both cap and base to receive cartridge fuses in a vertical position.

804,115. Electrical Insulator. Gilbert W. Goodridge, Bridgeport, Conn. Application filed May 5, 1905.

An insulator-post, has a circumferential spiral groove to receive and hold the conductor wire, the post being of angular cross section at the groove, which is of varying depth between all the angles.

804,126. Railway Switching and Signaling Apparatus. Winthrop K. Howe, Buffalo, N. Y., assignor to the Taylor Signal Company, Buffalo, N. Y. Application filed March 28, 1904.

A feature of the system is an electromagnetic cut-out for cutting off the battery in the event of a cross between any active wire and any wire leading to the opposite pole of the battery. There is also an auxiliary circuit-breaker relay for cutting off the battery at a second point, a conductor being common to all switch-motor circuits, a conductor common to all signal-motor circuits, a conductor connecting the coil of the circuit-breaker relay with the switch common, a conductor connecting the coil with the signal common, and a resistance coil in each of the conductors leading from the coil to the common conductors.

804,133. Electrical Binding Screw. William Kaisling, Chicago, Ill., assignor to the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. Application filed May 22, 1903.

Details are described.

804,156. System of Electric-motor Control. Charles A. Mudge, New York, N. Y. Application filed March 2, 1905.

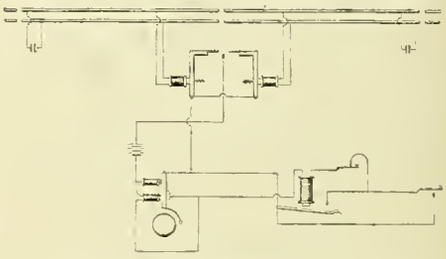
A main controller, one or more motors, a master-controller, and a main operating device having hydraulic and electric means for governing its operation through successive steps so that it is held in the steps indicated at the master controller are the patentable features of the device.

804,176. System of Automatic Signaling for Electric Railways. Fitzhugh Townsend, New York, N. Y., assignor to the General Railway Signal Company. Application filed August 1, 1905.

A transformer fed from a source of alternating current has its secondary connected across the rails, a second transformer having its primary connected across the rails. A relay having one member connected across the secondary of the second transformer has its other member across the source of signaling current.

804,180. Self-restoring Signal-controlling Device. Eugene W. Vogel, Chicago, Ill., assignor to the Railroad Supply Company. Application filed July 23, 1901.

Electromagnet mechanism and a make-and-break device are included in a circuit with means for automatically closing the circuit when a train occupies a predetermined section of track. Other means shunt the make-and-break device to effect an uninterrupted energization of the magnet and thereby discontinue the signal. (See cut.)



NO. 804,180.—SELF-RESTORING SIGNAL-CONTROLLING DEVICE.

804,182. Metallic Circuit for Operating Signaling Devices. Albert K. Andriano and Hermann Herbstritt, San Francisco, Cal. Application filed March 6, 1905.

Direct conductors and return-conductors are arranged to form metallic circuits between stations, a direct-line switch and a return-line switch at each station connecting the station by a metallic circuit with another selected station. An electrically operated device at each station is permanently connected into the direct line and the return line individual to the station. A source of current normally disconnects from all the direct lines and return lines.

804,189. Apparatus for Measuring the Length of Electric Waves. John A. Fleming, London, England, assignor to the Marconi Wireless Telegraph Company, London, England. Application filed February 8, 1905.

Apparatus for measuring the lengths of electric waves embodies a coil of wire, the effective length of which may be varied, and an instrument movable with relation to the coil for indicating the presence of a complete stationary electric wave therein.

REISSUE.

12,406. Direct-current Dynamo-electric Generator. Benjamin G. Lamme, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed May 2, 1905. Original application dated December 15, 1896.

A parallel-wound armature for multipolar direct-current machines is provided with alternating-current connections between points in its winding of normally equal potential through which leading and lagging currents may be transmitted to equalize the magnetic circuits of the machine and combined with a number of pairs of brushes equal in number to the pairs of poles.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on November 13, 1905:

392,604. Combined Fire Alarm and Telephone Telegraph. G. C. Hale, A. Barrett and J. Zetner, Kansas City, Mo.
392,632. Electric Elevated Railway. R. T. Oney, Charlestown, W. Va.
392,633. Electric-lamp Switch. C. G. Perkins, Hartford, Conn.
392,660. Insulation of Cores of Dynamo-electric Machines. B. Bidwell, Chicago, Ill.
392,665. Electric Gas Lighter. H. A. Cleverly, Philadelphia, Pa.
392,666. Incandescent Lamp Socket. T. Coad, Forest Gate, County of Essex, England.
392,675. Electric Railway. R. M. Hunter, Philadelphia, Pa.
392,679. Electric Speed Governor for Waterwheels. G. M. Lee, Little Falls, N. Y.
392,701. Electric Machine for Lighting and Extinguishing Gas. G. E. Thaxter, Boston, Mass.
392,698. Coin-controlled Electrical Weighing Scale. W. H. Smith, Banders, Tex.
392,724. Electric-circuit and Apparatus Guard. I. H. Farnham, Malden, Mass.
392,736. Electrical Apparatus for the Prevention of Incrustation. M. Kotyra, Cardiff, County of Glamorgan, England.
392,737. Overhead Conductor for Electric Railways. E. E. Ries, Baltimore, Md.
392,765. Dynamo-electric Machine. E. Thomson, Lynn, Mass.
392,772. Electrical Railway. O. Allen, Denver, Colo.
392,775. Electric Circuit. J. A. Barrett, Brooklyn, N. Y.
392,816. Mechanical Telephone. L. Mellett, Newton, Mass.
392,826. Automatic Switch for Secondary Batteries. J. S. Sellon, Hatton Gardens, England.
392,836. Carbon Battery. J. B. Wallace, Ansonia, Conn.
392,838. Message and Time Recorder. J. C. Wilson, Boston, Mass.
392,843. Telephone Support. S. Bergmann, New York, N. Y.
392,863. Electric Railway. B. Heywood, New York, N. Y.
392,890. Regulation of Electric Motors. W. Stanley, Jr., Great Barrington, Mass.
392,914. Telegraphy. S. D. Field, Stockbridge, Mass.
392,930. Method of Synchronizing Electric Motors. F. J. Patten, New York, N. Y.
392,967. Synchronizing System for Electric Motors. F. J. Patten, Bath, Me.
392,970. Annunciator. F. Ritchie, Chicago, Ill.
392,971. Electric Railway. I. Robbins, Camden, N. J.

WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XXXVII. CHICAGO, NOVEMBER 25, 1905 No. 22

LIBRARY OF ELECTRICAL ENG'G.

Electrically Operated Refuse-loading Station.

In Germany, much more than in this country, municipalities are on guard to prevent anything taking place within the city limits which will in any way discomfort the inhabitants or lead to unsanitary conditions. In the matter of handling street refuse, for instance, great care is taken. In Berlin, to cite a recent example, according to regulations issued in the course of last year, the loading of domestic refuse at the railroad stations has to be effected in such a way as not to give rise to the production of any dust.

The company dealing with the conveyance of refuse from the houses had therefore to provide special means of avoiding the production of dust in connection with the loading. Loading stations were therefore erected in different parts of Berlin. That of the Silesian railway in Mühlen Street is represented by the accompanying picture and is briefly described in what follows.

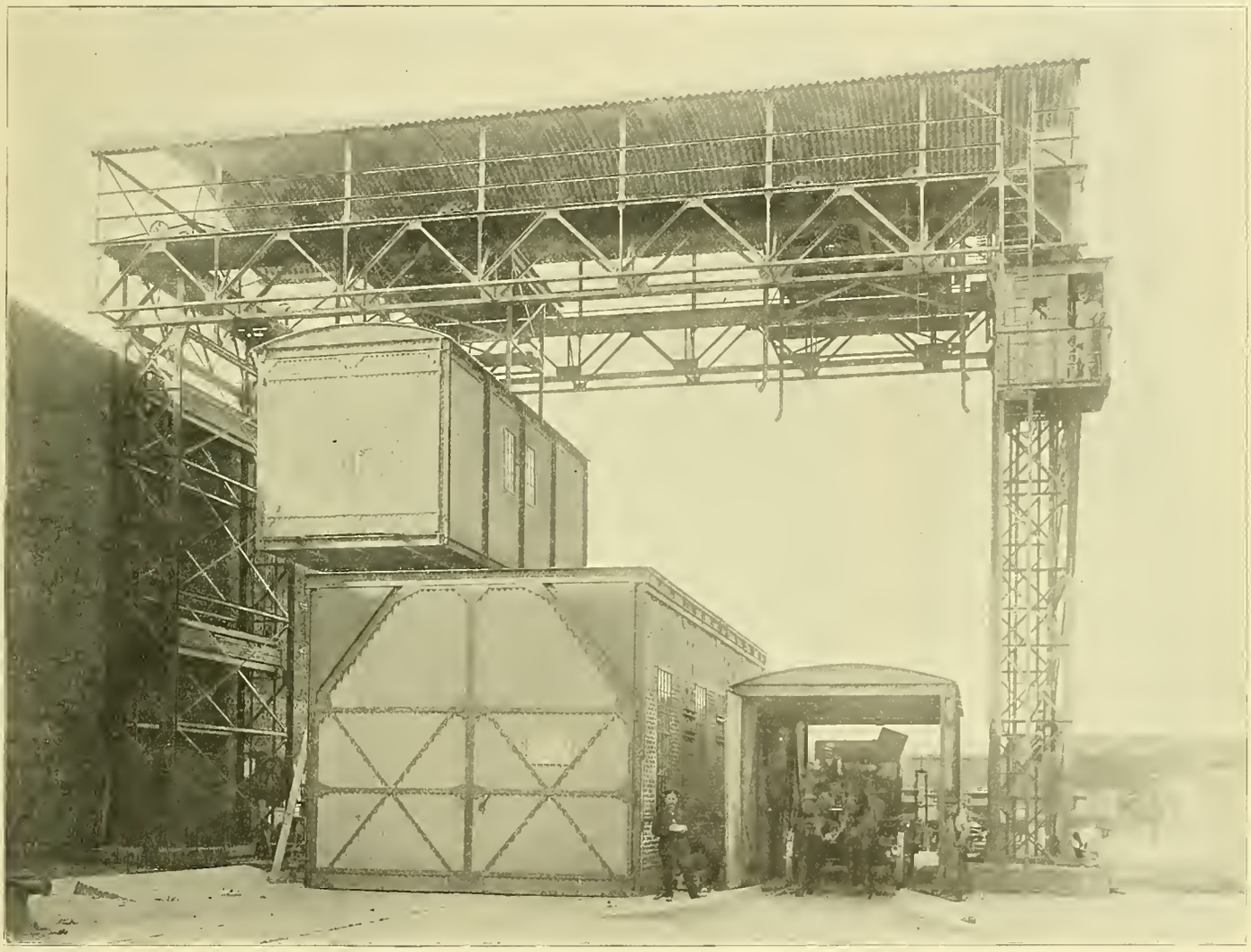
The level of the street being flush with the railroad track, a hoist had to be installed, the operation of which is effected by means of electricity in a most convenient manner. As seen in the picture, the hoist carries the driving gear in its upper roofed part and extends like a frame across the "hall" or receptacle intended to receive the cars of the railroad company. On both sides of the "hall" are placed hoisting cages to receive the horse-drawn wagon of the refuse company. Both the dust bins on the wagons and the hoisting cages are provided with openings in the bottom corresponding with traps in the ceiling of the "hall," which traps open automatically downward.

The discharging process is as follows: After the loaded refuse wagon has entered the hoisting cage, suspended from wire ropes, the doors of the latter are locked and the cage is lifted by means of electric motors and conveyed laterally above the "hall," where it is stopped. Next a lever mechanism is actuated, the traps will open and the whole refuse contained in the bin will drop into the railroad car situated underneath. The "hall" is kept locked on all sides during this operation, and no dust is allowed to escape.

As soon as the bin is entirely discharged, which operation requires only a few minutes, the hoisting cage will return the same way, the empty wagon being removed, while the second cage with its contents is raised on the other side of the "hall." After having thus filled the railroad car with the refuse it is safely covered and conveyed by means of electrically driven capstans to the sidings leading across the loading "hall" and the courtyard of the loading station and thence into the railway station ready for shipment to refuse-destroying plants or to be used for fertilizing purposes.

The lifting of the hoisting cages, each of which with a loaded wagon, horses and driver, weighs about 14,400 kilograms, is effected by two hoists driven by a 15-horsepower motor, while two five-horsepower motors are set apart to effect the transverse motion. The driver's cabin containing all the switching, controlling and starting apparatus required for the service, and whence a good view and ready control is obtained of the whole plant, is located laterally on a pillar of the hoist.

The energy required to feed the motors is supplied from the mains of the Berlin Electricity Works, to whose managers the writer is indebted for the above particulars. A. G.



ELECTRICALLY OPERATED REFUSE-HANDLING PLANT IN BERLIN, GERMANY.

The Telefunken Station at Norddeich.

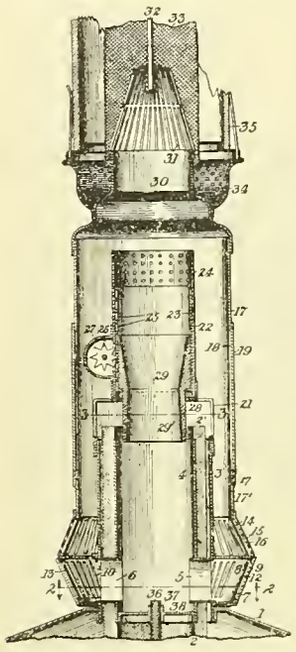
The General Postoffice Department of the German government is now building a wireless telegraph station of great height at Norddeich, which probably will be for the time being the most efficient in the world, in the belief of the United States Consul Diedrich of Bremen. "It is expected to cover a circuit of not less than 932 miles. This station will convey not only messages to and from Germany, Switzerland, France, Great Britain and Denmark, but also the larger part of Italy, Sweden and Norway, and even portions of Spain, the Balkan peninsula and Russia; to the southeast it will operate as far as Saragossa; in the south it will almost reach Naples and Cetinje; in the east get close to St. Petersburg, and in the north it will talk to the people at Drontheim and about halfway up to Narvik. German vessels homeward bound from America will be able to communicate with the German station at Norddeich when they are still on the Atlantic far beyond Land's End, 12° west of Greenwich. The installation at the station will be set up by a Berlin firm supplying machinery, apparatus and accessories for wireless telegraphy, according to the system called 'telefunken.' At first it was proposed to erect this gigantic telegraph station on the island of Borkum, but finally Norddeich at Norden was chosen as the northwesternmost corner of the German Empire. Norddeich is also the terminus of the Prussian railway system in the extreme northwest and a small seaport for the Frisian Islands. The towers for the station are to be 213.25 feet high. The foundations have already been laid and the work of erecting the iron superstructure will soon begin. I am informed that the entire plant, including

dwellings for the officials and employes, will be completed during the month of November and that by the beginning of the next year this latest and largest telegraph station will be ready for performing its work."

A New Fuel for Gas Engines.

United States patent No. 803,534, issued on October 31st to C. K. Harding of Chicago, relates to a new gaseous mixture for internal-combustion engines and covers both the process and the apparatus for producing the gaseous mixture.

The most novel feature of this invention is that catalytic action is employed chemically to act on kerosene and heavy hydro-carbons to break them up into lighter hydro-carbons, pentane gasoline,



APPARATUS FOR PRODUCING COMBUSTIBLE GAS MIXTURES

etc., as well as oxidized derivatives, such as alcohols, aldehydes, fatty acids, ethers and ketones. This sort of destructive distillation and partial oxidization of kerosene is effected by passing the oil vapor mixed with air in contact with and through a red-hot tube of refractory material carrying metals of the platinum group in an extremely fine state of division and of such catalytic power that the tube will be raised to the required temperature (a dull red heat), but will not get so hot as actually to ignite or inflame the mixture.

Each single molecule of average kereosene has 12 atoms of carbon united to each other and to 26 atoms of hydrogen $\left((CH_3)_2\ (CH_2)_{10}\right)$ and requires 37 molecules of oxygen for its combustion. Atmospheric air being only one-fifth oxygen, it is practically impossible to get enough air in contact with such a complex hydrocarbon to secure the simultaneous combustion of the entire 38 atoms of hydrogen and carbon necessary for a clean and efficient explosion.

Natural gas and all manufactured gases are, however, chiefly simple compounds, having only one or at most two carbon atoms in their molecules. Pintsch gas, made entirely from petroleum, has a composition similar to alcohol, in that it has but two carbon atoms and represents a desirable form for motor fuel.

The light hydrocarbon gas mixture, burning with a smokeless and non-luminous flame, may be used for various purposes, the patent showing one form applied to a lamp. In the illustration the top of the round wick of an argand burner is shown at (2), from which the oil is vaporized. The tube (29) is supported in adjustable relation within the top of the wick and carries the active catalytic material inside and outside the lower portion. There is an annular passage between the outside of the tube and the vaporizing surface of the wick, and when in action the oil vapor, mixed with some air, is carried down this passage and up the tube.

The catalytic material of the tube together with oxygen from the air oxidizes some of the hydrogen of the kerosene and keeps the lower end of the tube (29) red hot or at any temperature desired by adjusting the air shutters at the bottom, raising the tube or lowering the wick. The heat radiated from the tube vaporizes the oil from the wick, which simply acts to feed the oil to the vaporizing zone near the red-hot tube, and when it is turned down the generator stops.

Comparison of the Characteristics of Illinois and Other Coals.

Professor S. W. Parr of the University of Illinois, in a recent University Bulletin, contributes some valuable information concerning the coals of Illinois—their composition and analysis. Without going deeply into the analytical part, it is believed that some of the comparisons which he makes between coals mined in Illinois and other parts of the country will be found of interest, especially as he has made these comparisons clear by a number of diagrams which set forth the results of his investigations in a lucid manner.

Taking up first semi-bituminous coal, and referring to Fig. 1, the characteristics of this type are made evident. The results are not hypothetical, but are taken from an actual sample of Pocahontas coal, which belongs to this class.

The outer zone in the diagram represents the constituents as ordinarily found by proximate analysis, and in tabular form would be represented thus:

	Per Cent.
Ash	3.49
Moisture	0.93
Volatile matter	18.70
Fixed carbon	76.88
Total	100.00
Total non-combustible	4.42
Total combustible	95.58

Hence, 104.62 pounds of coal are required to make 100 pounds of actual fuel.

In the next to the outer zone of the figure the constituents are the same, except that the "volatile matter" is subdivided into that part which in the hypothetical coal molecule is known as water of composition, as distinct from the "moisture" or hygroscopic water. This constituent in the actual coal amounts to 4.21 per cent., leaving for actual combustible in the volatile part only 14.50 per cent., instead of 18.7 per cent., as before indicated. In this case 109.43 pounds of coal are required to make 100 pounds of actual fuel.

The inner zone of the diagram shows a still further subdivision of the true volatile combustible into carbon, hydrogen and sulphur.

FIG. 1. CONSTITUENTS OF SEMI-BITUMINOUS COAL.

Coal thus far considered is common to the eastern states and to European countries.

It may be that analytical processes, at least the so-called "proximate analysis," convey an element of untruth, not of sufficient magnitude, however, to disturb the results.

Briefly, a parallel statement may be made concerning the coals of the Mississippi Valley. To carry out the comparison, a second diagram (Fig. 2) was prepared. This was not made up from the hypothetical coal molecule, but from the average of results obtained from 10 typical Illinois coals.

As in the first diagram, the outer zone represents the ordinary proximate analysis and by the usual method would be reported thus:

	Per Cent.
Ash	8.00
Moisture	7.00
Volatile matter	35.60
Fixed carbon	49.40
Total	100.00
Total non-combustible	15.00
Total combustible	85.00

Here 118 pounds of coal is needed to make 100 pounds of fuel.

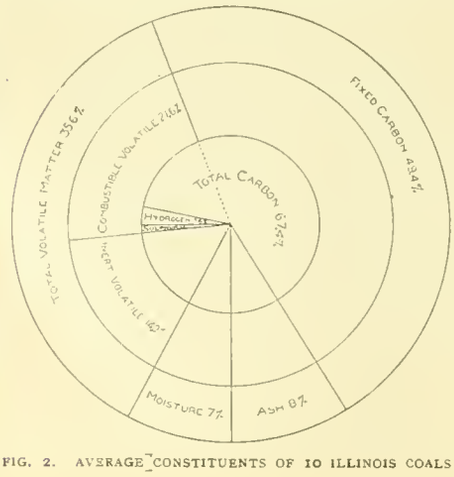


FIG. 2. AVERAGE CONSTITUENTS OF 10 ILLINOIS COALS

The next zone shows the relative parts when a division is made of the volatile matter, and for this type of coal the analytical data agree somewhat closely with the hypothetical coal molecule. This zone shows the volatile matter to consist of 14 per cent. of inert matter, or "water of composition," and 21.6 per cent. of true combustible matter, instead of the amounts shown above. Hence there are required 141 pounds of coal to make 100 pounds of actual fuel, instead of 119, as by the usual method.

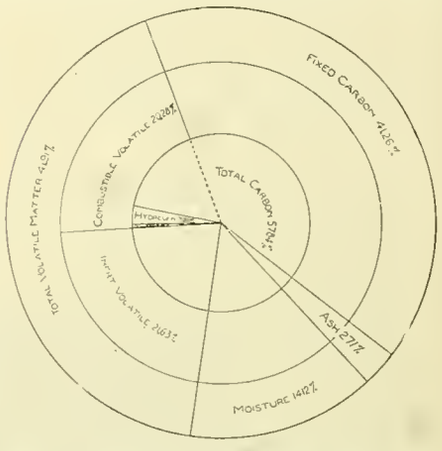


FIG. 3. CONSTITUENTS OF LIGNITIC OR BROWN COAL.

It is of interest here to present a third diagram (Fig. 3) showing the same facts with regard to brown coals, a North Dakota lignite being used for the analysis. By reference to the outer circle, which represents the usual method of analysis, the following are obtained:

	Per Cent.
Ash	2.71
Moisture	14.12
Volatile matter	41.91
Fixed carbon	41.26
Total	100.00
Total non-combustible	16.83
Total combustible	83.17

Hence, by this showing, 120.23 pounds of coal would be required to make 100 pounds of combustible.

However, upon further analysis of the volatile matter, it is found to consist of 21.63 per cent. of water of composition and of only 20.28 per cent. of actual combustible. Here there would be needed 162.49 pounds of coal to make 100 pounds of actual combustible.

Tests on Osmium Lamps.

Experiments were recently carried out at the Technological Institute of Vienna to determine the average life and power consumption of osmium lamps. Six lamps of 35 volts and 16 candlepower and six lamps of 35 volts and 25 candlepower were employed for testing purposes. The lamps were connected three and three in series, and the groups thus formed were placed on an alternating-current circuit at 105 volts. The horizontal luminous intensity and the consumption were measured every 100 hours, until the lamps were destroyed. The results obtained were as follows:

A lamp of 16 candlepower gave at first 15.1 candlepower, with a consumption of 1.68 watts per candlepower. After 400 hours, the luminous intensity increased to 17.3 candlepower, and at the end of 2,100 hours fell again to 15.6 candlepower. The consumption went down to 1.46 watts per candlepower, and then went up to 1.58 watts.

Another lamp of 16 candlepower gave at first 15.2 candlepower, then 17.5 after 400 hours, and 16 at the end of 2,200 hours. The corresponding power consumptions were 1.62, 1.43 and 1.535 watts, respectively.

A lamp of 24 candlepower gave at first 22.35 candlepower, then 24.6 after 600 hours, and 23.7 after 1,700 hours. The power consumptions were, respectively, 1.65, 1.51 and 1.56 watts.

Finally, a lamp of 23 candlepower gave 22.25 candlepower at first, 24.1 candlepower at the end of 300 hours and 22.6 candlepower after 2,100 hours, the corresponding power consumptions being 1.65, 1.53 and 1.61 watts.

It will be seen by the tests that the average life of the lamps was 2,200 hours, the limiting values being 1,793 and 3,036 hours. Among the lamps tested, three alone presented a diminution in light of 10 per cent., one after 1,750 hours, the other after 940 hours, and the third after 820 hours. In taking as basis the lamp which diminishes 10 per

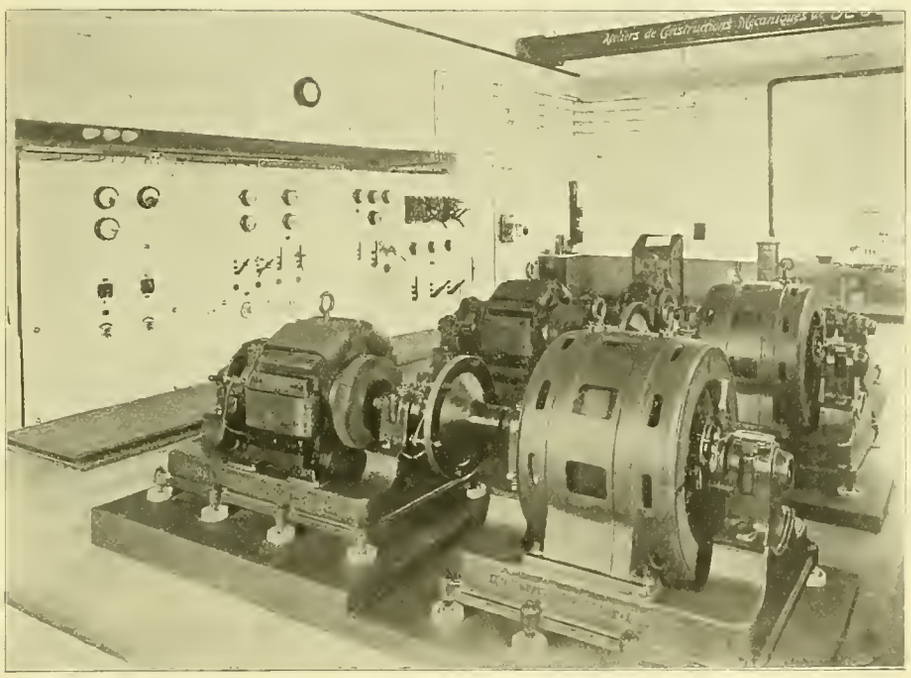
cent. in luminous intensity, the average life is found to be 1,985 hours, and the average power consumption 1.60 watts per candlepower for a lamp of 16 candlepower and 1.80 watts for a lamp of 25 candlepower. The candlepower in the results is given in terms of the Hefner candle.

Converter Station for Vevey Railway in Switzerland.

By A. de Courcy.

An extensive system of electric railways has been in operation for some time between the town of Vevey, Switzerland, on the bank of Lake Leman, and the surrounding region. The traffic on the railway lines is considerable, and especially so during the summer season, when large numbers of tourists and residents come to the towns of Vevey, Montreux and other attractive points on the shores of the lake.

The Vevey railway system, which includes a number of lines of some length, is operated by the Compagnie des Chemnis de Fer Electriques Veveysans. This company secures the power which it needs for operating the road from an outside plant, and it uses a large amount of 4,000-volt three-phase current at 50 cycles. In order to transform



CONVERTER UNITS AND SWITCHBOARD IN RAILWAY SUB-STATION AT VEVEY, SWITZERLAND

this current into direct current at low voltage for the tramway lines, the Vevey company erected a large station in the neighborhood of the town in which are placed a considerable number of motor generator units. The electrical outfit of the Vevey plant was supplied by the Compagnie de l'Industrie Electrique et Mecanique of Geneva, and the machines were designed by Réné Thury, the well-known Swiss engineer.

Groups in the present plant were accordingly constructed so as to convert the three-phase current from the main line into 750-volt direct current, which is used on the motors of the cars. The accompanying picture shows the two series of converter groups and the switchboard. In the rear is a booster group, which forms one of the features of the plant.

Converter groups represented in the illustration are made up in each case of a non-synchronous 100-horsepower tri-phase motor, coupled direct to a direct-current machine of equal power. The three-phase motor of the converter group is connected directly upon the primary circuit at 4,000 volts. The motor is in the foreground, which enables the details to be observed. It is of a cylindrical and partly enclosed pattern, and is well protected. The motor is provided with two self-oiling bearings. The armature is equipped with collector rings, with a short-circuiting apparatus and a device for lifting up the brushes when the motor is in full running. At the above voltage these motors are designed for a capacity of 100 to 120 horsepower at a speed of 730 revolutions per minute.

Connected direct to the motor by means of an elastic coupling is a Thury generator of the consequent-pole type, also provided with self-oiling bearings. This machine uses a set of carbon brushes. Each of the generators has a capacity of 100 horsepower, and is designed to furnish a current of 88 amperes at 750 volts normal tension. The speed is about 730 revolutions per minute. The Raffard system of elastic coupling, which has become the standard in most of the European plants, is used in all the groups. While using an amount of energy equal to 81 kilowatts on the motor side, the converter group is able to furnish about 66 kilowatts from the generator at the tension of 750 volts. The efficiency of the group when running at the normal speed and at full load is stated to be 82 per cent. At the present time the Vevey plant contains three converter groups, which are all built on the same plan. The third group was added some time after the others, to provide for the increase of traffic on the line, and is not shown in the picture.

The booster group is placed alongside the converter groups. The motor and generator are of similar construction and when coupled together act as a positive and negative booster, and work in connection with a storage battery contained in the station. The battery is connected in parallel upon the railway lines according to a method which is much practiced in Europe, and serves to keep the voltage well balanced and take up any variations of current while the lines are running. The booster is designed to operate while the battery continues to remain in the circuit. It serves to keep the voltage fixed, which is needed for operating the railway, in spite of the alternating state of charge and discharge of the battery. The booster group is made of a direct-current motor, which is connected to the 750-volt circuit, coupled to a generator which is automatically regulated and connected permanently into the circuit of the storage battery. The generator acts to boost the battery when it is in a state of discharge, and, on the other hand, to boost the part of the line current which is to be used for charging the cells. The electromotive force of this machine is required to change its sign completely and to pass from a maximum positive to a maximum negative, according to the needs of the system. It is normally 150 volts, but it can be raised to 265 volts at the maximum for the end of the battery charging, at the rate of 2.7 volts per cell. The variations of the field of the generator are obtained by means of an automatic voltage regulator which acts upon a resistance.

The motor which operates the booster machine is of 40 horsepower and takes 750 volts from the converter circuit, operating at a speed of 600 to 750 revolutions per minute. Both motor and generator of the booster set are six-pole machines of the Thury pattern. Like the machines of the converter groups, they are mounted on porcelain insulators. The above arrangement of the booster in connection with the storage battery allows of suppressing a certain number of cells and replaces the different devices which need to be used when the cells are charged and discharged, seeing that the charging is carried out while the line is working and without increasing the voltage of the line. Since all the cells of the battery are kept in circuit and are therefore worked at the same rate, it is easier to keep up the general condition of the battery. The above system has been running for some time past upon the Vevey railway lines, and it has proved very successful. The illustration shows the main switchboard, made up of seven marble panels, and containing the switches and instruments for operating the converter and the booster groups.

Interurban Express and Freight Traffic.[1]

By N. E. Graston.

All of you who are connected with electric railways are acquainted with the fact that it is only within the last few years that some managers have come to look on handling of freight and express traffic on interurbans with favor. I think those who have inaugurated this class of service find it profitable, and that it does not interfere with their passenger traffic. The freight and express traffic, as you know, is still in its infancy, yet it has shown that it can be operated, even with so small a volume of traffic, at a profit. At the present time every company is confining its traffic to its own line. This traffic could be increased very materially if the traffic managers of the different interurbans would get together and arrange for a system of through rates between their respective lines on the same rate basis as steam lines have between like points. Until this is done we cannot hope to increase our through traffic, as the sum of the two local rates makes our rates so high that shippers will not favor us with the business.

Every company has a certain amount of fixed charges connected with the operation of the freight and express department, such as salaries of agents, rent of stations, etc. Through traffic could be handled without any noticeable increase in expenses, and at the same time it would bring in not a little revenue; and we can handle it if we will only organize and get through rates into effect.

Our inability at this time to interchange freight traffic with steam lines is working a great hardship on us all, and I hope the time is not far distant when they can see their way clear to arrange for connections and working arrangements with us whereby we can interchange traffic with them. When we can do this our traffic and revenue will show a good increase. Until then we will be handicapped, and it is costing us considerable traffic, which we should have for local points on our own lines, as well as traffic to points on connecting lines, as heavy shippers of merchandise refuse to give us any business, for the reason that to do so would entail additional expense to them. They say that they can send all their output to steam lines with one cost of transfer. We should arrange for interchange with all lines as quickly as possible.

The traction lines of Indiana were very fortunate in getting their lines so located that they traverse not only the most thickly inhabitant portion of the state, but the very best agricultural districts as well. We should assist the farmer in every way possible to find a market for his products, as it will encourage him to increase his shipments, and by so doing we increase our revenues as well.

It should at all times be the policy of electric lines to put in good sidetrack facilities at each station on the lines and at such other points where the business will justify the expense, as good track facilities are a very important item to the traffic department; they help secure business and enable that department to take care of it in a satisfactory manner after it is secured. Then, too, we should have good sidetrack facilities to enable us to get our trains over road with the least delay possible, for this enables us to keep the operating expense down to a minimum.

Take a walk through the yards of steam lines and you will find that they have the best facilities to handle their traffic. We must do likewise if we expect our proportion of the traffic.

I think the official classification should be adopted on interurban lines as the mode of classifying freight, although it has some few articles classed improperly. One classification to which I call your attention is household goods. I think that these goods are classified too low for profitable business to interurban lines. I think further that it would be well if traffic managers of electric lines would get together and go over the classification carefully and get out an exception sheet (which would be uniform on all lines) to the articles named in the official classification, which they think not properly classified for interurban traffic.

We should at all times hold our rates to the highest possible point, and see that our agents apply them properly to get most revenue out of every shipment. Our rates should be based on the same basis as steam lines. You will find that they are figured on a good profitable basis. Before we publish a new rate sheet, if we have not the figures of the steam lines at hand, we take the matter up with the traffic department of the lines in the ter-

1. A paper read before the Indiana Electric Railway Association at Rushville, November 9, 1905. Mr. Graston is superintendent of freight and express traffic for the Indiana Union Traction Company.

ritory which we are arranging tariff for, asking it for its class rates to same points. In this way we are enabled to get out our tariffs on the same basis without any conflict in rates. It is necessary, if we are to secure our share of the traffic, that we make the same rates as steam lines between the same points.

In billing freight we are using a way bill which I think is very complete. It consists of four sheets of paper—the original and three copies. This is so folded that forwarding agents make all the copies at one writing by use of carbons. The waybill shows "station from," destination, date, car number, name of consignee, consignor, description of articles, weights, rate and amount of freight. After forwarding agent makes the waybill he delivers the original and one copy to conductor, who checks his freight to and from car with it. When he gets the freight to destination he delivers the original and copy to agent. When agent makes delivery of freight he signs original and delivers it to consignee with the goods, which is his expense bill, and he has the consignee sign the copy, which he retains for his receipt of delivery. The forwarding agent sends one of the two remaining copies he has to auditor and keeps the other for his files. You see the forwarding agent makes expense bill at the same time he makes the waybill.

Each company should be provided with sufficient equipment so that it can handle and move all the business offered to it daily without delay to the traffic, for my experience has taught me that failure to move your traffic promptly diverts traffic very quickly, and once taken from you it is a very hard matter to regain it. For this reason we should be prepared to move the business without delay. To overcome this complaint it is necessary that we keep a few extra cars ready for immediate use at all times to care for any traffic that might be secured. The cars for use in handling freight should be good large cars (45 to 50 feet in length) and of good capacity. The motor cars should be equipped so that they can handle trailers without difficulty. Every company should have several good box-car trailers to take care of its carload business, in addition to the handling of local traffic. I think there should be as much business handled with trailers as is possible to be done, as it serves to keep down the operating expense.

Too much care cannot be given to the erection of freight stations and platforms. These stations and platforms should be erected so that floors will be on level with floors of your freight cars. This will not only enable your trainmen to handle their freight more quickly and carefully, but it leaves freight where it will be convenient for transfer men to load upon their drays. I find at stations where we are not equipped with high platforms that we are losing considerable traffic. The merchants at these points tell us that they would gladly give us their business if our facilities were equal to those of steam lines.

We should be very careful in selection of our agents, especially at our most important stations. We should be careful to get good, intelligent, sober and industrious men, as they come in daily contact with the business public in general, and on them depends to a large degree the success of the company in their respective cities. Our representatives at our stations should put forth every effort to please the transfer men at his station as well as his patrons, as my experience has taught me that the transfer men practically control a very large percentage of the less-than-carload business in their respective cities, and we should let them know, by word and action, that anything they can do for our company will be appreciated. When this is done you will find them a great help to us in securing local traffic for our lines in their cities.

One of the greatest difficulties that we are experiencing at present, I find, is to get our patrons to understand that we are prepared to handle all kinds of freight traffic. Most of them have the idea that we cannot handle any class of freight but small packages.

I think that it is very essential to have a good solicitor to go out and see each merchant and shipper and keep after them for more of their business and keep our line before them. Our competitors have solicitors on the road all the time, and they have special instructions to give the territory paralleled by interurbans their attention first of all. One of these representatives in conversation with me advised me that he had special instructions to do everything possible to be done to divert business from interurbans, and I find that they are strong competitors; and it stands us in need to have a good man out and keep the territory well canvassed, and keep our patrons in line.

To increase the volume of business requires watchfulness, care and solicitation to foster trade and to take care of it in a way that is sure to give general satisfaction. Industries must be served to the best advantage. The ideas of shippers, merchants and business community must be given consideration. The business public and a common carrier are of mutual value, and, therefore, all patrons are entitled to courtesy. The business must be developed and small shippers should be accorded the same liberal treatment that is given to shippers of large tonnage. It is quite easy to secure business by cut rates or other inducements that mean a loss of revenue to the company, but this we must guard against at all times. It should be our endeavor to improve the service on our lines and establish a standard for them of quick dispatch and careful handling, free from loss and damage—a service that will commend itself to the business public in general, and one that is far superior to any like transportation offered by steam lines. To do this it is necessary that every employe give the handling of the business his careful attention.

New York Central Terminal Electrification—Sub-stations, Transmission and Distribution.

Work on the terminal electrification of the New York Central and Hudson River Railroad in and near New York city is progressing steadily, and it is confidently expected that electrical operation of trains in the electrical zone will be accomplished some time next year. This great work has been under way, including the preliminary investigations and reports, since August, 1901, and a number of descriptive, illustrated articles on the subject have appeared in the Western Electrician. One of the more recent was that of April 1, 1905, giving many of the details of the work in hand, including a description of the principal features of the power houses at Yonkers and Port Morris, N. Y. In the present article more particular attention will be paid to the transmission lines, sub-stations and distribution.

FIG. 1. VIEW SHOWING CABLE TOWER AT JUNCTION OF OVERHEAD AND UNDERGROUND DISTRIBUTION AND ALSO PROTECTED THIRD-RAIL ON NEW YORK CENTRAL.

Transmission.

Current generated at the two main power stations at Port Morris and Yonkers is to be transmitted three-phase at 25 cycles 11,000 volts to eight sub-stations, located as follows: Fiftieth Street and Lexington Avenue, Grand Central Terminal, New York; Mott Haven; Kingsbridge; Yonkers; Irvington; Ossining; Bronx Park, and Scarsdale.

Transmission lines are partly overhead and partly underground. The system is designed to give the greatest protection against interruption of all kinds. Each sub-station may be fed from either power station, and the lines are so disposed that no ordinary accident could cut off a sub-station from its power supply.

All overhead transmission lines are supported by latticed steel poles set in concrete foundations. Conductors will be of either No. 0000 bare copper wire stranded cable or of aluminum stranded cable, spaced 36 inches apart on the cross-arms. Cross-arms will be of yellow pine. The insulators will be supported by steel pins. Poles will be spaced 150 feet apart on tangent, and closer on curves, as existing conditions demand. An experimental line has been erected by the company, so that its engineers may develop the installation to the fullest degree.

All overhead lines are protected by the latest form of lightning arresters, and details of the overhead construction have been considered so minutely that the success of the system is assured.

Underground cables have three conductors of No. 0000 stranded copper, with paper insulation and lead sheathing. Duct lines are of vitrified tile, covered with waterproofing and laid in concrete. The manholes, placed at stated intervals on the lines, are designed for arrangement of cables with regard to the best manner of handling and supporting them when they installed. Each cable lies on shelving of concrete supported on iron pins. These shelves can be removed when necessary, and are designed to facilitate the easy handling of cables as well as protection to sheathing and splicing. The manholes are roomy and are laid out to permit the bending of cables in easy curves. Much ingenuity has been used in the construction of these underground lines and manholes, and many of the ideas developed are novel.

Through the Park Avenue tunnel and along the viaduct, and also through the Harlem Division depression, the conductors will be carried in 3½-inch steel pipes supported by brackets. Across the Harlem River the conductors will be in submarine cable, laid in a dredged trench in the bed of the river, back-filled with gravel.

At points where the lines change from overhead to underground construction, cable towers of attractive architectural design (see Fig. 1) will enclose the connections, together with lightning arresters and disconnecting switches.

Sub-stations.

At the sub-stations the high-tension current is stepped down to direct current at 666 volts for delivery to the third rail. Fig. 2 is a cross-section of a typical sub-station. The main equipment of each sub-station consists of three rotary converters and their accompanying transformers and subsidiary apparatus. The arrangements provide for a future installation of five rotary converters. The relative locations and capacity of the sub-stations are as shown in the following table:

Substa. No.	Location.	Area of Main Floor. Sq. Ft.	Miles from Grand Central Station.	Present Installation of Rotary Converters.	Future Installation of Rotary Converters.
1	Grand Central Terminal	4,796.6	.38	3 of 1,500 kw.	5 of 1,500 kw.
2	Mott Haven	3,845.27	5.47	3 of 1,500 kw.	5 of 1,500 kw.
3	Kings Bridge	3,845.27	9.44	3 of 1,000 kw.	5 of 1,000 kw.
4	Yonkers	3,639.33	15.64	3 of 1,000 kw.	3 of 1,500 kw.
5	Irvington	3,845.27	22.11	3 of 1,000 kw.	5 of 1,000 kw.
6	Ossining	3,845.26	30.31	3 of 1,000 kw.	5 of 1,000 kw.
7	Bronx Park	3,845.27	9.30	3 of 1,000 kw.	5 of 1,000 kw.
8	Scarsdale	3,845.27	19.02	3 of 1,000 kw.	5 of 1,000 kw.

Apparatus in each sub-station is arranged in the following order across the station: Entrance of high-tension lines, high-tension switching apparatus, transformers, rotary converters, direct-current switching apparatus. Along the station there is a succession of complete units such as that described above, the controlling apparatus being located at the center.

Accessible but little-exposed wiring necessitated the use of wall chases for the high-tension lines, and determined the use of transformers having both high-tension and low-tension terminals underneath the main floor.

Galleries, except for lightning arresters, are omitted. The use of electrically operated switches

and circuit-breakers for both the high-tension alternating current and the low-tension direct current was introduced. All of these switches and circuit-breakers are operated from the control boards. Ample spacing of the machinery and a very complete system of barriers for the protection of live conductors has been arranged for.

Underground lines enter the sub-station basements through ducts and are terminated at end bells, where they divide into three separate conductors running to three series transformers which supply current to the measuring instruments. The scheme adopted for the entrance of overhead lines was settled after a careful examination of all systems in use and is believed to afford the best possible protection against rain and snow not only to the incoming line but also to the apparatus in the building.

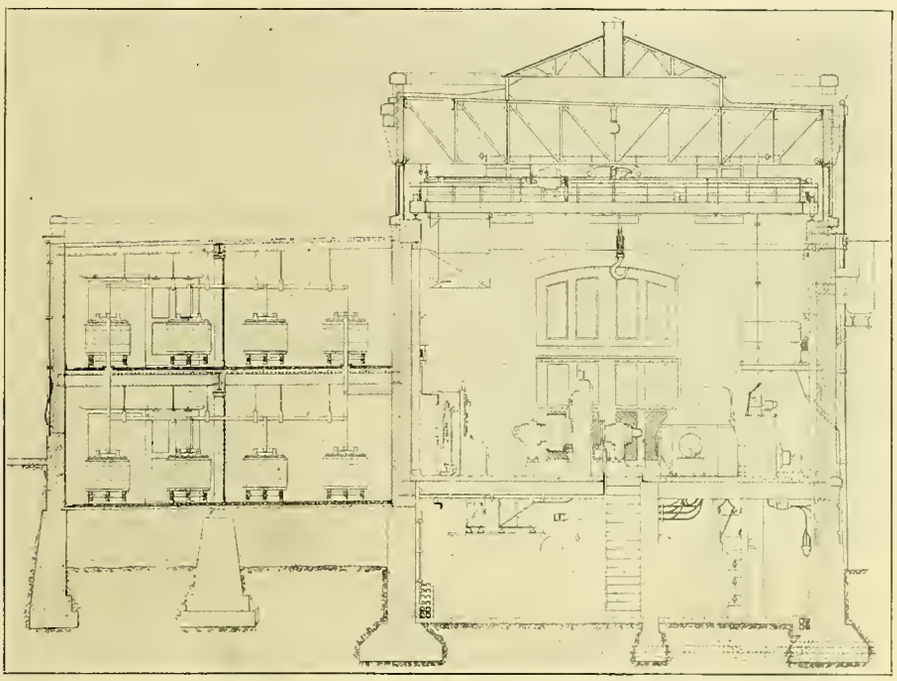


FIG. 2. CROSS-SECTION OF TYPICAL SUB-STATION FOR NEW YORK CENTRAL.

Lightning arresters were designed with the view of separating the phases as much as possible and to make all parts accessible. The groups of arresters are mounted in such a way that a complete set may be taken out and replaced with the greatest facility, a feature which is believed to be original with this installation. All overhead lines are provided with knife switches to disconnect them from the sub-station apparatus.

Each high-tension bus compartment is of concrete and is provided with concrete barriers to separate the lines connected to the busses. The series transformers for the measuring instruments pertaining to lines and machines are suspended from the ceiling in a row near the bus compartment and are separated by barriers. In order to obtain this uniform arrangement and yet leave the front terminals of the oil switch dead when not in use the high-tension lines between the series transformers and the power transformers are looped under the bus compartment, an arrangement which affords a very neat and practical way of combining two advantages which hitherto have not been jointly obtained.

Wiring, where bare, is of copper tubing, which gives an excellent mechanical construction, a feature of special importance for the delta of the power transformers. The high-tension bus-bars are supported rigidly, but nevertheless in such a way as to take care of expansion and contraction. All openings in the bus compartment are protected by fireproof doors.

Oil switches are electrically operated and are designed to carry a substantial overload. They are provided with pilot lamps to indicate at the central board whether they are open or closed, and the lamp circuits are so arranged that there is no indication unless the plungers complete their stroke without rebounding. The compartments are of brick which matches the interior of the sub-stations, the barriers between phases being soapstone.

Two sub-stations are equipped with single-phase 550-kilowatt transformers to supply the 1,500-kilowatt converters, whereas the sub-stations with 1,000-kilowatt converters have 375-kilowatt transformers. These have a normal ratio of 11,000 to 460 volts and are provided with extra taps for varying the voltage according to the drop in the transmission lines, or according to the distribution of load among the sub-stations. They are of the air-cooled type with terminals underneath. The air is supplied by two induction motor-driven blowers, one of hich suffices to supply the station.

Rotary converters are of the sextuple-connection three-phase type, which combines the advantages of the ordinary three-phase and six-phase type. They convert the alternating current at 460 volts into direct current at 666 volts.

The direct-current switchboards will have motor-operated switches and circuit-breakers, controlled from the boards at the center of the station. The positive feeders after leaving the switchboards are provided with end bells, which terminate the lead sheathing of the cables which run out to the third rail in underground ducts. Negative leads from the converters run through the foundations and connect to an ammeter shunt which carries the entire station output. The negative feeders are bare 2,000,000 circular-mil cables, which run out directly to the tracks in pipes.

There are two controlling boards situated at a part of each station which will be the center when the station is extended to its final limits. There is a bench board which carries the principal instruments and control apparatus, whereas an upright board carries the auxiliary control apparatus for lighting, etc. Each sub-station is provided with an electric traveling crane, which is also supplied with arrangements for hand operation.

The electric storage-battery equipment is believed to be the largest railway battery installation in the world. It will not only take care of load fluctuations, but it is sufficiently large to operate the entire system under normal conditions for a period of one hour in case of failure of the generating apparatus. Five of the batteries have an output each of 2,250 amperes for one hour and the others give 3,000, 3,750 and 4,020 amperes, respectively.

Batteries are located in buildings adjoining the sub-stations and are operated in connection with boosters and switching apparatus in the sub-station.

Sub-station lighting is done with incandescent lamps operated by alternating current at 120 volts. The current is taken from the 400-voltpower circuit and the voltage reduced by special transformers.

DIRECT-CURRENT FEEDER SYSTEM AND THIRD RAIL.

The direct-current feeder system is designed to give a duplicate path for the current from the sub-station to the third rail. It is also designed to confine any trouble which may occur to one track only, thereby making any interruption of traffic as slight as possible. Switches are provided at the third rail to disconnect all feeders at that point in case of a ground between the rail and the station. A train-length section of third rail is separately fed from the sub-station and is designed to prevent trains bridging between sections. All direct-current cables are installed in tile conduits close to the tracks, except the auxiliary feeders which join the sub-station busses and supplement the conductivity of the third rail. These are, in some localities, run overhead on the transmission poles. The four third rails and auxiliary feeders are joined together through circuit-breakers situated in small houses at intervals along the line, thereby increasing the effective conductivity.

An under-contact third rail will be used. The rail is of special bullhead section, 70 pounds to the yard, with high electrical conductivity. It is supported by cast-iron brackets bolted to long ties spaced 11 feet centers. Insulators fit loosely over the top and web of the rail, thus allowing some vertical play. A clamp fits around the side and top of the insulator and is bolted to the bracket. The top and sides of the third rail will be covered with insulating material to give thorough protection against accidental contact.

ENGINEERS AND CONTRACTORS.

The work as outlined above is under the charge of Mr. W. J. Wilgus, vice-president of the New York Central. The details described in this article have been worked out under the direction of Mr. E. B. Katte, electrical engineer.

The contractor for the transmission-line poles is the McClintic-Marshall Construction Company; rotary converters for eight sub-stations, Westinghouse Electric and Manufacturing Company; storage batteries for eight sub-stations and exciter storage batteries for eight sub-stations, Electric Storage Battery Company; lighting and power equipment for the two power stations and sub-station No. 4, Thompson-Starrett Company.

Ohio Society of Mechanical, Electrical and Steam Engineers.

The annual meeting of the Ohio Society of Mechanical, Electrical and Steam Engineers was held in Canton, Ohio, on November 17th and 18th. The first day was taken up with business matters, the reading of papers and their discussion, and 50 or more members were in attendance. Saturday was spent in visiting the Buckeye Engine Company's plant at Salem and the Morgan works at Alliance, the members going to these places on the Stark electric line.

"The Handwriting of Mechanics" was the subject of a paper by Eugene Ransom, in which he discussed mechanical drawing in all its details. He pictured the wonderful pieces of machinery that may be shown in drawings, and outlined the United States standard of drawings as defined by the Patent Office. Henry Lane of Cleveland read a paper prepared by George G. Bennett of Cleveland on "The Heat Unit and Its Application to Steam Heating," which contained much valuable information to engineers.

R. H. Probert of Akron presented a paper on "Electric versus Steam Locomotives." Mr. Probert said that in many instances electric power may be substituted for steam with much profit. He also made a comparison of the increased passenger traffic in late years, due to frequent cars on electric roads. This, of course, is due to the substitution of electric power, as trains could not be run so frequently and with profit if hauled by steam locomotives.

In the afternoon the following-named papers were read: "Pumping Engines and Machinery," by Oscar F. Rabbe of Toledo; "Compressive Strength of Materials," by Robert A. Orin of East Liverpool, Ohio; "Losses in Power Plants," by Charles N. Harvey of Zanesville.

The following-named officers were chosen: President, W. T. Magruder of Columbus, vice-presidents, Oscar F. Rabbe of Toledo and H. E. Stone of Cambridge, Mass.; secretary, F. W. Ballard of Cleveland; assistant secretary, H. H. Kelly of Atlanta, Ga.; treasurer, W. D. Theobold of Canton; board of managers, C. J. Miller of Canton and Robert J. Hetzel of Dayton, Ohio. It was decided to hold the next meeting at Pittsburg on May 17 and 18, 1906.

Atlanta's New Electrical Project.

The Southern Light and Power Company of Atlanta, Ga., which has filed a petition with the City Council asking for a franchise to do a lighting, heating and power business in Atlanta, has purchased property on Edgewood Avenue on which it purposes to locate its plant and offices, work to be commenced as soon as the city shall grant the franchises asked. It is announced that the company will do a general electric-lighting and heating business and will furnish power to concerns wishing it. The company has acquired control of the current that will be generated by the North Georgia Electric Company, which says it will ultimately develop 100,000 horsepower at Gainesville. The Southern Light and Power Company proposes to bring the current to Atlanta on wires supported by steel towers 45 feet high.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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DATES AHEAD.

American Society of Mechanical Engineers (next meeting), Edison building, New York City, December 5th to 8th.

New York Electrical Show, Madison Square Garden, New York city, December 12th to 23d.

Independent Telephone Association of Wisconsin (annual convention), Hotel Pfister, Milwaukee, December 20th and 21st.

Automobile Club of America (annual exhibition), Sixty-ninth Regiment Armory, New York City, January 13th to 20th.

Chicago electrical exhibition (first annual exhibition of Electrical Trades Exposition Company), Coliseum, Chicago, January 15th to 27th.

WOODEN cars on railroads will probably become a thing of the past, gradually, being succeeded by steel cars, which have greater strength to resist the shock of possible collision and are non-combustible. It is reported that the Pennsylvania Railroad Company has decided to contract for no less than 1,500 steel passenger cars. One motive for this decision, probably, is the desire to have only steel cars run through the system of tunnels under the North and East rivers in connection with the great new terminal station in New York city. The practicability of steel cars has been well shown by those in service in the New York subway, and it is to be expected that no railway officer hereafter will be anxious to operate wooden passenger cars in a tunnel system, particularly with electric power. But for general railroad service, too, the steel-frame passenger cars promise to reduce the casualties in wrecks, and the companies will no doubt introduce them to replace the wooden cars as the latter are worn out. Possibly, also, steel cars may eventually be used generally on the interurban roads, although this likelihood is somewhat more remote.

A STRIKING statement is attributed to H. G. Stott, superintendent of motive power of the Interborough Rapid Transit Company of New York, if he is correctly reported in the daily newspapers of that place. The company has been sued for maintaining a "smoke nuisance" at its Seventy-fifth Street (Manhattan Division) power house, and when on the stand Mr. Stott is alleged to have said that if the company tried to burn nothing but anthracite coal in the power house the price of that kind of fuel would be doubled in New York city. The witness added that the power house was the largest in the world, requiring about 700 tons of semi-bituminous coal a day. "We have experimented with anthracite coal," said Stott. "To run the elevated lines with it we would have to use 1,800 tons a day, or one-half of the supply brought to the city daily. We would have to build a power house twice as big, and even then we could not furnish power enough with that kind of coal to handle the traffic on the elevated lines." This is what Mr. Stott is reported to have said, but he may not have said it just that way. Even if hard coal was burned by the company, and 1,800 tons was required daily, it does not necessarily follow that the price to other consumers would be doubled. The ratio of 700 tons of bituminous to 1,800 tons of anthracite in equivalent heat production is also hard to understand. The alleged statement has aroused many protests in the New York papers. It is of interest as showing the magnitude of some modern power houses, and it also calls attention once more to the fact that managers owe it to themselves as well as others to reduce the smoke evil by at least careful firing if in no other way.

IN THIS DAY and generation a 12-mile railroad tunnel in which the trains are pulled by steam locomotives is hardly to be thought of. Electrical operation, with its freedom from steam, smoke, cinders and noxious gases, is of course the thing. It is therefore gratifying to observe that the Swiss Federal Council is now considering the advisability of using electricity to operate the trains in the Simplon Tunnel instead of steam. For this it has sent to Italy a commission accompanied by Mr. Zemp, the state engineer, who has just reported. The plan of electrifying the road through the tunnel is now considered feasble, as the power plants in Brigue alone, on the Swiss side, can furnish sufficient power for the south side of the tunnel. It is intended to utilize some of the power belonging to the electric railroads in the north of Italy for the same purpose, and it is probable that the inaugural train, propelled by electricity, will go through the tunnel about the middle of next year.

This is as it should be, of course. The Simplon Tunnel, connecting Switzerland and Italy under the Alps, is the longest in the world, and also the most recently completed of the world's great tunnels, the actual piercing of the main tunnel being finished on February 24, 1905. It is 12 miles and 440 yards long. It is a great engineering achievement, and it would certainly be most short-sighted policy to mar its operation by the use of steam locomotives when the electric-railway system can so easily be applied.

GREAT INVENTIONS are loudly proclaimed, and the inventor receives the approbation of the public, which sometimes amounts almost to adulation. But behind the inventor there nearly always stands a man of whom the public rarely hears, but whose work is none the less worthy of much praise. This man is the highly skilled mechanician, the one with the practical knowledge of the ways and means by which the ideas that the inventor has formulated may be brought to realization in an actually working machine. Such a man was James C. Warner of Chicago, whose death we are called upon to record on another page of this issue. Mr. Warner belonged not only to that class of highly skilled workmen in the branches of mechanics requiring the utmost nicety and precision—a class, alas, which seems to be fast disappearing!—but he also was himself an inventor of note, and a man who did a great deal to further the interests of the electrical industry, particularly in the field of the telegraph and telephone.

Samuel F. B. Morse individually conceived the idea of the recording electric telegraph. But he was an artist by profession; he did not possess the trained skill necessary to build the delicate instruments needed for the fulfillment of the fond hopes which were destined to result in the production of one of the greatest agents in the civilization of man. To whom, then, did he turn in his dilemma? To the practical man who could do things—and that man was James Warner. It was Mr. Warner who made the actual instruments used by Morse on the first telegraph line in America; and it in no wise dims the fame of the inventor of practical, commercial telegraphy to associate with the great name of Morse another one, honorable but less widely known—that of Warner.

UNDERGROUND telegraph wires between cities would present the great advantage of uninterrupted service, no matter how severe the weather conditions overhead. Nearly every winter the newspapers give reports of storms, with "wires down in all directions." Underground circuits between Chicago and New York, for instance, would obviate this trouble. But there are several practical objections. One would be the great expense. It would be desirable to lay the wires in iron pipe, and this pipe alone would cost between $1,000 and $1,500 a mile, or over $1,000,000 for the distance between the two cities mentioned. Then there would be the cost of trenching, the building of manholes, the insulation of the wires or cables and other items of expenditure. It is probable that the interest on the money invested in such a line would exceed the annual cost of repair to a corresponding overhead line, heavy as the latter item is. Another objection to the underground wires exists in the fact that owing to the retardation in a buried cable, as compared with bare wires in the open air, the circuits would work more slowly. With good weather conditions the free wires on poles give better and quicker service than the cables.

The underground alternative is one that has been given considerable attention by telegraph engineers, and several years ago Mr. C. M. Baker, superintendent of construction for the western division of the Postal Telegraph-cable Company, made some tentative estimates on the cost and practicability of underground telegraph lines between Chicago and Toledo—a distance of about 200 miles. If the idea should be adopted, Mr. Baker advocated iron pipe laid three feet below the surface of the ground, and he showed the necessity of manholes at regular intervals and the desirability of utilizing a level right-of-way, such as that of a railroad, rather than going up hill and down dale with the trench, following the contour of the country. But the idea was not considered practicable, and overhead wires still convey the telegraphic messages between Chicago and the Ohio city.

In England there are a few long underground telegraph circuits, although in that country also the greater part of the cross-country construction is overhead. In large cities, of course, both in England and the United States, the telegraph wires are carried beneath the ground.

OBITUARY.

James C. Warner.

After a long and honorable life spent in cheerful activity in the mechanical and electrical pursuits to which he was devoted, James C. Warner died on November 14th at his home in Chicago at the age of 82 years. Up to within two years of his death Mr. Warner was engaged in active work at the Western Electric Company's factory, where he had been employed since the organization of the company. The immediate cause of his death was trouble with the liver which advanced age made it impossible to combat successfully, in spite of the man's naturally vigorous and rugged constitution.

James C. Warner filled a place in the history of electrical development which was peculiarly his own. He was an Englishman, or, to be more precise, a Londoner by birth, and apparently he inherited some of his mechanical trend of mind. His father and grandfather were highly skilled mechanics and inventors. His grandfather received special recognition from William IV. for inventions which were patented, and his father was given a gold medal by Albert, the prince-consort, for a number of inventions relating to engraving, rose-engine work having been invented by him. Ernest P. Warner of Chicago, son of James Warner, has now in his possession a lathe, still in excellent condition, which his grandfather made and used about 120 years ago. So it will be seen that James Warner started out in life with a natural bent for mechanics, and this liking continued through life. By his death one more of the rapidly disappearing type of highly skilled mechanicians has passed away.

Perhaps as concise and at the same time brief a summary of the happenings of Mr. Warner's life as is to be found is in some sworn testimony of his which was given in a patent suit a little over two years ago. A portion of this testimony is here quoted:

"My first experience in the electrical world was when I was a boy about 13 or 14 years old. My brother-in-law, Mr. F. Kirby, was foreman for Cooke & Wheatstone and engaged in making telegraph instruments; that was in England.

"About 1843 there was a lull in the telegraph business and my brother-in-law came to New York and made some apparatus for Samuel F. B. Morse that was used on the first line between Washington and Baltimore. I also worked on these instruments. My next experience was in working for the Illinois and Mississippi Telegraph Company at Ottawa, Ill. I continued to work for them until the Western Union Telegraph Company leased the lines of the Illinois and Mississippi Telegraph Company; I continued in the employ of the Western Union Telegraph Company until the Western Electric Manufacturing Company was formed in Chicago, and I continued with the Western Electric Manufacturing Company to the present day. As an inventor I have some five or six patents owned by the Western Electric Company."

It may be mentioned here that the Western Electric Company succeeded the Western Electric Manufacturing Company referred to in 1881.

In the above quotation an interesting fact is brought to light, and that is that Mr. Warner actually fashioned with his own hands, while working in his brother-in-law's shop in New York, the first instruments used by Morse on the historic telegraph line between Washington and Baltimore. It may be explained that the instruments made in England prior to the date of Morse's invention were of the type known as the needle telegraph. They operated upon the principle of a deflection of a magnetic needle at right angles to the flow of current in a wire. The first recording telegraph instruments, however, were devised by Morse, and it was by the help of Mr. Warner that they were made a practical success. The identical instruments made by Mr. Warner and used by Professor Morse to send the first message on this continent are in a glass case in the receiving room of the main office of the Western Union Telegraph Company, 195 Broadway, New York.

During a period of 10 years in New York city, before going with the Illinois and Mississippi Telegraph Company, Mr. Warner was engaged in the glass business as a mechanic, and developed a number of processes for which it is said his employers took out the patents.

It was in 1854 that Mr. Warner removed to Ottawa, Ill., to become engaged in the manufacture of electrical instruments for the Illinois and Mississippi Telegraph Company. When this company was absorbed by the Western Union he was continued in the employment of the Western Union in the capacity of foreman. Finally the shops were sold to the Western Electric Manufacturing Company, the predecessor of the Western Electric Company.

Through all the changes Mr. Warner was retained and was engaged in perfecting the telegraph system, and when telephony came into vogue he devoted much of his attention to that branch. The drop and spring-jack which bear his name are the inventions of Mr. Warner. During the last years of his activity he was employed in the experimental department of the Western Electric Company's factory. His last work outside of this was in Melbourne, Australia, where he introduced for the

JAMES C. WARNER.

Western Electric Company the first multiple telephone switchboard used in that country.

A man of ability, a reader and close observer, and with unusual opportunities for studying the men engaged in the development of the electrical industry, Mr. Warner's mind was a veritable storehouse of valuable information.

On November 15, 1848, he was married in Brooklyn to Miss Sophia Preston, who survives him. One son, Mr. E. P. Warner, an engineer for the Western Electric Company, is living.

Showing the modesty of his nature, the following sentence quoted from an address he once made to the old Chicago Electrical Association is particularly expressive:

"Born when the steam engine was a mere baby and the telegraph in swaddling clothes, I have watched the years roll by and the children grow and develop, unable, through lack of early education, to take a leading part in the training, but always most deeply interested, and adding my mite cheerfully to the performance of the great task."

Charles Cuttriss.

The death occurred on November 17th of Mr. Charles Cuttriss, an electrical expert and recognized authority on the laying of submarine cables. Mr. Cuttriss was electrician of the Commercial Cable Company, with which company he had been connected since 1884. He was the man in charge of the laying of the American Pacific cable, and had done most of the important submarine-cable work for the Commercial company. Recently Mr. Cuttriss had been in charge of the laying of the completing section of the Pacific cable, and while in the vicinity of Manila he contracted malarial fever, from the effects of which he became so depressed that he later took his own life. He was esteemed not only for his practical knowledge of cable laying, but was often called into consultation by the officials of the Commercial company when important work was to be undertaken. Mr. Cuttriss was a personal friend of the Mackays, who recognized him as one of the leading authorities on the important work to which he devoted his life. He was about 55 years of age and a member of the American Institute of Electrical Engineers.

Frederic H. Betts.

The death of Frederic Henry Betts in New York city on November 11th recalls many famous electrical lawsuits. He was one of the best-known lawyers in patent litigation involving electrical patents and was engaged in the famous patent cases for the Western Union Telegraph Company, the American Bell Telephone Company and the old Edison Electric Light Company. Up to a short time before his death he was heard in important cases, having been the leading consel in recent space-telegraph patent suits. It is said of him by a prominent Chicago patent lawyer that there has not been a really important electrical patent case in 30 ycars in which he was not arrayed on one side or the other.

Mr. Betts was 62 years of age. He was born in Newburgh, N. Y., and graduated from Yale in 1864, and, from the Columbia Law School, was admitted to the bar in 1866. He was prominent in municipal reform movements in New York and was always closely associated with Yale University. At the time of his death Mr. Betts was one of the legal advisers of J. P. Morgan & Co. He was a member of the leading clubs of New York. Surviving him are his wife and three children.

Indiana Municipal League Discusses Public Ownership.

Municipal franchises and municipal ownership of public utilities were the principal subjects discussed at the fourteenth annual meeting of the Municipal League of Indiana on November 15th. The discussion was opened by an address on "Municipal Franchises," by Finley P. Mount, city attorney of Crawfordsville. Mr. Mount said his experience was that the success or non-success of municipal ownership of public utilities was largely a matter of bookkeeping. He said it was absolutely impossible to divorce the management of such enterprises from politics. "Every employe in a plant under municipal ownership," said he, "from a coal shoveler up, knows he owns his job through political preference. You cannot get municipal ownership separated from politics, no matter how hard you may try."

Mr. Mount gave a history of the trials and tribulations encountered by the electric-light plant at Crawfordsville owned by the city, saying that for 15 years it was a losing proposition, and while it is now being operated by a bipartisan board in a paying and satisfactory manner, the experience had been a very expensive one to the city. Mr. Mount was confident a city would get better results from properly framed and well-guarded franchises to private corporations for public utilities than from municipal ownership and control.

Mayor Becker of Hammond argued in favor of municipal ownership of public utilities, excepting when the indebtedness of a city made necessary a grant of franchise to a private corporation in order to get service. He said, "If we cannot govern a municipal plant, it is evident that we are not able to govern ourselves."

Mayor France of Huntington said that he favored municipal ownership. He insisted that party politics should not enter municipal affairs. William Fortune, editor of The Municipal Magazine, said that he favored municipal ownership of water plants. He said the better plan would be to allow the people to vote on an important franchise before it was granted to a private corporation.

A paper was read on "Municipal Ownership of Water and Light Plants," by H. C. Ayers, mayor of Portland. Mr. Ayers' paper covered much the same ground and reasoning assumed by Mr. Mount. The delegates participating in the discussion were about equally divided in favor of municipal and of private ownership and control of public utilities.

The following-named officers were elected for the ensuing year: President, Fred J. France, mayor of Huntington; vice-presidents, B. R. Russell, ex-mayor of Crawfordsville, and George R. Carr, mayor of Greenfield; secretary, John F. Taggart of Richmond. The next meeting will be held in Marion on June 15, 1906.

Municipal Ownership Investigation.

The first meeting of the committee of 31 appointed to investigate the subject of municipal ownership under the auspices of the National Civic Federation will be held in New York city on November 27th under the chairmanship of Melville E. Ingalls of Cincinnati, chairman of the directors of the Big Four railroad. A brief statement as to the scope of the inquiry has been issued and the important points likely to be discussed include the effects of municipal ownership on politics, the appointment of employes, municipal corruption, wages and hours of labor and the relative cost of service. The final report of the committee will include a history of the municipal ownership movement.

Consul Hannah of Madgeburg, Germany, reports that the king of Italy has offered six prizes for an international competition on the occasion of the exposition in Milan in 1906. Among them is one of $1,000 "for a convenient and simple device to protect workmen in electrotechnics from the currents with which they come into contact," and another of $2,000 "for an improvement, a system, or a machine, which has real practical value and possesses the property of newness."

QUESTIONS AND ANSWERS.

Dynamo and Motor Design.

S. G. L. of Summerfield, N. C., asks advice regarding the design of a small dynamo which he wishes to build. He sends sketches as to the sizes of the various parts and wishes to know the length and size of wire for armature and fields, the ampere-turns and the wattage and voltage that may be obtained from the machine.

ANSWER.

From the data given it is not possible to answer the questions. The voltage at which the machine is to operate is one of the factors which is necessary in starting out with the design, and this is not stated. If the inquirer intends to operate small incandescent lamps, 15 to 25 volts would probably be satisfactory, while if standard voltage is used the case will be entirely different. The number of revolutions per minute would depend entirely upon his facilities for operating, and should, under no conditions, exceed 1,500 revolutions per minute.

In the sketch enclosed with the inquiry projections are shown on the armature surface, but whether these projections are spacing blocks or armature teeth is not specified. In either case the width of the spaces should be given in order that the proper amount of wire may be calculated. If these projections are non-magnetic spacing blocks, then the air-gap would be five-sixteenths inch on each side, as shown by the sketch. This would be entirely too much for a small machine, and a great number of ampere-turns would be required to overcome the reluctance of the air gap. It would be good practice to use a toothed armature having slots and teeth of approximately the same section.

There is no detail showing whether the armature is to be of laminated or solid iron. The latter construction would, of course, be prohibitive on account of high eddy-current losses.

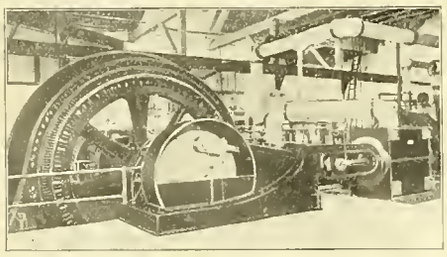
An inquiry comes from H. A. A. of Pawnee City, Neb., which reads as follows: "Can you furnish me instructions for making a one-fourth-horsepower induction motor for 120-cycle current at 110 volts? Instructions to be plain and simple for an amateur."

ANSWER.

Data for the construction of such a motor are not readily available in terms which will be plain to one not acquainted with the methods of construction and operation of such machines. In fact, the manufacture of a motor of this size and number of cycles would be a rather difficult task for an amateur. However, original work of this kind is not to be discouraged, and the Western Electrician will be glad to give space in its columns to any good suggestions for answering this question which interested readers may contribute.

Compact Street-lighting Plant.

The city of Alpena, Mich., which recently voted an issue of bonds to defray the cost of a municipal lighting plant, has contracted with the Allis-Chalmers Company of Milwaukee for the electrical and power equipment. This consists of a 60-cycle Bullock alternating-current generator, normal capacity 150 kilowatts, direct-connected to a Reynolds-Corliss cross-compound heavy-duty engine; an exciter unit, jet condenser, switchboards, sub-station apparatus and equipment for 100 arc lamps connected in series. A feature of this installation will be its compactness, as provision has been made for the future enlargement of the plant, when the growth of the city demands it, by an extension of the existing building and the addition of another generating unit.



INTERIOR OF STREET-LIGHTING PLANT AT OWENSBORO, KY.

The accompanying illustration shows a similar plant installed by the Allis-Chalmers Company in Owensboro, Ky. The Alpena plant will greatly resemble the one illustrated.

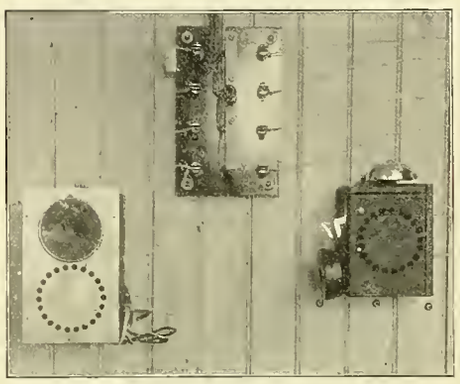
The Dictograph and Multiphone.

Two new products of the Hutchison Acoustic Company, New York, are the dictograph and the multiphone, the latter being similar to the acousticon, which was described in the Western Electrician of September 23d.

Illustrated in the accompanying picture is the dictograph, which is in reality a telephone on a small scale, but of original design. The receiver and transmitter are in one part, as shown in the picture to the left. The advantage of the instrument is that it enables a person speaking 30 feet away from the transmitter to be heard or will allow of the hearing of a whisper six to 10 feet away.

The internal mechanism of the instrument is the secret of the inventor, but it lies largely in the receiver, which is constructed without the regular induction coils in use in the ordinary receiver.

The possibilities of this instrument are great, but



TWO TYPES OF DICTOGRAPH APPARATUS.

it is especially adapted for use in place of the ordinary speaking tube, or where a local telephone is needed. It can be very easily used by an employer for dictating to a stenographer, as the latter could take the dictation at any distance from the speaker, without having to hold a receiver to the ear. It, of course, works both ways, allowing both persons to converse equally well.

On the right-hand side of the picture is to be seen an instrument much similar to the one described, but with a receiver for the ear. In this instance the person listening has to hold the receiver, but the person talking can stand as far from the transmitter as when using the one-piece dictograph.

The multiphone, which is much similar to the acousticon, was given a practical demonstration in New York on the evening of November 17th. At that time a performance of "Veronique," the English opera, was being given in the Broadway Theater. Two doors above and 200 feet away from the stage a number of guests of the company were sitting in a room and enjoying the singing by means of the multiphone.

The room was out of hearing distance from the stage, being shut off by two or three thick walls, which were absolutely soundproof. In the room was a receiver, fitted with an ordinary metal megaphone horn, through which the whole opera was heard by the company. The monologue and solo parts were as realistic as they would be heard from the stage, but, owing to a slight vibration made by the metal horn, the regular chorus and orchestra parts were vibrated. This latter defect in the horn can be overcome by the use of a glass horn, says the inventor, Mr. K. M. Turner of the Hutchison company.

Suggested Changes in the National Electrical Code.

At the meeting of the electrical committee of the Underwriters' National Electric Association to be held at the rooms of the New York Board of Fire Underwriters on December 6th, several important committee reports and a large number of suggestions for changes in the National Electrical Code will be considered. The suggestions have not been considered by the electrical committee, but are simply a compilation of recommendations received by the secretary from individuals in response to a circular sent out in October.

This meeting will be open to all interested in the matter of rules for the installation of electric wiring and apparatus as contained in the Code. The importance of these meetings should not be overlooked, as they offer to those interested in electrical work an opportunity to be heard in the considering of rules and restrictions.

That the work of the electrical committee of the Underwriters' association is important is recognized by the officers of the National Electric Light Association, who have sent out a circular letter requesting that members take advantage of the meeting on December 6th and appear or be represented so as to co-operate and bring about such modifications of present or proposed rules as may be unfair, burdensome or impossible to comply with under local conditions.

The committee reports and suggestions to be considered at the meeting have been printed in bulletin form and are being sent out from the office of the secretary of the Underwriters' association, 55 Kirby Street, Boston. The committee reports offering proposed changes or suggestions are those on car wiring, double and single-pole switches, high-tension motors, switches and cut-outs, rheostat specifications, wiring and construction of fan motors and flexible tubing. Besides these, there are individual suggestions for changes involving the following rules of the Code: Rules 1, 3, 4, 8, 11, 12, 13, 14, 17, 21, 22, 24, 25, 26, 27, 28, 42, 45, 50, 51, 54, 55, 60, 62, 64. There are also 29 miscellaneous suggestions.

The Problem of the Gas Turbine.

Dugald Clerk, the new president of the Junior Institution of Civil Engineers in England, delivered his inaugural address on November 3d, when he was inducted into the chair by Sir William White, past-president of the Institution.

Mr. Clerk said that the wonderful success obtained with the steam turbine in its various forms had naturally attracted the attention of engineers to the apparently analogous problem of the internal-combustion turbine. Up to the present, however, the dreams of the theorist had obstinately declined to realize themselves in tangible iron and steel. It appeared to him that too little weight had hitherto been given to the differences between the steam and internal-combustion engine problems, and some had, indeed, assumed the solution of the gas turbine to be the easier of the two. Mr. Parsons, as long ago as 1884, had outlined the fundamental idea of nearly all subsequent proposals for gas turbines. The problem had been recently investigated by R. M. Neilson, Dr. Charles E. Lucke and Prof. Sidney A. Reeve. It was recognized that the temperatures possible in the cylinder gas engine were impossible for the gas turbine. In ordinary, if not in the best gas-engine practice, temperature ranged as high as 2,000° C., which was considerably over the melting point of platinum. No turbines constructed on the lines of Parsons or Laval could be possibly made to work with continuous supply of such gases, and it was said by those who took a favorable view of the gas turbine that it was necessary to use the gases at a much lower temperature.

Mr. Neilsen fixed 700° C. as a temperature which turbine blades would probably stand without too rapid deterioration. The speaker differed from Mr. Neilson in taking that view. Nothing new had been proposed as to the thermo-dynamic cycle of the gas turbine, so that all reasoning upon efficiencies depended upon the deductions already made for internal-combustion engine practice. Seeing the impossibility of constructing a turbine with materials to stand a high temperature, many had proposed to convert high temperature into kinetic energy. Such proposals included the compressing of a gaseous mixture to, say, 50 or 60 pounds above atmosphere, the igniting of that mixture within a combustion chamber at constant pressure, and the expansion of the mixture through an expanding jet of the Laval type, so as to drop the temperature and obtain its equivalent in kinetic energy or velocity of the gaseous particles. The rapidly moving particles at the relatively low pressure and temperature were then allowed to impinge upon rapidly rotating blades of sickle configuration and give up their energy of motion. This appeared to be the most feasible of all the gas-turbine proposals.

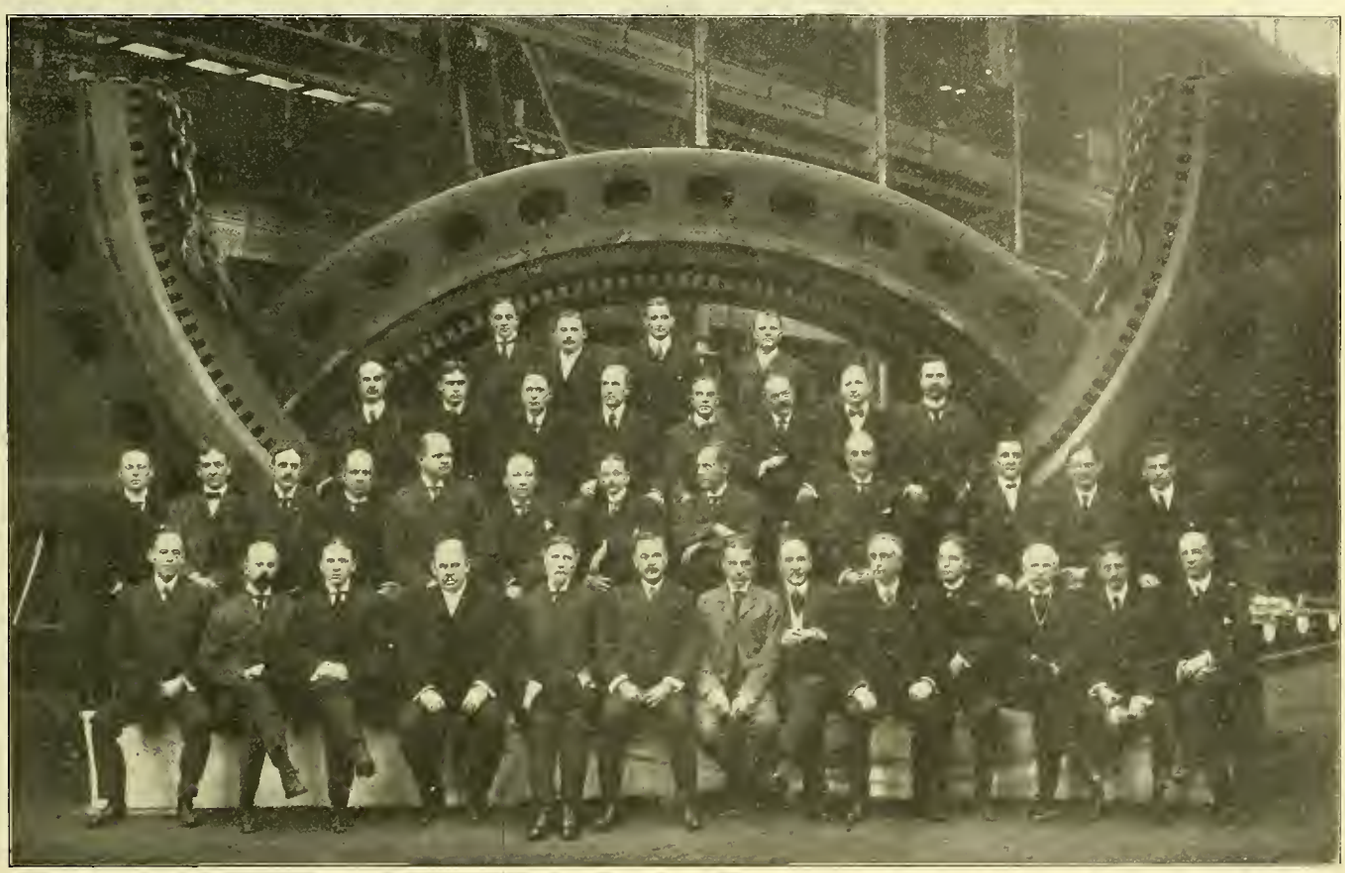
Success by this cycle of operations required (1) a rotary or turbine compressor of high relative efficiency; (2) an expanding nozzle which should ensure that free expansion was quantitatively equivalent to adiabatic expansion behind a piston; (3) a rotating turbine of such construction as to secure very high efficiency of transformation of kinetic energy of the moving gas into effective work available at the turbine shaft. The difficulties, both theoretical and practical, of realizing those conditions were very serious indeed. He was not aware of any turbine compressor capable of compressing up to 140 pounds absolute for atmosphere with anything like 60-per cent. efficiency, while before success could be obtained the efficiency of compression, as far as diagram was concerned, should be at least 90 per cent. Assuming that to be attained, however, and taking 90 per cent. of efficiency of nozzle expansion and 80 per cent. efficiency of conversion in turbine, it would seem one could obtain with a cycle, having negative work equal to 0.4, the following efficiencies: To get 0.4 of work in compression would require 0.445 of work put into the compression. On expanding in the nozzle there would be obtained 0.9 only of the total energy of the flame gases in the shape of kinetic energy, and of that 0.9 there would be only 0.8 returned in the shape of available work by the turbine. That gave a total work for the turbine of $0.72 - 0.445 = 0.275$, so that for a cycle which should give 0.6 in the work there was only obtained 0.275, or about 22 per cent. Inasmuch as no such efficiencies of compression or of jet expansion as had been assumed in this calculation were at present known, there appeared to be no

likelihood of the production of any gas turbine which could rival the reciprocating engine in efficiency and in economy.

Compromise might effect something, and a more hopeful line for the gas turbine was in the use of steam to provide the working fluid under compression without a compressor, and in the heating of this steam by a very small quantity of combustible mixture of gas and air under pressure. This would be a compromise between the flame turbine and the steam turbine, but, although such a machine could be made to operate mechanically, its efficiency would not be high.

Westinghouse Managers' Meeting.

The annual convention of the district managers of the Westinghouse Electric and Manufacturing Company was held November 13th to 16th, at the general offices of the company at East Pittsburg. Mr. R. L. Warner, New England manager of the company, acted as chairman of the meetings, which



GROUP OF WESTINGHOUSE MANAGERS AT MEETING IN PITTSBURG.

were attended by the following-named representatives of the company:

C. S. Powell, general agent, New York City.
W. F. Zimmerman, representative, New York City.
Maurice Coster, manager export department, New York City.
W. C. Webster, assistant to 2d Vice-President, New York City.
F. H. Shepard, New York City.
G. Pantaleoni, general southwestern manager, St. Louis, Mo.

Managers.	Managers.
J. R. Gordon, Atlanta.	C. F. Medbury, Detroit.
H. H. Seabrook, Baltimore.	T. J. McGill, Minneapolis.
D. E. Manson, Boston.	C. A. Bragg, Philadelphia.
C. W. Underwood, Buffalo.	W. F. Fowler, Pittsburg.
T. P. Gaylord, Chicago.	D. E. Webster, St. Louis.
C. W. Regester, Cincinnati.	W. W. Briggs, San Francisco.
G. B. Dusinberre, Cleveland.	N. P. Randolph, Seattle.
J. E. Johnson, Dallas.	Paul T. Brady, Syracuse.
L. M. Cargo, Denver.	

At the opening session, which was held Monday morning, addresses were delivered by Mr. E. M. Herr, first vice-president of the company; by Mr. Frank H. Taylor, second vice-president, and by others of the officials. During the four days of the convention papers on topics of general interest were read by many of the officials and managers and by representatives of allied companies.

On Wednesday evening the delegates and representatives of the local Westinghouse companies were entertained at the Hotel Schenley by Mr. E. M. Herr.

At no time in the history of the company have the managers spoken with more enthusiasm of the business conditions in their respective territories. Among these opinions expressed were the following:

"I have it from the lips of a representative of one of the largest commercial interests in South America that the people in those countries would rather buy American machinery than buy European goods."

This statement was made by Mr. Coster, the manager of the export department. Speaking further on the prospects for export business, he said: "The outlook for foreign trade has never been brighter in this country than at present. The superiority of American machinery as compared with European manufacture, is being demonstrated every day, and in these markets where the Germans and English have heretofore enjoyed a monopoly, America is now gradually obtaining the lion's share of the business. As far as the Westinghouse companies are concerned, we are enjoying the particular advantage that the name of Westinghouse is well known the world over; that our goods are used in every country on the globe, and hence we have no difficulty to obtain business for our companies."

Among the other attendants at the managers' meeting, R. L. Warner, the New England agent, stated: "The business outlook in New England was never brighter than at the present time, and especially does this refer to the Westinghouse Electric and Manufacturing Company. Our product is constantly growing in favor, and I also believe that the fact of the New York, New Haven and Hartford Railroad Company being about to operate its trains by the single-phase locomotive, will be a great factor upon the electric-railway business of the Westinghouse Companies."

F. H. Taylor, second vice-president: "I feel that this is a subject of congratulation, not only to ourselves, but also to the entire business interests of Pittsburg, that the prospects for prosperity in our works never will be brighter than at present. While we are already in possession of the facts which prove that the year of 1905 has been the banner business year in the history of the factory, we have every reason to believe from the assurances given us by our district managers from all over the country, who have now been in session here, that the industrial advancement throughout this country promises an unprecedented activity, and that our company will reap the benefit of this activity in a measure perfectly satisfactory to the company. I look for the business of 1906 to be materially larger than that of 1905."

C. S. Powell, general agent, New York city, said: "The adoption of electricity by the Pennsylvania Railroad on the lines of its eastern division, by the New York Central on part of its lines, and the decision of the New York, New Haven and Hartford Railroad Company to operate trains with the single-phase locomotive, will prove a great impetus toward increasing the future business in the electrification of railroad lines throughout the country. As the progress and development of this matter began in the East, so I foresee the advancement of electric railroading in the fact that these eastern railroads have set the ball rolling in that direction."

T. J. McGill, the northwestern agent, located at Minneapolis, in speaking of the business outlook in that part of the country, said: "Every indication at present in the Northwest leads me to believe that 1906 is going to be the greatest year in history. The record-breaking crops of 1905, at high market values, have greatly increased our local wealth and have attracted a large volume of outside money for investments. The railroad traffic, all building operations and bank clearances have had a marvelous increase and a healthy one. Further, the beneficial results are pre-eminent. At one time the Northwest was only known as a sparsely inhabited section, but we must now agree with Mr. J. J. Hill, who says that it ranks as an empire."

J. R. Gordon, the representative of the South, with headquarters at Atlanta, stated: "The development of the South within the last five years has been truly phenomenal. Business, commercial and manufacturing enterprises are daily increasing. Electricity has had as much to do with this development as any other factor, on account of the fact that it has made possible utilization of the many waterfalls which are located in that section of the country. These waterfalls are now being rapidly developed, and the power is used for driving the machinery in the old manufacturing plants and gives a new impetus to the establishment of others."

L. M. Cargo, representative for the district comprising Colorado, New Mexico, Wyoming, Utah Idaho, stated that: "The new discoveries of valuable minerals are made in our district almost every hour, and the wealth of gold, silver and copper, especially the latter, is inestimable. This means a greater development of the mining industry of that country than has yet been dreamed of, and, inasmuch as the application of electricity makes the operation of mines an easy task, we are looking for a great business in that branch of the industry."

W. W. Briggs of San Francisco said: "The people on the Pacific slope are looking forward to a period of uninterrupted prosperity. I believe that the development of interurban railway business has only just commenced, and with the perfection of the single-phase locomotive and the steam turbine this particular branch of the business will be very much greater than it has been heretofore."

C. A. Bragg, district manager, of Philadelphia, says: "In regard to the prospects for business in the coming year, they appear to me most flattering. If we have had successes in the past and banner years, I think the coming one will make them look insignificant as regards the amount of profitable business there is ahead of us. There is nothing in the horizon that I can see which will interfere with not only our business but the general prosperity of the country. The indications are so strong that I cannot see how they can in any manner be harmed."

The accompanying group photograph shows the gentlemen in attendance at the meeting. Many well-known faces can be recognized in it.

The trustees and faculty of the Thomas S. Clarkson Memorial School of Technology of Potsdam, N. Y., are sending out invitations for the "Founder's Day" exercises, which are to be held Thursday evening, November 30th. The address will be delivered by John C. Wait, M. C. E., LL.B., of New York city.

SELLING ELECTRICITY.

Under this heading will appear, from time to time, articles, suggestions and examples which will be of assistance in the constant effort to increase the existing demand for electric current and to create new demands.

The Sign Business.

In a letter of recent date the Newburg (N. Y.) Light, Heat and Power Company says: "When the sign business was called to our attention with sufficient force to really impress us we purchased a sign of quite elaborate proportions, reading 'Light' on one side and 'Power' on the other, placing the same in a prominent position on our office building. This sign has been operated every night from early dusk until midnight since its purchase. We then made a thorough canvass of all probable customers in the city for sign business, in an effort to sell signs to the customer outright. This did not prove a success, but we managed to sell two signs to prominent customers. Since those were installed we changed our policy and are now furnishing signs free to customers who will enter into term contracts, the term varying from one to five years, the price for illuminating varying with the length of the term. A flat rate is made for operating these signs, and lamp renewals and all attendance are furnished by us so that the customers is obliged to give no care or attention to the sign. The signs are operated by clock switches which we find to be fairly satisfactory. We now have 14 signs in use, and our experience shows that these bring us in a considerable greater revenue per kilowatt than our regular lighting and run for a longer period. We shall probably make a second canvass in the near future on somewhat different lines and expect to be able to place a considerable number of additional signs. Our city has a population of 25,000, but the business men are somewhat conservative, so that under the circumstances we feel fairly well satisfied with the results of our efforts up to date."

A Connecticut central-station company reports that it figures the rental on the signs put out on a basis that will reimburse it for the cost of sign and wiring complete at the end of two years, plus eight cents a kilowatt-hour for current furnished. The business was established by paying solicitors $3 for each contract made for a sign for a period of two years.

A company in New York state sells signs at cost and installs them free. It considers the sign proposition a paying one.

Central-station Avdertising.

Effective newspaper advertising of electric-light companies is not confined to any one section of the country. A month ago there was illustrated in this department a good central-station ad in a New York daily newspaper, while herewith is reproduced a recent effort in the same line published in Omaha This ad is perhaps not quite so attractive as the New York example, and it would perhaps have been wiser to have displayed less prominently the mere name of the company and utilized the space to give still more emphasis to reasons why it is of advantage to use electric light and power. What the company is going after, of course, is new business; its corporate name is probably well known already. Nevertheless, the ad is sure to be read and to do good. The typographical arrangement is balanced with considerable ingenuity, and the reasoning setting forth the advantages of the various types of apparatus contains many "pointers" of interest. In its original form this ad was 10 inches high and 15½ inches wide, taking the full width of the newspaper page.

Another scheme of advertising adopted by the larger central-station companies is the publication of monthly papers for free distribution. These papers are attractively printed and illustrated and set forth the uses to which electricity can be put, with interesting examples. The pleasing style in which these publications are issued is shown by the three cover designs herewith reproduced. These little magazines are about six inches wide and nine inches high and contain from 12 to 16 pages. The papers illustrated are Edison Light of the Edison Electric Illuminating Company of Boston. Bulletin of the New York Edison Company and Light and Power of the Public Service Corporation of Newark, N. J. The Electric City of Chicago is a paper of somewhat different size and character. Although published in the interest of the central-station companies of Chicago, it is issued by a separate concern, the Electric City Publishing Company.

Decorative Lighting at Coney Island Carnival.

A five-day carnival, from September 19th to 23d, inclusive, wound up the Coney Island season of 1905. It is rather interesting to note, as indicating the difference in climate, that the largest of the amusement parks in Chicago was kept open until October 15th, although Chicago is a trifle farther north than New York. However, the season at "Coney" closed in a blaze of glory, with enormous crowds and exuberant merrymaking. The processions and spectacles were more artistic and more pretentious than the corresponding features of the year before. In addition to the usual brilliancy of the electrical illumination, thousands of incandescent lamps were strung across Surf Avenue. The accompanying illustration, taken from a night photograph and reproduced from The Brooklyn Edison, shows the striking effect.

Electric lighting is, of course, particularly well adapted for decorative purposes, both indoors and out, and in all cities and towns the central-station manager should be on the alert for opportunities of this character. He will often find it to his advantage to promote intelligently street fairs, carnivals and celebrations to increase the demand for current.

NIGHT PICTURE OF SURF AVENUE, CONEY ISLAND, DURING CARNIVAL.

Rates in Marseilles.

Marseilles, the third largest city in France, has just made a contract with the Compagnie Générale d'Electricité for the supply of current for all purposes within its limits. The concession is for 36 years. The price of current for private consumption is fixed at 0.062 franc per hectowatt-hour, with reductions in case of large consumption. For industrial uses and for power the price is fixed at 0.0375 franc per hectowatt-hour. For public lighting the price is 0.03 franc per hectowatt-hour, reduced to 0.02 franc for the industrial schools or public sanitary services. In addition, the concession holders are obliged to furnish for the town trade-schools, without charge, a total of 100,000 hectowatt-hours.

Electrical Operation of Waterworks.

In a letter to the local paper at Morgan Park, Ill., with reference to pumping water by electricity, Fred W. Insull, secretary of the North Shore Electric Company, which company supplies the electric lighting in suburban towns around Chicago, says that his company is ready and willing to make a proposition to the village for the furnishing of the same number of street lights which it now has, and for the pumping of the same amount of water now used by the village, at a price which will be at least one-third less than the present cost of maintenance of the street lighting and water department. The North Shore Electric Company has spent considerable time and money, Mr. Insull says, in investigating the economical pumping of water from artesian wells, for the reason that it controls the waterworks at Harvey, La Grange and Oak Park, having 11 artesian wells at Oak Park, two at La Grange and three at Harvey, all of which it is arranging to equip with electric pumping machinery. The experience of the company for the last three years is that a saving of at least 40 per cent. can be effected by electric pumping as compared with the cost of pumping by compressed air.

Electric Fans as Auxiliary to Steam Radiators.

The electric-fan season is about over. The electric-fan season is about to begin. A paradox? No. Merely the statement of a fact, for the electric fan, which keeps you cool in hot weather, can also be made to keep you warm in cold weather.

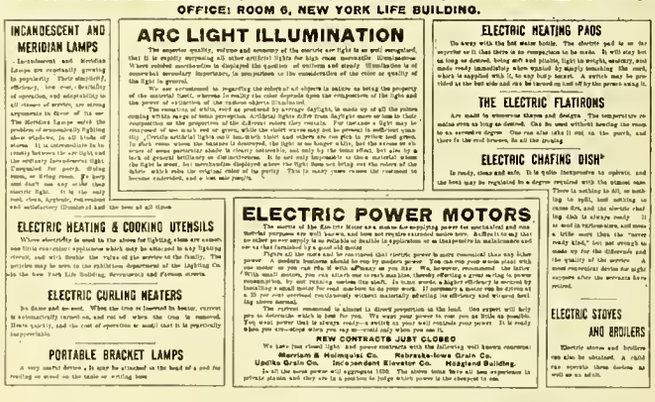
How?

Thusly:

There are many rooms in steam-heated apartments where either the radiator is too small or the steam pressure too low to maintain a comfortable temperature in cold weather. Here is where the electric fan applies. Set it where it can blow against a large part of the radiator surface, and your cold room will soon be warm. Thus the same agency that cools you in summer serves to warm you in winter, just as you may blow your hot coffee or porridge to cool it and blow on your cold hands to warm them.

Therefore put not your electric fan away because you no longer need it to keep you comfortable in the dog days, but have it in readiness

COVER DESIGNS OF CENTRAL-STATION PERIODICALS.



FACSIMILE OF ADVERTISEMENT IN OMAHA DAILY NEWSPAPER.

for cold-weather use, where it may be found equally a boon.

Of course, without Edison service in your home, you are unable to avail yourself of these incidental advantages and conveniences. But then, today, no man or woman either, can afford to be without this modern agency of comfort, health and good cheer. The luxury of one decade is the necessity of the next, and in 1905 we may well and truly paraphrase an old motto, and say with significance, "What is home without Edison service?"

If there are difficulties in the way, we can remove them.—The Brooklyn Edison.

What Abundant Lighting Did for Denver.

With the plans going forward for the additional municipal lighting that will make Denver the real "City of Lights," we should not overlook the fact that the business men were the first practical exponents of the new idea. Their displays of lights, almost countless now on the downtown streets, were the first practical step toward making the city beautiful with lights. They have practiced what we all have preached.

The desire for lights for commercial purposes grew upon the business men almost imperceptibly, so they say. Before they knew it they found that lights were one of the most effective advertising mediums. Those who adopted the lights told of increased business, of an indescribable feeling of greater cordiality produced between merchant and patron. Their neighbors heard of this; they began to consider.

The result is evident on every business street, and even into the residence sections and the suburbs. Drug stores, groceries and other smaller business houses far out from the heart of the city have their light signs and have their windows illuminated by numerous electric bulbs. It must be to the interest of them all or they would not continue the use of the lights. They benefit, the people benefit, because the lights form a pleasing break in walking through streets made more or less dark by the foliage. The "City of Lights" soon will be a reality, one of the best that has ever befallen Denver.—Denver Post.

Methods of Extending Business.

President Blood of the National Electric Light Association has appointed Mr. James I. Ayer of Boston to report on the progress of electric heating at the next convention of the association to be held in May or June next. The report made by Mr. Ayer on this subject at the Denver meeting attracted much attention and was fully discussed, both report and discussion showing clearly how much can be done in the way of getting new business by demonstrating the comfort and convenience as well as the economy in many cases, of the use of various household utensils operated by electric current. This industry is constantly advancing in efficiency and variety of apparatus, and Mr. Ayer's next report will be looked for with interest.

It is interesting to note that one or two of the larger stations in the association have recently established an electric-heating department with the object of pushing this branch of the industry. The Edison Electric Illuminating Company of Brooklyn may be mentioned as an example. Such a department might be proportionately valuable in smaller stations.

The committee on rates and costs which made a report to the Denver convention of the National Electric Light Association has been reappointed by President Blood. The committee consists of Charles L. Edgar (chairman), Louis A. Ferguson, Samuel Scovil, Frank W. Frueauff, P. G. Gossler and R. S. Hale. George W. Brine, who was a member of the committee last year, declines on account of illness to serve again this year.

Elevator Service.

Referring to the efficiency and economy of electric-elevator service in office buildings, the statement is made that the electric elevators in the Times Building, New York, average 103 car-miles daily on week days. Their average consumption of current is 3.82 kilowatt-hours a car-mile. The service is high speed and high class, and of a kind which some years ago was thought impracticable for electrical machinery. Slower cars average less, some as low as two kilowatt-hours a car-mile. Central-station current is used.

For People Who Don't Use Electric Light.

Don't blow out the gas.
Don't sputter if the curling tongs singe.
Don't expect ironing to be a pleasure.
Don't expect hot-water bags to stay hot.
Don't throw burning matches any old place.
Don't expect your walls to keep clean.
Don't knock the kerosene lamp over.
Don't complain of the odor it can't help.
Don't think your home looks modern.
Don't imagine you're enjoying life fully.
Don't let your fire insurance lapse.
Don't move into an "unwired" building.
Don't have an illuminated Christmas tree.
Don't fall down the cellar stairs in the dark.
Don't chafe at the alcohol chafing-dish.
Don't cut your throat shaving in a poor light.
Don't answer the door-bell carelessly at night without a porch light.—The Electric City.

Cause and Effect.

In view of the present agitation on the subject of central-station advertising, it is interesting to hear the impressions of an observant visitor in an important city of the Central West, not long since:

"Lying over last evening for an hour or so at C——, we were glad of the opportunity to leave the train for a short walk. Our attention was particularly arrested by the darkness of the principal retail streets, although the hour was only eight o'clock and the sidewalks were well crowded with pedestrians, theater-goers, etc. We finally concluded that the impression of comparative gloom was due to the very small number of electric signs in use and the few lighted show windows, rather than to any lack of efficient street lighting by regular lamps. * * *

"A little further on we passed the extensive offices and display room of the C——— Gas and Electric Company, and were surprised beyond measure to find that in place of the brilliant displays made by lighting companies in other cities, not a single exterior lamp was visible, and the street was as dark as any other we had passed through. It seemed quite evident that the failure of the lighting company to employ electricity for its own advertising had exercised a marked influence on the natural tendency of other merchants to the use of electric signs."—Emerson Monthly.

Municipal Ownership Not Profitable in Great Britain.

In a report on British tramways, Consul Williams of Cardiff, Wales, calls attention to the fact that a large part of the English people favor the municipal ownership of all important public utilities, but submits figures to show that it is far from being as successful as its friends would wish. He thinks the matter of municipal ownership is one that deserves a great deal of careful consideration and expert examination. He writes:

"Public ownership of municipal utilities is popular in many British towns, and recent enabling legislation has allowed the advocates of the system to make investments on a large scale. The schemes cover a multitude of utilities, some almost purely social, but the largest items have been spent on power plants and electric trams. The ratepayers do not find the last-named profitable in all cases. For instance, the Cardiff Corporation Tramways, representing a capital expenditure of $3,530,048, returned a net profit of only $101.60 for the year ending March 31, 1905. This poor showing may be attributed to two causes—excessive costs and low income. In the matter of costs, a good showing was made so far as working expenses were concerned, for, although there is a payment of time and a half for Sunday work and double time for holidays, they amounted to only 5.948 pence per car-mile.

Relative Working Expenses.

"The following table shows the relative working cost per car-mile of the large tramway systems:

Town.	Years.	Working Cost. Pence.
Glasgow	1905	5.18
Newcastle-on-Tyne	1904	7.19
Manchester	1905	6.99
Bolton	1905	6.13
Hull	1904	6.04
Nottingham	1904	6.59
Aberdeen	1905	6.53
Liverpool	1904	7.25
Walsall	1904	6.15
Cardiff	1905	5.94

"It will be seen that Cardiff compares very favorably, being second only to Glasgow. The excessive inclusive costs in Cardiff were occasioned by the high loan charges, which amounted to 3.282 pence per car-mile, or 33 per cent. of the total expenditure. This was due to the magnitude of the capital expenditure, and herein lies a lesson for the advocates of public ownership in America. It is useless to expect any municipality to pay when the undertaking is handicapped by its capital expenditure. The low income in 1904-1905 may be attributed to several causes. First, of course, is the penny fare, which reduces the revenue to a minimum. The economic conditions prevailing in this country make penny fares imperative.

Division of Routes and Stages.

"The Englishman walks much more than the urban American, both from desire as well as necessity, and a higher fare would reduce the tramway revenue very much. The year's statistics demonstrate this fact, for, of the 23,372,579 passengers carried, 22,458,194 paid the penny or two-cent fare, and of the others only 755,876 paid the two-penny or four-cent fares. In order to reduce working expenses, while securing all possible penny fares, tramway managers have found it necessary to divide their routes into penny stages. This recalls a misapprehension under which many Americans labor, for the penny fare on British trams is a stage and not a trip fare. A trip of five to 15 miles, which can be made for five cents in many American towns, is not possible here, for the longest penny ride is rarely two miles long, while many are much shorter. The longest in Cardiff is 3,930 yards, and the shortest is 2,159 yards. These are representative figures.

"Perhaps the principal cause of the reduced income in 1904-1905 was bad trade. This was an unexpected experience for the advocates of public ownership, and the lesson should be taken to heart by Americans. It appears that tramways are the first municipal utilities to feel the bad effects of hard times. Depression in trade has led to a reduction of wages in many industries, and the tramway receipts have registered these reductions like a barometer. The chairman of the British Electric Traction Company (Limited) is quoted as saying that the net profit of his company was about $97,330 less than it was last year. At the same time they noticed that all companies of that sort had issued reports containing evidences of depression in trade.

Income per Car-mile.

"The following table shows the income per car-mile of 10 of the largest towns owning their own tramways:

Town.	Years.	Income. Pence.
Glasgow	1905	10.43
Newcastle-on-Tyne	1904	10.94
Manchester	1905	10.73
Bolton	1905	10.63
Hull	1904	9.61
Nottingham	1904	12.24
Aberdeen	1905	10.46
Liverpool	1904	10.67
Walsall	1904	9.00
Cardiff	1905	9.028

"In comparing the income per car-mile with that of American systems, four or five facts must be borne in mind. Many British towns do not operate their trams full time on Sunday, and the service in Cardiff does not begin until 2 p. m. Many double-deck cars are used, 100 of the 130 cars in Cardiff being of that type. British towns are more compactly built than American towns, and long hauls into the suburbs do not prevail here. Overloading of cars is not permitted, and conductors show 'Full' cards as soon as a car has taken on its quota of passengers. Stops are made only at certain points, and signaling elsewhere is useless.

"The exploiting of Britain for tramways is only beginning. Even London, as well as a great number of provincial towns, is almost virgin territory, and interurban electric-traction lines are almost unknown. The steam railways, which have catered so well to the traveling public in the past, and the many conservative regulations in rural districts, have combined to retard the growth of traction lines, but the present movement, having for its aim the recolonization of England, will bring the electric tram into favor. It in turn will open a way for the profitable investment of millions of pounds."

Improvements in Mobile.

The city of Mobile, Ala., is usually spoken of as a conservative town, and to this conservatism, it is said, is due the sound condition of its industries. As representative of its business institutions and as an example for public-utility companies in other cities the Mobile Register points with pride to the Mobile Light and Railroad Company. It says in effect:

The institution that has spent in the last few years probably the greatest amount of money for improvements in Mobile is the Mobile Light and Railroad Company—the company that owns all the street-car lines, one of the electric light plants and the only park near the city. This company for the last four years has been reconstructiog its physical property. It has taken up the 56-pound center bearing girder rails and replaced them with 90-pound grooved girder rails in the paved district. The rails have been set in concrete which extends nine inches below the base of the rail and has a width of eighteen inches.

To show that this company is being managed on the most conservative plan, one only needs to investigate the policy pursued in regard to charging to improvement accounts only such items as unquestionably belong there. For instance, the cost of relaying the tracks of the company, such as labor, ties, spikes, joints and bonding, were all charged to maintenance account, the improvement account being only charged with the value of the excess weight of the 90-pound rail above the 56-pound rail formerly used; 56 pounds of rail per yard was charged to maintenance.

The same policy has been pursued at the power house. A new steel frame power house (the first steel frame building in the city) was erected right over the old station. Only the cost of the new power station over and above the cost of the old station was charged to improvements, the amount of the cost of the old station being charged to maintenance. The new station has an engine room floor. The cost of raising the engines and generators and the additions to the foundations were all charged to maintenance. These items at the power station alone ran up to nearly $50,000.

A number of new cars have been purchased. Some of the old cars were worn out or were nearly worn out, so that the cost of the new cars were charged to maintenance. Twenty new cars are now under course of construction for this company.

As a consequence of this policy, improvement bonds of this company are issued only to a small amount of the money actually spent in improvements, the balance being charged to maintenance accounts for which no bonds can be issued. For that reason bonds of the company are considered of the best and the entire large issue has been taken in the local market.

The British Columbia Electric Railway Company recently distributed among its employes the sum of $17,000, each employe receiving $40. This sum represents the annual dividend distribution. The company has a profit-sharing system and divides a percentage of the dividends among the employes.

Copper and the Electrolytic Refining Industry.[1]

By John B. C. Kershaw.

The copper production of the world in 1904 amounted to the enormous total of 613,000 tons, according to the recently published statistical table compiled by Messrs. H. R. Merton & Co. To this total the mines of the United States contributed no less than 334,000 tons, or over 54 per cent.

The increase of production during the last 11 years has been most striking; but, as shown by the figures in the following table, the rate of increase has been somewhat irregular year by year, being lowest in 1895 and 1900, and highest in the years 1896, 1899 and 1904, respectively:

Year.	Output.	Average Price.	Year.	Output.	Average Price.
1894.....	324,000	£40 1/8	1900.....	479,000	£73 1/2
1895.....	334,000	42 7/8	1901.....	516,000	68
1896.....	373,000	47 1/4	1902.....	541,000	52 5/8
1897.....	399,000	49 1/2	1903.....	574,000	57 7/8
1898.....	429,000	51 3/8	1904.....	613,000	58 3/4
1899.....	472,000	72 3/4			

During these 11 years the production of the United States has grown from 159,000 tons to 334,000 tons, the mines in Arizona having chiefly contributed to this increase. The copper mines of the United States are now, in fact, producing more copper than all the mines of the world produced 11 years ago, and, moreover, are still rapidly increasing their output. On the other hand, the older copper mines of Germany, Spain and Portugal have not added to their aggregate output during the same period; on the contrary, as regards the mines located in the two latter countries, there is a tendency for the production to diminish. The increase, however, is not confined to North America. For example, Australia has enlarged her output from 9,000 to 34,000 tons in the 11 years; Canada from 5,000 to 19,000 tons; Chile from 21,000 to 30,000 tons; Japan from 20,000 to 34,000 tons; and Mexico from 12,000 to 51,000 tons. Judged by percentages, the last country has increased its production to a greater extent than the United States or any of its rivals, and it is noteworthy that this development has occurred chiefly in connection with the reworking of old mines.

The enormous expansion of the copper-mining industry during the last 11 years is chiefly due to the great demand for this metal in the electrical engineering and allied trades. Copper ranks next to silver as an electrical conductor, and its electrical conductivity depends greatly upon its purity. Hence the demand for copper refined by the electrolytic process, its purity being much higher than that refined only by the ordinary metallurgical method. In fact, in 1903 it was estimated that over 324,000 tons of copper, or nearly 57 per cent. of the total output, was refined by the electrolytic process.

Electrolytic copper refining is the largest as well as the oldest of the electro-metallurgical industries, and in view of the fact that the greatest refineries are now found across the Atlantic, it is noteworthy that the industry originated in the United Kingdom, being founded by one of the Elkington Brothers at Pembrey, South Wales, in the year 1869. Charles Watt, in his remarkable patent No. 13,755, of 1851 (the master patent of the electrochemical and electro-metallurgical industries) was the first to point out that crude metals could be purified in the electrolytic cell by making them function as anode in a suitable electrolyte, in which the impurities could not dissolve. Watt was many years too early with his patent, and until the direct-current dynamo had been invented and much improved, no industrial development of Watt's ideas was possible. In the year 1865, however, James Elkington, of the famous Birmingham firm of electroplaters, commenced experimental work upon these lines, which resulted in two patents being applied for in that year and in 1869, and in the latter year a small factory for operating the refining process was erected at Pembrey, near Swansea, South Wales. The output at this factory in the early days was only 1,500 pounds of refined copper per 24 hours, or about 250 tons per annum. Cylindrical earthenware vessels, 33 inches high by 17 inches in diameter, were used as depositing cells and each contained four cathodes and six anodes. They were placed terracewise in order to obtain circulation of the electrolyte, and 100 of them were connected in series. A saturated copper sulphate solution functioned as the electrolyte. This experimental plant at Pembrey proved so successful that the plant was soon enlarged to a capacity of 1,000 tons per annum. This oldest electrolytic refinery in the world is still in existence, although it has passed into the hands of another firm—Messrs. Elliots' Metal Company of Birmingham.

As regards the principle of the electrolytic method of copper refining, it is simply an extension, on an enormously magnified scale of operations, of one of the earliest experiments carried out by the student of electricity in the physical-science laboratory. The decomposition of a solution of copper sulphate by means of the electric current, and the deposition of copper at the cathode, using pure copper-foil electrodes, is an old and well-known laboratory experiment and is the basis of the electrotyping industry. When this experiment is carried out with impure copper as anode material, and with a slightly acid solution of copper sulphate as electrolyte, the conditions obtaining in the refining works are exactly reproduced. It will be seen that the impurities of the copper do not dissolve, but collect on the face of the anode, and finally fall to the bottom of the beaker or vessel in which the experiment is made. The copper alone dissolves at the anode, and is redeposited at the cathode, while the impurities collect as the insoluble "anode slime," or mud. If we possessed eyes capable of penetrating the molecular structure of the clear blue copper solution contained in the glass jar during the experiment, we might expect to see a regular and continuous drift of myriads of the most minute particles of copper from the piece which was being dissolved toward the other; and if we possessed means of isolating one of these particles, and of testing it, we should find that it carried an extremely infinitesimal charge of electricity. When we realize that this transfer of copper from the one piece to the other is taking place atom by atom, and it is calculated that there are sixty thousand million million of atoms in one cubic inch, it may seem incredible that this method of producing pure copper should be used on a scale of operations for industrial purposes.

The electrolytic production of copper, however, not only exists as an industry, but, as already pointed out, is one that in recent years has attained very great magnitude. In the period 1870-1890, the growth of the electrolytic copper-refining industry was slow, and the refineries erected in this country, Germany, France and America were all of small size. The second refinery in the United Kingdom was that of Messrs. Bolton and Sons, followed by the erection of three plants at Swansea, about 1880, for Messrs. William Foster & Co., Messrs. Vivians and Messrs. Lambert, respectively. Since 1891, however, the industry has undergone enormous expansion, chiefly in America. According to Ulke, the statistician of the industry, there are 32 refineries in operation at the present date, with an annual output of 324,000 tons. America contributes nine refineries and 86 per cent. of this total. The English refineries are six in number, and are stated by the same authority to be producing 8.8 per cent. of the 324,000 tons, or 28,500 tons per annum. Reliable figures on this subject are, however, difficult to obtain since for many years past the English refiners have refused to publish any details concerning their works or output, and Ulke's figures are simply estimates based on expert knowledge.

The transfer of the chief center of the electrolytic copper-refining industry to the other side of the Atlantic from England and Germany, where it originally developed, has been brought about by comparatively simple causes. The electrolytic process of refining copper is most successfully worked with metals from pyretic ores, carrying considerable amounts of silver and gold. When such crude metal is treated by the electrolytic process, the silver and gold collect on the bottom of the baths as "anode slimes" or mud. The value of the precious metals recovered from the slimes produced, when refining certain classes of ore, pays many times over for the cost of the refining process, and it is these ores which are chiefly found in the butte districts of the western mining states of Montana and California. Twenty years ago these ores were only smelted in America, and the crude metal was shipped to England, France and Germany, for the refining operation. Today this position of affairs is changed. America no longer exports the crude copper containing silver and gold as impurities; she extracts these metals by the electrolytic refining process, either at the mines, as at Anaconda, or at one of the smelting and refining works erected in the eastern states, and exports only refined copper to Europe. English, German and French works have thus been deprived of their most valuable source of metal for the electrolytic refining operation, and the development of the industry on this side of the Atlantic has consequently been checked by causes beyond the control of the owners of the refineries. For this reason none of the electrolytic copper refineries in England are comparable in size and output to those found across the Atlantic, and much difficulty is experienced by their owners in obtaining a supply of crude metal, even for the much smaller scale upon which they are operating.

1. From the Engineering Supplement of the London Times.

Electric Heat That Wasn't Used.

Park Benjamin, in a recent communication to the New York Times, says that it was a pity the ball recently given by Prince Louis of Battenberg on board his flagship the Drake at a North River dock should have been marred by the cold merely because, Mr. Benjamin says, the prince's advisers "failed to discover that abundant electric heaters were available and that a branch from the nearest electric main, which the electric-lighting company could have provided, would have given all the current needed to make the ship comfortable." Mr. Benjamin continues: "It was found entirely practicable recently to heat temporarily in this way the wide piazza over 100 feet in length of a residence located in the northern part of this state during the extremely cold weather in midwinter. No request appears to have been made of the electric-lighting people to deal with the easily-met conditions existing on the Drake, although it was known here long ago that this ball was contemplated, and cold snaps in November are certainly to be expected."

Among the guests at the ball were August Belmont, Mr. and Mrs. Clarence Mackay, Mr. and Mrs. Thomas F. Ryan and Mr. and Mrs. George Westinghouse.

Ohio Telephone Notes.

A syndicate of Columbus and Toledo men has purchased $30,000 worth of the stock of the Galipolis Telephone Company, getting control of the plant. Cyrus Huling and Frank L. Beam of Columbus, Dwight Sapp of Mount Vernon, W. W. Morrison and J. E. Gardner of Toledo and E. N. Coen of Vermillion are the men interested. The company has 500 subscribers with a modern plant. Plants will be constructed at Middleport and Pomeroy, and all will be connected with the long-distance lines at Athens. The plants will form part of the proposed merger of companies at Charleston, Point Pleasant, Parkersburg, Guyandotte, Huntington and other West Virginia towns, as well as some in Ohio.

Charles Y. McVey has been made general manager of the Federal Telephone Company to Cleveland, to succeed J. B. Hoge, whose time is largely taken up with other duties and with his position as president of the National-Interstate Telephone Association. Mr. McVey has been assistant general manager of the Federal for some time. He came to Cleveland some years ago, after being connected with a local company at Youngstown. He will have supervision over the United States Telephone Company also.

Toledo papers say that the Bell people are arranging to go after business in that city in a more active way than in the past, having completed some important improvements to the switchboards, and extensions to the lines. The price of service has also been reduced some.

The new Bell exchange in Painesville is giving good satisfaction. It was cut over when the subscribers numbered 300. The list is now increasing. The plant is modern in every way, and the long-distance arrangement is good. Business between Cleveland and Painesville is heavy, owing to the fact that many Clevelanders have summer homes there. This town is on the eastern boundary of the present Bell territory. L. J. Van Allen is the manager of the exchange.

During the month of October the Central Union cut in new cables and made the city system metallic at Tiffin. At Circleville additional cable work was put in and additional switchboard facilities completed.

The Cincinnati and Suburban Bell Telephone Company and the Citizens' Telephone Company of Kentucky have inaugurated a novel system of making Christmas presents of telephone service for one year. They offer 10 telephones free in a contest to the 10 persons sending in the best reasons why Bell telephones should be in every residence. The contest will be open to all, and answers must be in the office by December 15th. The answers are limited to 50 words, and disinterested judges will make the award.

The Perry County Telephone Company of New Lexington has increased its capital stock from $35,000 to $50,000.

The Stillwater Mutual Telephone Company of Flushing has been incorporated with a capital stock of $5,000. A. W. Collins, O. H. Groves and others are interested.

The Frayzesburg Telephone Company of Frayzesburg has been incorporated with a capital stock of $10,000 by S. H. Frazier, A. J. Stitt and others.

C.

Indiana Telephone Items.

The Burnettsville Co-operative Telephone Company has been organized to establish an exchange in Burnettsville and build and operate telephone lines throughout White County.

The Clayton Telephone Company has passed to the ownership of R. D. Stone of Clayton. He announces that he will begin at once extensive improvements and extensions.

The Lowell Telephone Company's exchange was destroyed by fire on November 13th. The exchange will be rebuilt at once and some new equipment added.

The Crawfordsville Home Telephone Company announces that it has made long-distance connection with points in Illinois, Indiana, Ohio, Kentucky, Missouri and Kansas.

The Central Union Telephone Company and the city authorities of Terre Haute have agreed upon a plan for putting the company's wires underground. The contract or agreement provides for a conduit system, to be used jointly by the Central Union Telephone Company, the Western Union and the Postal telegraph companies, and that one duct shall be reserved for the city's low-tension wires.

The Indianapolis Telephone Company and the New Long-distance Telephone Company will soon issue a new joint telephone directory. Mr. C. E.

Stinson, the new general manager, announces that an aggressive policy relative to pushing the toll lines has been decided upon by the officials. The plan is now to run toll lines into every city and many of the smaller towns in Indiana, and to connect them all with Indianapolis. The resignation of Mr. H. B. Sale as general manager of the Indianapolis company has been accepted. Mr. Sale has served the company with signal ability and close application for five years, and will now take a rest for a time.

The Town Board of Hope has for the second time denied a franchise to Lewis Blades to construct a telephone system in Hope.

The Indiana State Tax Board has recently issued a report which shows that the 268 Independent telephone companies in Indiana reporting to the auditor of state for 1905 represent an investment of $11,605,873, an increase of $3,897,242 over 1904. The gross earnings for the last fiscal year were $3,500,000, a gain of 77 per cent. over the last preceding year. The report also shows that improvements to the amount of $112,846 were paid out of the earnings the last year, this amount being an increase of $42,117, or 60 per cent.

The Sterling Electric Company of Lafayette was engaged in an infringement suit at Chicago last week, brought by the Western Electric Company against the Galesburg (Illinois) Telephone Company, to enjoin the latter from using a switchboard manufactured by the Sterling company, patented by Samuel B. Fowler. The Western Electric Company asserts an infringement of a patent controlled by it. The question was taken under advisement until next January, when a decision will be handed down. S.

Southeastern Telephone Developments.

The Southern Bell Telephone Company is making extensive improvements at Cordele, Ga., including the addition of three new sections to the switchboard.

The Home Telephone Company of Georgetown, S. C., has been commissioned by the state with a capital of $16,000. It proposes to do a local and long-distance business. W. W. Lawton is president and St. Julien A. Lawson manager and treasurer.

The North Carolina Telephone Company of Hurdle's Mills, Person County, has been organized with $100,000 authorized capital. D. F. Miller and associates are the stockholders.

The Harris Telephone Company has been chartered at Roxboro, N. C.

The North State Telephone Company has applied for a franchise to operate in Greensboro, 20 miles from the home of the company at High Point, N. C., the capital of the North State being $20,000. L.

Telephone News from the Northwest.

The Northwestern Telephone Exchange Company held a convention in Minneapolis of its managers from various points of the Northwest, there being 80 present. Matters pertaining to the business were considered. A theater party and banquet were given.

Pine City, Minn., has granted a franchise to the Northwestern Telephone Exchange Company for a local exchange.

North Branch, Minn., has granted a franchise for a local exchange to the Northwestern Telephone Exchange Company.

The sale of the Iron Range Telephone Company to the Northwestern Telephone Exchange Company has been completed. The Iron Range company originated at Wadena, Minn., W. R. Baumbach being the principal owner and promoter. It has built and operated an extensive system through the northern part of the state.

The St. James Telephone Company of St. James, Minn., has effected a purchase of the local telephone exchange in St. James from the Southwestern Minnesota Telephone Company, paying $9,000. The company will build a system of rural lines.

C. E. Church, manager of the local exchange at Northfield, Minn., of the Northfield Telephone Company, has accepted a position with the Northwestern Telephone Exchange Company.

R. A. Heck and others of Hardwick, Minn., contemplate forming a local company and installing a telephone exchange.

The Litchfield (Minn.) Telephone Exchange Company has let the contract for the erection of a new exchange building. The building will be completed by January 1st and a new common-battery system installed.

Work has been started at International Falls, Minn., on the installation of a telephone system by the International Telephone Company, an auxiliary of the Northwestern Telephone Exchange Company.

Cambridge, Minn., is the latest point of war between the Northwestern and the Twin City Telephone companies. Cambridge has two local exchanges—the Maple line, which connected with the Northwestern and the Cambridge Telephone Company, which connected with the Twin City. The Twin City bought the Maple Leaf system, however, and cut off the Northwestern. Soon after the Northwestern bought a controlling interest in the Cambridge Telephone Company and promptly cut off the Twin City. The Twin City sent a crew of men who cut out the Northwestern wires and reconnected the Twin City, whereupon the Northwestern sent a crew and again cut out the Twin City wires and connected the Northwestern once more.

The LeRoy (Iowa) Telephone Company has absorbed the M. J. Loftie Telephone Company, which has operated several lines in and about New Haven, Iowa.

The Corn Belt Telephone Company of Waterloo, Iowa, has assumed control of the Buchanan County system, including the exchange at Independence.

Advertising for Telephone Girls.

To keep up a force of efficient operators in the face of increasing business and resignations due to marriages and other causes is one of the chief sources of worry of many a telephone manager. In addition to their own forces, the telephone companies in the larger cities are constantly appealed to to furnish operators for private-branch exchanges. To secure a supply of the right kind of help, the Chicago Telephone Company is a pretty steady advertiser in the "Want" columns of the daily papers. The following is one of its "ads," and it may be of general interest.

IF YOU ARE A GIRL

In want of employment in which
Your education and training will aid you,
Would you not like a position
Of such a character that
You would take pride in it—
Whose work would not overtax your strength,
Because you remained seated while on duty
And enjoyed frequent intervals of relaxation
In rooms adapted expressly to your comfort—
Under a company which not only
Provided your luncheons free and
Paid you a salary while teaching you,
But steadily increased your wages
And promoted you to higher positions
As you proved worthy of them—
Would you like to be a telephone operator?
If so, and if you are of
Sound health and at least sixteen,
Apply immediately, etc.

GENERAL TELEPHONE NEWS.

A. B. Bruner has purchased the business of the Baldwin Telephone Company of Baldwin, Kan.

Seventy-seven telephone companies were incorporated in Ohio during the year ended November 15th, according to advance sheets of the report of the secretary of state.

The Independent telephone company operating in Idaho is negotiating for a connection between its lines and those of the Independent company at Portland, Ore. The Idaho company recently filed a trust deed of $500,000.

The organization of the Wexford County (Mich.) Independent Telephone Company was completed at a meeting held at Sherman recently. The company is capitalized at $1,000 and expects to increase the capitalization to $5,000. The officers are: President, G. A. Lake; vice-president, A. B. Southwick; secretary, D. L. Rose; treasurer, R. D. Fredrick; trustees, Oscar Litchard, A. O. Light and James Kellogg.

The annual convention of the Independent Telephone Association of Wisconsin will be held at the Pfister Hotel in Milwaukee, Wis., on December 20th and 21st. The Wisconsin telephone conventions have always been held in February, but the date has been changed to December, as it is considered a more favorable time. An interesting programme has been prepared. Richard Valentine of Janesville is president and H. C. Winter of Madison, secretary and treasurer.

It is reported that Comptroller Grout of New York city will take steps to prevent the United States Independent Telephone Company from doing a general telephone business in that city. This company is claiming privileges under a franchise granted 11 years ago to the Mercantile Electric Company, but, according to Mr. Grout, the Mercantile company has only authority to do business as a burglar-alarm concern. President Finucane of the United States company expresses his confidence that the courts will uphold the telephone privilege of the old franchise.

MANUFACTURERS AND DEALERS.

The Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y., reports having closed contracts for switchboards at Robinson, Ill.; Lakewood, Ill.; Holt, Mo.; Houlton, Maine; Bingham, Utah; Harrisonville, Mo.

The Western Electric Company of Chicago is erecting a large warehouse in Atlanta, Ga., in which will be placed a full line of telephone supplies for the convenience of the Southern Bell Telephone and Telegraph Company.

The International Telephone Manufacturing Company of Chicago reports a favorable demand for its new permanently adjusted all-metal receiver, which is entirely enclosed in hard-rubber shell and cap. This receiver was only recently placed on the market.

CORRESPONDENCE.

Great Britain.

London, November 8.—The inaugural meeting of a new body styled the British Science Guild seems to have left everyone who can claim to be able to take a legitimate interest in such matters in some doubt as to the real functions of this new institution. The avowed objects of the guild are: (1) To bring together as members of the guild all those throughout the empire interested in science and scientific methods in order, by joint action, to convince the people by means of publications and meetings of the necessity of applying the methods of science to all branches of human endeavor and thus to further the progress and increase the welfare of the empire; (2) To bring before the government the scientific aspecets of all matters affecting the national welfare; (3) To promote and extend the application of scientific principles to industrial and general purposes; (4) to promote scientific education by encouraging the support of universities and other institutions where the bounds of science are extended or where new applications of science are devised.

These are the official objects of the guild, and if influential support spells success, then the organizers have nothing to fear. But both in the technical and lay press the question has been asked as to how, in practice, the guild can hope to carry out any work for which many of the existing institutions have not been intended. The speeches at the inaugural meeting all tended toward greater educational facilities at the expense of the state, and there even appeared a little divergence of opinion on the question of whether we were or were not behind other nations in this respect.

A rumor has been circulated that in the next session Parliament intends to adopt the suggestion made by the London Traffic Commission that there should be a permanent traffic board for London. This will not be surprising to many who have studied this matter, for the recommendation in question appeared to be the only one in the report of the traffic commission that lent itself to early adoption.

There is still considerable discussion concerning tramway matters in London. The proposal to carry tramways over certain of the Thames bridges, which has been rejected by Parliament for so many successive sessions, has again been resuscitated and the arguments in its favor will this year be considerably strengthened by the support of the city corporation, which has hitherto set a deaf ear to all the pleadings of the County Council, an attitude that has had quite a marked effect upon the ultimate decision in the past. The northern tramways have also been well to the fore during the last few weeks, and estimates for the conversion of the existing horse lines, when they come into the possession of the County Council in April, next year, have been passed, aggregating nearly $4,500,000.

It has been stated that the success upon the Northeastern Railway Company's electrified lines around Newcastle has been such that the conversion of a considerable mileage to the south of that district is in contemplation.

Some new turbo-generating sets have been installed by the Glasgow corporation. The machines each have a capacity of 4,500 horsepower and are manufactured under Parsons' patents, the alternators also being of British design and manufacture. Current is generated at 6,500 volts.

The difficulties of the Torquay corporation concerning the loan for additional generating plant still continue, and a further inquiry has been held by an official of the Board of Trade with respect to the matter. After having had several conferences a sort of breach has occurred between the tramway company (for the supply of current to which the extra plant is needed) and the corporation, the latter being bound by an act of Parliament to supply current. The Local Government Board has not yet been satisfied that the interests of the ratepayers are being well served in view of the past history of the municipal electricity undertaking, and so hitherto more than one scheme suggested has not met with approval. The decision in the latest case has yet to be given. The case is an interesting one as an instance of the exercise of authority by a public department over a municipality, municipalities having been hitherto able to do much as they pleased, especially with a tramway company, by reason of the veto under the tramways act.

All sorts of rumors are about as to what is contemplated by various promoters in connection with the supply of electric power in London during the coming session of Parliament. All doubts will soon be at rest, however, for application for bills have to be made before the end of this month. G.

New York.

New York city, November 18.—The Brooklyn Rapid Transit Company has just placed the third installment of its order calling for 300 50-horsepower motors and 150 controllers, being one-third of the entire order. The company is planning to develop Canarsie Landing, on the shore of Jamaica Bay, as a pleasure resort, and announces a scheme

to run elevated trains from the Manhattan end of Williamsburgh Bridge direct to Canarsie. Before this can be done several legal questions must be fought out in court.

The New York Central railroad will issue in December over $17,000,000 new stock for the purpose of obtaining money to carry out its terminal improvements in this city and the electrification of its suburban lines.

On Thursday judgment was given to several hundred plaintiffs in claims for damages against the New York City Railway Company for refusal to grant transfers at Twenty-third Street. Most of these suits are being brought by the employes of the city.

The work on the Belmont Tunnel, which will connect Manhattan with Long Island City, is so far progressed that the compressed-air machinery is being operated.

The property of the United Traction Company of Albany, N. Y., has been sold to persons interested in the Delaware and Hudson railroad at an approximate price of $7,500,000. The United company controls the street-railway systems of Albany, Troy, Rensselaer and Cohoes.

The Hudson and Manhattan Railway Company has filed a petition for 1½ miles of additional track and for a proposed branch to extend from Jersey City to Newark, N. J., a distance of 8½ miles. A part of this new line will be entirely below the surface.

Next Tuesday evening the New York Telegraphers' Aid Society will celebrate its fiftieth anniversary in this city and has issued a cordial invitation to all telegraphers, old and new.

Prof. W. Wallace Kerr of the Hebrew Technical Institute is giving a course of popular lectures on electric arc lighting.

The Carpenter Electric Battery and Lamp Company of this city has been incorporated with a capital of $10,000. The directors are E. S. Thomson, C. B. Waite and Lillias H. Waite, all of this city.

The quarterly report of the Interborough Rapid Transit Company shows a deficit of $117,741 for the elevated roads for the three months ended September 30th. The surplus for the subway was $227,560, so that the quarter's surplus from the operation of both divisions amounted to $109,820. This compares with a surplus of $411,310 on September 30, 1904, nearly two months before the subway was opened. Gross earnings of the Interborough company for the quarter were $3,905,097, an increase of $672,148 over the corresponding period of last year. Operating expenses increased $598,352.

The first trolley extension of the Belmont-Long Island railroad combination has been put in operation. The line runs through Glen Cove village, connecting with the Long Island railroad, and runs along that company's tracks to Sea Cliff. The tracks to the Glen Cove landing will be finished in another month. Some months ago August Belmont and the Long Island Railroad Company bought up all the trolley lines in Nassau County and obtained at the same time franchises for new lines.

Work on the projected New York, Westchester and Boston railway has so far progressed that the directors hope to have the line between West Farms, Mount Vernon, White Plains and Port Chester in running order by November, 1907. Much of the grading has been finished between West Farms and Mount Vernon. At Sawmill Lane, where the heaviest grading is necessary, about three-quarters of a mile has been finished and is now ready for the laying of the rails. Two steam shovels, two gravel trains and 300 men have been employed there since June 1st. D. W. W.

Dominion of Canada.

Ottawa, Ont., November 18.—Work has been commenced at the Ottawa Car Shops, Ottawa, Ont., on a number of electric cars for Jamaica, British West Indies. These car works turn out very fine cars, and they have received many orders during the last few years from distant countries.

The sale of the Carleton Electric Light Works to the St. Johns (N. B.) Street Railway Company has been completed. By this deal the street-railway company has wiped out of existence its only competitor in the lighting business in St. Johns.

The light committee of the City Council of Kingston, Ont., had the city engineer figure out the cost of lighting the city's streets by electricity, and he made it at $59.50 per lamp per annum. The committee then recommended that the price be reduced to $62 each per year and to increase the number of street lights. The price is about the lowest in the smaller cities of Ontario.

The City Council of Guelph, Ont., a couple of years ago undertook to run the street railway as a municipal venture, and although it is a small city of 13,000 in population it has made a success of the enterprise. Last year there was a clear profit of $2,000. The street railway is managed by a commission of five members, consisting of the mayor, one alderman and three citizens not of the council. These serve without salary and are chosen annually. Under them is a general manager who receives the small salary of $1,000 per annum for his services.

Eugene Haanel, superintendent of mines for Canada, has sent to the Department of the Interior the first of a series of publications on the economic minerals of the Dominion. In dealing with mica the expert says that Canadian mica mining has now reached such proportions as to entitle it to a prominent position in the mineral industries of the country. Referring to the future possibilities of the mica fields of Canada, Dr. Haanel says the outlook for the production of a large tonnage is very bright, and if Canada should ever be called upon to furnish the world's supply of mica the fields of Ontario and Quebec could be prepared for such an emergency.

Cecil H. Smith of the Ontario Hydro-electric Power Commission has returned from an extended European trip. He states that in every case, so far as he was able to see and learn, electrification of railroads has been attended with a betterment of service, more speed and cleaner and more comfortable cars. He visited Switzerland, Germany, France, Belgium, Austria, Italy and England. In all parts he visited the electric road is looked upon as the coming one, and large sums of money are spent in the development of waterpowers. In Italy the greatest advances have been made, where electricity has superceded steam to a great extent. Roads established only a short time ago now run as many as 42 trains a day and travel at the rate of 40 miles per hour. Wherever power houses are being built in Europe they are built first double the size for present requirements and are of a more permanent character than many of the works established here.

R. W. Leonard, engineer in charge of the installation of an electric plant at Kakabeka Falls, near Fort William, Ont., reports to the Montreal promoters of the enterprise that when the plant is in operation it will revolutionize the commercial life of Fort William and Port Arthur. It is intended to establish at present a plant with a capacity for 28,000 horsepower, and this can be provided without having, in the eye of the casual observer, any appreciable effect on the falls.

An expenditure of $1,000,000 during the coming year in securing additional rolling stock in constructing new feeder lines and installing additional machinery in the main power house and the various sub-stations has been decided upon by board of directors of the Montreal street railway. W.

Southeastern States.

Charlotte, N. C., November 18.—The Morganton (N. C.) Furniture Company, a $125,000 concern, has secured the privilege of operating an electric-light and power plant in connection with its other interests.

It is given out that there will be a meeting of the directors of the Anderson (S. C.) Traction Company early in December for the purpose of increasing the capital stock to $280,000, it being proposed to build a trolley line from Anderson to Greenville, by way of Belton, Pelzer and other points.

It is reported that about January 1, 1906, a $3,000,000 electrical concern will begin operations in the state of Georgia, using the waterpower on the Chattahoochee River near Gainesville and other points. Plans are said to have been already completed.

The United Railways of Baltimore has placed an order for 200 cars of convenient and modern equipment for use on the suburban and city lines, the purchase having been financed by the issuing of $1,000,000 car-trust certificates, the Safe Deposit and Trust Company being the trustee.

The contract has been signed for the building of the Winston Interurban electric railway, a 30-mile system in North Carolina.

Considerable interest has been attached to Charlotte, N. C., on account of the great electrical developments in the section including the Catawba Power Company and the Whitney Reduction Company at Salisbury, there being in sight power representing perhaps more electrical energy than is available at any point in the entire South. The Catawba company will have available in a short time, it is said, something like 170,000 horsepower, while other large additions to this power are to be brought in by the two concerns as their plans of development are executed.

A charter has been granted to the Citizens' Light and Power Company at Lenoir, N. C., capitalized at $25,000, W. P. Ivey and others being interested.

An electric-light and ice plant will be erected at Brevard, N. C., during the coming winter. L.

Ohio.

Cleveland, November 18.—Judge Tayler of the federal court today held that the Cleveland Electric Railway Company is entitled to an injunction restraining the Forest City Railway Company from interfering with its rails, poles and wires on Central Avenue. He also held that giving a renewal of franchise to the Forest City Railway Company is invalid, and that a renewal could be given only to the original grantee, the Cleveland Electric Railway Company. However, the only right the latter possesses in the street is the property right in its rails, poles and wires, as its franchise expired March 22, 1905. According to this decision, neither of the companies has a franchise in the street, and the city is at liberty to act as it sees fit. The city may make a new grant to the Forest City Railway Company, if it desires. City Solicitor Baker claimed that the property on the ground belongs to the city, on the same basis that improvements on leased property revert to the landlord at the termination of the lease.

It is entirely probable that the Elkins-Widener syndicate will secure the Appleyard roads, when they are sold under foreclosure, as it seems they will be within a short time. All arrangements to this end seem to have been made within the last few weeks, and last week the receivers were in Boston conferring with interested persons there regarding the matter.

J. W. Holcomb and Jay Latimer, managers of electric-railway syndicates at Cleveland, have dissolved partnership. All the property now in course of construction is the Buffalo, Dunkirk and Western. Mr. Holcomb retains the offices of the firm in the Electric Building. Mr. Holcomb and C. R. Norley, president of the Stark Electric, are planning a road from Cleveland to Alliance. From Alliance the road will run to Ravenna, Brady's Lake, Hudson, Twinsburg, Falls Junction, Randall and Cleveland.

A committee has been appointed by the Cleveland Chamber of Commerce to investigate and report upon the extension of franchises for the Cleveland Electric Railway Company. Both the city and the management of the road have agreed to give the recommendations careful consideration.

J. O. Bradfield will be in charge of the freight service that is to be established on the Scioto Valley Traction Company some time in December.

Receiver Stacey B. Rankin has fixed upon December 1st as the date for the sale of the Springfield, Charleston, Washington and Chillicothe road. It was appraised at $80,000.

A lot of material belonging to the Miami and Erie Canal Transportation Company was sold by the receivers a few days ago to meet pressing obligations and pay attorney and court fees.

J. H. Merrill, chairman of the transportation committee of the Ohio Interurban Railway Association, has issued a bulletin stating that 31 roads are now embraced in the mileage agreement, covering 1,798 miles of road. They are in the three states of Ohio, Indiana and Michigan. The November meeting of the association will be held at Youngstown next Thursday.

The Fort Wayne, Van Wert and Lima and the Western Ohio have purchased land, jointly, at Lima and are erecting a freight depot.

The new machinery for the Columbus Public Service Company has been installed and is ready for use. The addition doubles the capacity of the Mound Street plant.

In the case of John W. Kent against the Cincinnati, Dayton and Toledo Traction Company, the Supreme Court has decided that if a trolley car is so crowded that passengers cannot get inside, the fact that a notice has been posted in the car warning them from riding on the platform does not relieve the company from liability in case passengers riding on the platform are injured.

The report of the secretary of state for the year ended November 15th shows that of the new corporations formed, the capitalization of new electric railways amounted to about $23,000,000. Increases aggregated $12,167,000. The number of electric railways incorporated was 44. Twenty-one electric-light companies, with a capitalization of $3,542,000, were incorporated.

The voting trust of the Lake Shore Electric Railway Company has been dissolved and the securities returned to the original owners in exchange for their voting-trust receipts. This voting trust was formed to safeguard the bonds held by the banks in Cleveland and elsewhere and was made up of men representing the banks. The usefulness of the trust has passed, since the syndicate is in position to take care of its property now.

John S. Harshman of Springfield has announced that arrangements have been made to reorganize the Springfield, South Charleston, Washington Court House and Chillicothe Traction Company, creditors to the amount of $125,000 agreeing to the plan. The proposition provides for an issue of $800,000 bonds, payable in 20 years, to secure money to complete the line from South Charleston to Chillicothe. The creditors are asked to take these bonds at par and surrender their claims.

The East Liverpool Traction and Light Company of East Liverpool has filed a mortgage for $30,000,000 in favor of the Union Trust Company of Pittsburg. The funds realized from the sale of bonds under this mortgage will be used in extending the lines owned by this company. O. M. C.

Indiana.

Indianapolis, November 18.—The project to build an electric line from Columbus to Richmond, by way of Greensburg, by the Columbus, Greensburg and Richmond Traction Company, has been revived. Considerable money has been subscribed in aid of the road.

Three new and modern freight cars for the Indianapolis, Columbus and Southern Traction Company have been received and put in service.

It is rumored that the Big Four Railway Company has bought the Indiana Central Traction Com-

pany's line between Wabash and North Manchester. The object is to forestall the extension of the Indiana Northern Traction Company, which now operates a line between Marion and Wabash, and has obtained a right-of-way from Wabash to North Manchester, paralleling the Big Four.

A traction line from Matthews to Marion is proposed by the Marion, Matthews and Muncie Railroad Company, recently organized, with offices in Muncie.

Two electric lines are being surveyed out of Jeffersonville, one to Sellersburg via Watson, and the other to Charleston via Watson.

The Toledo and Chicago Traction Company, which has completed its grade within two miles of Fort Wayne, has obtained a valuable right-of-way through Fort Wayne by the purchase of the old feeder-canal bed. The company's whole force is now grading a line on this newly acquired land. The company announces that it will at once build a freight station in Fort Wayne.

The Indianapolis and Eastern Traction Company has inaugurated a through freight service between Indianapolis and Newcastle.

George J. Marott, principal owner of the Kokomo, Marion and Western Traction Company, has purchased 38 acres of forest for a park near Kokomo. The park will be improved at once.

D. R. Morrison of Hartford City has patented a crude-oil engine which he says will bring about a revolution in motive power for Indiana factories. The engine is constructed on a plan similar to an ordinary gas engine and can be operated at a minimum cost of 10 cents a day, it is said. The engine makes its own gas from the crude oil, which is fed into the cylinder from a tank, and is so constructed that the exhaust oil can be used a second time. A local company will build a large plant to manufacture the engine.

Steps have been taken by the authorities of Terre Haute to build an electric-light plant to be owned and controlled by the city. Alvin M. Higgins, chairman of the Board of Public Works, heads the movement.

The National Foundrymen's Association, which held a meeting in New York this week, voted to establish a school for apprentices at the Winona Technical Institute in Indianapolis. A plant will be fully equipped for use in the school. S. S.

Northwestern States.

Minneapolis, November 18.—The Minneapolis City Council has voted to readvertise for incandescent street-lighting bids, all former bids having been rejected. Proposals will be taken at once.

The council at Stillwater, Minn., will consider an ordinance providing for a system of city electrical inspection.

The Black Hills Traction Company has announced that its new power plant on the Redwater, near Spearfish, S. D., will be completed by January 1st. It is estimated that about $300,000 will be expended on the plant and on the proposed trolley system.

Edward L. Healy of Red Lake Falls, Minn., is considering the feasibility of furnishing electrical service to Grand Forks, N. D., from Thief River Falls, Minn.

The council of Alexandria, Minn., is talking of installing additional machinery at the electric-light plant.

Frank Burbank of Windom has taken charge of the electric-lighting plant at Princeton, Minn.

The Municipal Electric Light and Power Company of Milwaukee has filed articles of incorporation with $100,000 capital. J. A. Wallis heads the list of incorporators. The new company has applied to the council for a franchise. The company agrees to erect a power and light plant to cost not less than $400,000. R.

Rocky Mountain States.

Salt Lake City, Utah, November 18.—Donald Fitzgerald, representing the American Railway Construction Company of New York, has enlisted the co-operation of the Commercial Club of Payette, Idaho, for the construction of an electric railway between that city and New Plymouth, a distance of 12 miles. The club has agreed to obtain subscriptions for the project to the amount of $75,000. The proposed line will cover one of the best agricultural regions in the state, and it is believed that actual construction work will commence within a few months.

J. F. McCarron has been granted a franchise for the construction of an electric railway in Weber County by the county commissioners at Ogden, Utah. The recently organized company has secured valuable franchises in other counties, and the object is to operate an interurban system between Salt Lake and Brigham City.

An application for water for electric power purposes has been filed with the state engineer by the Blue Bench Co-operative Water Company of Price, Utah.

W. D. Arnett, a mining engineer of Reno, proposes to begin next spring the erection of a water-power electric plant costing $100,000, with Reno and Sparks, Nev., as objective points.

J. A. Dunlap, purchasing agent for the Washoe smelters, has closed a contract with the Allis-Chalmers Company of Milwaukee for delivery of electric motors and generators of 5,000 electric horsepower to be delivered and installed ready for operation by July 1st of next year at Anaconda, Mont. A new power house will be built.

The Nevada Power, Mining and Milling Company has been formally granted its right-of-way for a pipe line and a power-house site in the Sierra Forest Reserve, in California, by the Washington authorities. The electric transmission line, nearly 100 miles in length, completed this fall, is now in operation, supplying power at Tonapah and Goldfield, Nev. Additional generators are to be installed.

The Laramie Light and Power Company of Laramie, Wyo., with a capitalization of $75,000, has filed articles of incorporation with the county clerk. W. C. Sterne, H. E. Kelley, Carleton Bliss and H. E. Nutting are the incorporators. G.

Pacific Slope.

San Francisco, November 17.—The Pacific Gas and Electric Company consolidation proposition is progressing favorably. According to the terms of the deposit agreement the privilege of depositing San Francisco Gas and Electric stock terminated November 14th. The time has been extended to November 30th, by which time most of the remaining stock will be placed on deposit.

The Edison Electric Company of Los Angeles has closed contracts for a 7,500-kilowatt Westinghouse-Parsons turbine generating set. This is equal to the largest unit of the kind ever built. The generator is to be three-phase 16,500 volts 50 cycles. The present equipment of the Los Angeles power house amounts to 4,000 kilowatts, and the company has several plants at other points.

The Rainer Water, Light and Power Company, with its principal offices at Portland, Ore., has been incorporated with a capital stock of $50,000, by E. F. Magoon, T. D. Richardson and A. B. Richardson.

A party of engineers, under J. H. Cunningham of Portland, Ore., has gone from Eugene, Ore., to Waterville, 15 miles distant, to make surveys for the power plant and canal which W. T. Campbell proposes to construct. A power site has been filed upon on the Mackenzie River. An offer has been made to supply power for a municipal lighting system for $5,000 a year. The city of Eugene has filed rights further upstream and may install its own plant.

The Portland-Salem Electric Railway Company of Portland, Ore., has been incorporated with a capital stock of $100,000 by W. J. Walsh, L. H. Cordes and H. Dunn.

The Willamette Valley Traction Company has been incorporated at Salem, Ore., by A. Welch, C. B. Rhodes, J. H. McNary and others with a capital stock of $1,250,000.

The Union Traction Company will secure rights-of-way and then extend the Santa Cruz, Capitola and Watsonville electric-railway line from Capitola to Soquel, Cal.

The Spokane and Inland Electric Railroad Company's directors have authorized the immediate extension of the company's system from Waverly to Rosalia, Wash., a distance of 14 miles. The new section, when added to the 35 miles of road from Spokane to Waverly, will make 49 miles of main line. The Palouse branch will be begun at Springdale Junction. A shipment of 20 30-ton flat cars is now on the way from Colorado loaded with steel rails for the new road.

The McMinnville (Ore.) water committee has sold the necessary bonds to insure the building of a gravity water system and improving the electric-light system to Morris Bros. of Portland. This firm has contracted to take the bonds in any sum from $40,000 to $80,000.

The Central California Traction Company, represented by H. H. Griffith, has been awarded a franchise for an electric railway over San Joaquin County roads upon payment of $5,500, the highest bid, at Stockton, Cal. There was competition, George F. Buck, attorney for the Southern Pacific, bidding $5,000 for the franchise.

The California Electric Company has been incorporated with a capital stock of $50,000. The directors are Richard Spencer, E. M. Scribner, W. F. Gibbs, Oscar Lawler, all of Los Angeles, and E. L. Sperry of San Francisco.

The Santa Ana trustees will call an election to vote bonds in the sum of $50,000 for the establishment of a gas plant and $60,000 for an electric-light plant, both to be under municipal management.

The Paso Robles Hotel Company of Paso Robles, Cal., will install an electric-light plant of its own.

The Pacific Electric Railway Company has taken over the old gasoline-motor line which formerly operated between Orange and Santa Ana, Cal., and will convert it into an electric road.

The Oroville Water, Light and Power Company will expend $10,000 in inaugurating a new telephone system in Oroville, Cal. The company is constructing an electric power-transmission line from its waterpower site, 16 miles distant.

The Napa and Lakeport Railway Company, recently organized to build a road from Napa to Lakeport, Cal., is actively at work making the final locations. A.

PERSONAL

The Royal Society of England has awarded a medal to Prof. John Henry Poynting, F. R. S., for his researches in physical science, especially in connection with the constant of gravitation and the theories of electrodynamics and radiation.

F. J. Stout, formerly superintendent of the Wheeling and Lake Erie Railroad, has been appointed general manager of the Lake Shore electric railway, with headquarters in Cleveland. Mr. Stout is one among many men to leave steam roads to enter the operating department of electric lines.

W. B. Powell, local manager of the Great North Western Telegraph Company in Montreal, has retired to devote his time to contracting. He was a well-known member of the Board of Trade, vice-president of the J. W. Harris Company and also a director of the Southern Counties railway.

On November 14th Mrs. Maund Baratt was married to Mr. Alfred F. Blundell, the president of the Red Telefonica, Havana, Cuba. The ceremony was performed in Christ Church, East Orange, N. J. Mr. Blundell has been in Cuba for six years and has many friends who will welcome the couple on their arrival in Havana.

H. F. Strickland of Toronto, Ont., has succeeded A. Bruce Smith as chief electrical inspector for the Canadian Underwriters' Association. Mr. Strickland has been for nearly 20 years identified with electrical work and besides has a practical knowledge of building construction. Mr. Smith has been appointed manager of telegraphs of the Grand Trunk Pacific lines now being built.

Ralph D. Mershon has been retained by the African Concessions Syndicate, Limited, of London, in connection with the proposed development of power at Victoria Falls, on the Zambesi River, Rhodesia, South Africa, and its transmission to Johannesburg and the Witwatersrand, for use in connection with gold mining. The distance of transmission will be about 700 miles. Mr. Mershon has just returned from a flying trip to Europe, made for the purpose of consultation relative to this enterprise.

Prof. Henry S. Carhart of the department of physics at the University of Michigan was granted leave of absence until the end of October in order that he might complete an extended trip in Europe and Africa. Early last spring he was invited by the council of the British Association for the Advancement of Science to be a member of the official party of scientists which was preparing to attend the annual meeting of the association in South Africa. Professor Carhart accepted the invitation and left the United States last July. On his return trip he accepted the invitation of the Reichanstalt to attend the conference preliminary to the meeting of the International Commission upon Electrical Units at Berlin.

D. G. Edwards, formerly of Cincinnati, has been appointed vice-president, in charge of traffic of all the traction lines of Ohio and Indiana controlled by the Philadelphia interests allied with the Randall Morgan syndicate. Mr. Edwards has been in the employment of the Cleveland, Hamilton and Dayton and Cleveland, Cincinnati and Louisville railroads as passenger-traffic manager for the last six years, and is regarded highly proficient as a business producer. Among the big traction properties which he will have charge of are the Cincinnati Traction Company, the Cincinnati Northern Traction Company, the Columbus, Buckeye Lake and Newark, the Columbus, Newark and Zanesville, the Lima and Toledo, the Fort Wayne, Van Wert and Lima, the Wabash Valley, the Indiana Union Traction Company, the Indianapolis Traction Terminal Company, the Indianapolis and Northwestern, the Indianapolis and Eastern, the Richmond Street and Interurban Company, the Indianapolis and Danville, the Indianapolis and Plainfield and the Indianapolis and Western. Mr. Edwards will have charge of passenger-traffic matters over 1,500 miles of electric railway. Mr. Edwards will organize the passenger department of the big merger company in as careful and thorough a manner as that of any steam-road system.

ELECTRIC LIGHTING.

The Leeds (N. D.) Electric Light and Power Company will install a new electric-light plant.

The Joplin Electric Light and Power Company of Joplin, Mo., has been incorporated with a capital of $75,000.

The Van Buren (Ark.) Electric Light and Power Company has sold its business to the Fort Smith Light and Traction Company.

J. W. Seeley and C. L. Allen have been granted a franchise to construct and operate an electric-light plant in Castledale, Utah.

Dr. B. S. Peck, Randolph Boyd and others have petitioned the Galva (Ill.) Village Board for a franchise to establish an electric-light plant.

The municipal lighting plant at Calgary, N. W. T., which has been installed at a cost of $60,000, has been put into operation. The plant is capable of supplying, in addition to the street arc lamps,

6,000 incandescent lamps, but it is understood that less than 40 applications for commercial service have thus far been secured.

The City Council of Coalville, Utah, has approved the plans and specifications for the power house for the electric-light plant in Coalville.

An electric-light company has been organized at Bluff City, Tenn., with J. D. Haun president, W. E. Wolfe, vice-president, and J. H. Bachman secretary and treasurer.

Preliminary steps have been taken for the consolidation of all the franchises of the Benton Harbor and St. Joseph (Mich.) Electric Light and Railway Company into one.

The London County Council on November 14th decided to introduce a bill in Parliament under which the council will construct a plant to supply all the electric energy for London and the suburbs. The cost is estimated at $40,000,000.

The taxpayers of Exeter, Ont., having voted down the proposition to install a municipal electric-light plant, it is probable that a new contract will be given to the Exeter Electric Light Company. In return for a 10 or 15-year franchise, the company would agree to enlarge and improve its plant.

The use of private electric-lighting systems in saw-mill plants in British Columbia is rapidly growing. In the last few months the Hinton Electric Company of Vancouver has installed complete outfits in five large mills. Some of the mills have also installed apparatus for the electrical operation of machinery. Several large mills are supplying electric light for nearby towns.

The Havana (Cuba) Gas and Electric Company is showing its up-to-date methods by placing an electrical engineer at the disposal of customers every day from 10 to 12 a. m. and from 2 to 4 p. m. In a notice to the public the company said that it was its business to sell current and that if it induced its prospective patrons to install apparatus, through consultation with its engineer, free of charge, both would be benefited.

Commissioner of Public Works Samuel A. Freshney of Grand Rapids, Mich., is of the opinion that the city should not consider municipal commercial lighting until the waterpower electric companies tributary to the city have projected their propositions. He says that these companies can deliver power much cheaper than that made by steam plants, and that before any franchises are given stipulation should be made to secure the power at the lowest possible rates for the city. The city is now generating its electricity from its own steam plant.

ELECTRIC RAILWAYS

The municipality of Berlin is said to have decided to build an underground electric railway at a cost of $13,750,000.

The Canon City Merchants' Association is encouraging a plan to build an electric railway from Canon City, Colo., to Cripple Creek.

Incorporation papers have been issued to the Joliet and Southern Traction Company, which intends to build an electric road from Joliet, Ill., through the counties of Will, Grundy and Livingston, to Dwight.

A franchise has been granted by the City Council of Evanston, Ill., providing for a new street railway to connect Evanston with the Northwestern Elevated extension from Wilson Avenue, Chicago. The franchise is granted to the Chicago and Evanston North Shore Railroad Company.

The Havana Central Railway, of which G. F. Greenwood is the general manager, has just secured the concession for an electric railway from Guines to Cienfuegos and from Guines to Batabano. This was secured after quite an active fight with the Cuban Central Railway, which corporation has just secured a similar concession.

The proposed Winchester and Washington (D. C.) electric railway is to receive its power from a plant to be built in Clark County, Va., on the banks of the Shenandoah River. A big dam is proposed across the river, but property owners are opposed to the plan because of fear of destroying the fine bass fishing, for which the Shenandoah and Upper Potomac are noted.

The permanent committee of the International Tramway and Light Railway Union decided, at its recent meeting, to hold the next convention in September, 1906, at Milan, Italy. An international exhibition of means of transport will be held at Milan during the congress. Among the principal questions to be solved by the convention will be one relating to the best means of braking employed by electric-railway systems.

The Vermont Internal Improvement Company, which was granted a charter in 1902 to purchase electric railways, build, mortgage, sell, lease and otherwise engage in furnishing electricity for power and light, was reorganized in Rutland, Vt., a few days ago, with a capitalization of $100,000 paid in. G. Tracy Rogers of Binghamton, N. Y., president of the electric-railway company of that city and extensively interested in the operation of street railways in and surrounding Buffalo, as well as one of the owners of the Rutland Street Railway Company, was elected president. Leo H. Wise of New York city was chosen vice-president, and C. H. West of Rutland was elected secretary and treasurer.

The Catskill Mountain and Mohawk Valley Railway Company of Oneonta, N. Y., has been incorporated to build and operate an electric surface railroad from Cairo, Greene County, to Oneonta, a total distance of 78 miles in Greene, Delaware, Schoharie and Otsego counties. The capital is $2,000,000 and the directors include Edward C. White, Edgar P. Holdridge and Charles V. D. Peck of New York city and others.

The Northwestern Elevated Railroad Company is seeking a franchise which will give it the privilege of making a new connection with the Union Loop, and thus relieve congestion on Fifth Avenue. The plans include the use of the new bridge which the Sanitary District is to build soon at Dearborn Street. The company is said to be purchasing land for an additional structure which will enable the running of trains independently of the present service.

The annual statement of the North Shore Electric Company, operating lighting plants in the suburbs of Chicago, for the year ended September 30, 1905, shows gross earnings of $370,831, compared with $224,637 for the previous year. Operating expenses, renewals, taxes, etc., amounted to $239,155, leaving net earnings for the year $131,676. Interest on first-mortgage bonds brought the surplus for the year's operation to $65,398. The outstanding issue of bonds amounts to $1,500,000.

The Public Works Department of Argentina, South America, now has under consideration work involving an expenditure of about $78,000,000. The principal items include: Railroads, $21,631,558; dredging, $5,841,000; bridges and roads, $8,871,000. The government has recently authorized Quesada Bros. to build an electric railway from Buenos Ayres to Lujan, and the government will build a railroad from Cerrillos to Rosario at a cost of $520,000. C. B. Madero will extend the electric street line from Riachuelo to Lanus or Banfield.

Having received its charter, the stockholders of the Lehigh Valley Transit Company of Philadelphia have effected a reorganization with Harry C. Trexler of Allentown as president. The properties included in the reorganization are those of the old Lehigh Valley Traction Company, the Philadelphia and Lehigh Valley Traction Company, the Allentown and Slatington Street Railway Company and the Coplay, Egypt and Ironton Street Railway Company. At a meeting of the directors held subsequently, Edward M. Young was elected vice-president; John C. Dawson of Philadelphia, temporary secretary and treasurer; Warren S. Hall of Allentown, general manager, and C. M. Walter of Allentown, auditor.

Bion J. Arnold of Chicago, owner of the stock and bonds of the Kenosha (Wis.) Electric Railway Company, has sold his holdings for $350,000 to A. C. Frost, president of the Chicago and Milwaukee Electric Railroad Company. The road will be connected at once with the lines of the Chicago and Milwaukee, and in two weeks cars will run from Kenosha to Chicago. Mr. Frost has said the Kenosha line will not be connected with that of the Milwaukee Electric Railway Company, which now runs to the north limits of Kenosha, but it will be part of the line to be built by the Chicago and Milwaukee road which will connect the two cities. Work of grading for this line is now in progress.

Consul Dunning of Milan, Italy, has frequently called attention to the work going on all over Italy of converting horse-car railways into electric roads or of opening up new roads made possible by the presence of electrical power generated by the waters in Italy's hills. He thinks it is time to urge American manufacturers to make haste in investigating every field in the world where work of this kind is going on. The fact that American manufacturers are producing some of the best types of railroad materials; that American railways are accepted as models in many parts of the world, both as to materials used and methods of running, would seem to justify a movement to secure sales in Italy and other progressive parts of Europe and the Orient.

PUBLICATIONS.

The Colwell Lead Company of New York city has issued a comprehensive catalogue, embracing a large line of metal goods and containing useful information and formulas.

Westinghouse standard steam engines, manufactured by the Westinghouse Machine Company, have now been on the market for more than 25 years. It was the foundation upon which the company's business was built. A new booklet has just been issued which describes these engines in detail. The company says that it has built nearly 6,000 engines of this particular type. If it is desired to become familiar with the characteristic features of these useful engines, the necessary information may be found in the booklet.

Rock drills are now sold by the Chicago Pneumatic Tool Company, and the products of the company in this line are illustrated and described in Catalogue No. 18. After deciding to extend the scope of its business to include rock drills the company acquired the selling rights to the well-known McKiernan rock drills, which are manufactured at Dover, N. J.

The Ohio Electrical Works of Cleveland is mailing some assorted literature describing its products. One catalogue is devoted to an extensive line of electrical toys, including miniature electric railways, small dynamos and motors, etc. Another catalogue is devoted to a line of electrical novelties. Decorative lighting outfits for Christmas-tree lighting are another specialty of the company.

The new catalogue of the Jeffrey Manufacturing Company of Columbus, Ohio, is devoted to coal-handling machinery in mines, and will be found of special interest to those connected with coal-handling operations. The catalogue contains 142 pages, all illustrated by pictures of the various machines and their parts. The book is really quite a comprehensive treatise on coal-handling machinery.

The International Instrument Company of Cambridge, Mass., is an extensive manufacturer of laboratory and testing instruments of various kinds, and it has recently sent out quite a bundle of circulars, each circular descriptive of some one instrument, such, for instance, as a Duff physics set, a saturated vapor pressure apparatus, apparatus for testing building material, etc. In all there are nine of these circulars.

Bulletin No. 60 of the Bureau of Labor, Department of Commerce and Labor, Washington, is devoted principally to government industrial arbitration. The subject, as treated, is a statistical account of laws and their results. Within its scope are included all laws in any land which have been enacted for the purpose of providing means for the settlement of collective industrial disputes. Both the essential features of such laws and the important facts as to their operation are given.

A catalogue of more than usual interest has been prepared by the John A. Roebling's Sons Company of Trenton, N. J. It treats of a variety of subjects, such as cableways, tramways, suspension bridges, cable railways, etc. That part of the book which is given up to suspension bridges is particularly interesting. Here are illustrated all manner of suspension bridges from the largest size down to small foot bridges. Under cableways come a variety of apparatus as used in quarries in logging camps, coal yards, etc.

A very interesting and attractive booklet has been issued by the General Electric Company upon the subject of the Curtis steam turbine. Illustrations, which are plentiful and of an excellent character, show some representative installations of the turbines, which are briefly described. It is interesting to recall that the first machine was put in commercial operation in the power house of the General Electric Company in Schenectady on October 1, 1902. Curtis turbines now in daily operation have a rated capacity of over 135,000 kilowatts. Besides the booklet above referred to, the company has prepared a large number of new bulletins, circulars, leaflets, etc. The new bulletins are upon "Portable Sub-stations for Electric Railways" and "The GE-80 Railway Motor."

Professor C. E. Lucke of Columbia University, New York city, is the author of a useful system of blanks for setting down the complete description of a steam power plant. The blanks are for use in making out reports and refer to all the intricacies of a steam plant. On the right-hand pages are enumerated the various elements or pieces of apparatus in the system, with blank spaces for the insertion of numbers or quantities by the one who is taking down the data on the system. The left-hand pages are left blank for photographs, sketches or drawings. There are also blanks for inserting figures on operating costs, labor costs, amount of materials of various kinds for operation, etc. The book contains 70 pages or 35 pages of blanks to be filled in, and when they are all filled in data sufficient for a complete report of the system will be found at hand. The book is published by the D. Van Nostrand Company of New York city.

SOCIETIES AND SCHOOLS.

This week's meeting of the American Institute of Electrical Engineers was scheduled to be held at 44 West Twenty-seventh Street, New York city on Friday evening. The following papers were on the programme: "The National Bureau of Standards," by E. B. Rosa and S. W. Stratton, both of Washington, D. C.; "A Testing Laboratory in Practical Operation," by Clayton H. Sharp of New York. The next meeting will be on December 15th.

The electrical engineering department of the University of Illinois is equipping another car for electric-railway tests, similar to the one which has been in use by the engineering student for several

years. The body of the car was received at the shops of the Illinois Traction Company in Champaign, where it is being fitted up. When the apparatus is installed, tests will be made on the electric railway between Champaign and Decatur.

At the twenty-fifth annual meeting of the Toronto Branch of the American Institute of Electrical Engineers on November 10th the subject for discussion was "Lightning Arresters." C. H. Wright introduced the subject by abstracting the paper read at the New York meeting by N. J. Neall. An interesting discussion was participated in by H. A. Moore, R. G. Black, K. L. Aitken, E. B. Merrill, W. G. Chase, E. Richards and F. A. Gaby.

The executive committee of the Canadian Electrical Association met in Toronto on November 11th to make arrangements for the convention of 1906. R. G. Black and James Robertson were appointed to secure papers for the convention, and the committee to make other arrangements is composed of R. B. Hamilton of St. Catherines, J. A. Kammerer, J. W. Campbell and J. P. Myler. It was suggested to the committee that the convention to be held early in June. Ex-President K. B. Thornton resigned from the executive committee owing to his removal to New York, and James Robertson was chosen his successor.

The American Society of Mechanical Engineers will hold its fifty-second meeting in New York the first week in December. The headquarters will be at the Edison Building, 44 West Twenty-seventh Street. The first session will be on Tuesday evening, December 5th, when President John R. Freeman will present his address. A business session Wednesday forenoon in the saloon of the steamship Amerika will be followed by an excursion to the Henry R. Worthington Hydraulic Works at Harrison, N. J. The meeting will close on Friday. Several sessions will be devoted to professional papers and besides there will be a lecture by Prof. R. W. Wood of Johns Hopkins University, a reception at the New York School of Automobile Engineers and the usual reception at Sherry's on Thursday evening.

MISCELLANEOUS

The Oliver-Stewart Company of Knoville, Tenn., has been incorporated with a capital stock of $25,000 by W. J. Oliver of Knoxville, A. B. Stewart of Columbia, S. C., and George F. Parkes of Nashville. Its purpose is to construct a power plant on the Tennessee River 30 miles from Chattanooga.

The Truckee River General Electric Company's generating station, built this year at Marmol, a few miles below Floriston, Cal., for the purpose of furnishing electric power to run the Comstock mines, is now supplying power. The company also owns the Floriston Pulp and Paper Mill, the electric plant at that place, the electric plant at Laughton, six miles above Reno, and the plan at Reno—the four largest in Nevada. It has a complete monopoly on the lighting and power situation in Western Nevada, supplying all that is used by Reno, Sparks, Verdi, Carson, Virginia, Silver City, Dayton and the other small towns in these vicinities.

Production of phosphorus presents a new field for the electric furnace. In making phosphorus the difficulty in the past has been to provide crucibles capable not only of resisting the extreme heat but also the action of the sulphuric acid, and much loss has been caused by breakages and by the escape of the products in the gaseous condition. In the electric furnace the acid is not needed, and the phosphorus is obtained by fusing together bone-dust mixed with sand and wood charcoal. At the extreme temperatures of the electric arc the silicic acid of the sand combines with the calcium of the bones and liberates the phosphorus. This process, discovered by Wohler, is only practicable at temperatures which render the use of clay crucibles impossible, as the evolution of the phosphorus only begins at 1,150° C. and is completed between 1,400° and 1,500° C.

One of the new Northwestern Limited trains of the Chicago and Northwestern Railway Company was recently placed on exhibition at the Wells Street Station in Chicago. The new features contained in the construction and equipment of this train make it one of the most comfortable, convenient, beautiful and safe that has ever been turned out. The electric lighting is particularly brilliant and includes berth reading lamps in every section, compartment and drawing room as well as the most modern designs and effective arrangement of lights in other parts of the train. The current for lighting of the train, for ventilation by means of rotary fans and for many other devices, such as small appliances for heating ladies' curling irons, with which each dressing-room compartment and women's toilet room is furnished, is supplied by a dynamo in the baggage car.

Franklin Institute, acting upon the investigations of its committee on science and arts, has reported upon the merits of the Shaw lightning arrester. The committee decided that, although there was nothing very novel in the device patented by Mr. Shaw, the introduction by him of a high-resistance carbon has made a valuable improvement and is a distinct advance in the art. The same committee, reporting upon the induction coil arrangement of D. B. Walter of Hamburg, Germany, speaks of the device as "a practical method for reducing the secondary potential of an induction coil, in successive steps, from its maximum potential to its least potential, so that it will satisfactorily operate Roentgen tubes of various resistances when the Wehnelt interrupter is used to operate the induction coil." The operation of this device with the Wehnelt interrupter in X-ray work is said to have been so satisfactory that although practically the same device has been independently used, the early publication of it by Dr. Walter has influenced the committee in recognizing him as the originator of the device.

TRADE NEWS.

A newspaper dispatch from Milwaukee a few days ago gave the news that a petition in involuntary bankruptcy against the Brown-Corliss Engine Company of Corliss, Wis., had been filed by several creditors.

A new electric company for Chicago is the Darche Electric Clock Company, giving as its object the manufacture of electric appliances. The capital is $40,000 and the incorporators F. W. Jansen, A. Y. Jansen and C. D. Fahrney.

The Central Electric Manufacturing Company of Rock Island, Ill., incorporated last week, with a capital of $30,000, proposes to manufacture electric appliances. The incorporators are W. H. Edwards, Gustav Stengel and Henry Tappendorf.

In connection with its electric-light and power business the Lee Electric Light Company of Clarinda, Iowa, contemplates entering the field for the manufacture of ice and cold storage. The company is in the market for machinery necessary to equip such a plant.

H. H. Albert, sales manager for the Standard Electrical Manufacturing Company of Niles, Ohio, which makes the Star incandescent lamp, was in Chicago last week. Mr. Albert says that his company has been doing a very gratifying business and that new users of Star lamps are daily added to the already large list.

The Doxsee-Barrere Electric Company of St. Louis has recently moved from its old address at 1108 Pine to 1414 Chestnut Street. This company has been enjoying a constantly growing business which necessitated the removal to its present quarters, where the entire four floors are devoted to its business exclusively, or about three times the floor space formerly used.

At the office of the constructing quartermaster, Cheyenne, Wyo., sealed bids will be received until December 2d for furnishing and installing electric fixtures in certain buildings, and for extending the lighting system so as to make proper connections therewith, at Fort D. A. Russell, Wyo. Plans and specifications and blank proposals may be obtained at the above office by addressing W. S. Scott, captain and quartermaster, United States Army.

Announcement is made of the opening in Augusta, Ga., of a new electrical supply and repair house to be known as the Union Electric Company. The firm is composed of W. H. Day and P. Y. Price, two enterprising young men of Augusta. Besides conducting a supply and repair house the new concern is prepared to furnish and install all kinds of electrical apparatus in the most approved manner. Facilities have also been provided for charging automobile batteries.

BUSINESS.

The handsome 22-story United States Express Building which is now being erected in New York has its steelwork protected by Silica-graphite paint manufactured by the Joseph Dixon Crucible Company of Jersey City, N. J.

The Weber Gas and Gasoline Engine Company of Kansas City, Mo., reports an excellent fall demand for its well-known Weber gas and gasoline engines. This company was fortunate in securing, some months ago, as sales and advertising manager, the services of Mr. William H. Spiller, who has shown efficiency and up-to-date methods in handling the important affairs of his office.

The Westinghouse Electric and Manufacturing Company has just perfected a portable pipe-thawing transformer of five-kilowatt capacity; also a choke coil to work in connection with standard 15 to 20-kilowatt lighting or power transformers, thus making standard-capacity transformers available for thawing purposes in winter. The company has some interesting printed matter describing this apparatus, which can be had by addressing any of its district offices.

The D. & T. anchor Company of La Crosse, Wis., whose drive and twist anchor has been meeting with great success, has just shipped an order from one of the leading jobbing houses to the United States government for shipment to the Philippines. This order was for 100 No. 1 anchors, and it is even rumored that the government has adopted this anchor as its standard. The D. & T. company also reports a shipment of 350 anchors to Kurz & Root of Appleton, Wis.

Central-station men, electricians and contractors will doubtless be interested in the offer made by the Vought-Berger Company of La Crosse, Wis. The company offers to send, prepaid, one of its automatic adjusters for incandescent lamps to any reliable institution using 50 or more drop lights, the names and addresses to be furnished by the central station or contractor, who is also to install the adjuster. The company asserts that in this way central stations can obtain considerable business not otherwise obtainable. It will be glad to send further particulars to interested persons.

C. H. McGehan & Co., 11 Broadway, New York city, makes a specialty of designing and manufacturing automatic machinery to meet any requirements. The firm asserts that it can assist all who find it necessary to devise means for turning out their product in greater quantities, in order to meet the demand without increasing their running expenses, and with less space and a smaller number of machines than are at present used. It is also said that many automatic machines have been designed and built for making parts and assembling them at less cost than by the former method. McGehan & Co. require a small deposit from a client before agreeing to attempt to build a machine, but it is understood that if they fail to build a machine that is satisfactory there will be no charge.

Some large contracts for pumping machinery have been secured recently by the Allis-Chalmers Company of Milwaukee, Wis. Three centrifugal pumps, each having a capacity of 10,000,000 gallons daily, are to be supplied the Massapegna pumping station, Borough of Brooklyn waterworks. The contracts were let by Michael J. Dady, general contractor, Brooklyn, N. Y. The pumps will be driven by vertical cross-compound engines. George H. Norman, president of the Newport waterworks, Newport, R. I., has awarded contracts for a vertical triple-expansion crank and flywheel pumping engine of new design. The engine will have a daily capacity of 6,000,000 gallons against a head of 190 feet. Equipment to be furnished the Metropolitan Water and Sewerage Board of Boston for installation at the Arlington waterworks station will consist of a horizontal compound condensing pumping engine, having a capacity of 1,500,000 gallons in 24 hours against a head of 290 feet. This engine is one of a new line of small horizontal engines designed recently by the Allis-Chalmers Company to replace pumping engines of the direct-acting type. The saving in steam consumption in this type of engine is from 20 per cent. to 50 per cent., compared with the direct-acting engine under similar working conditions.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) November 14, 1905.

804,204 Coupling for Conduits. William S. Brown, New York, N. Y. Application filed April 15, 1905.

An externally threaded nipple carries a two-part sleeve, the latter having an internal spiral thread or groove, and an intermediate enlarged section integral with the nipple and one section of the sleeve. The intermediate section has a recess provided with a groove, continuous with the groove or thread in the sleeve.

804,211. Dental Switchboard. Monroe N. Callender, San Francisco, Cal., assignor to J. W. Rooch, San Francisco, Cal. Application filed January 30, 1905.

A movable dental cabinet with a switchboard secured thereto, has wires connected at one end to the switchboard and contacts connected to the other ends of the wires.

804,232. Binding Post. Frank Jackson, Denver, Colo., assignor to the Jackson Manufacturing Company, Denver, Colo. Application filed December 14, 1904.

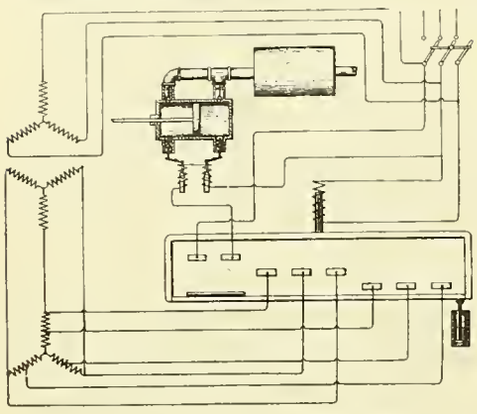
A thimble having a closed aperture end and an open flared end is also provided with a conical coiled spring in the thimble. A dished disk is centrally apertured, and provided on its edge with integral prongs, a headed screw being passed through the spring, thimble and disk, and a nut placed on the end of the screw.

804,256. Signal for Telephone Switchboards. Frank R. McBerty, Evanston, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed July 11, 1902.

In a visible signal are a pivoted weighted indicator arm, and a weighted armature operated by a magnet, overbalancing the arm to conceal the indicator. A separate armature engages the indicator arm to conceal the indicator and a magnet is provided for it.

804,279. Transmitter. Anthony Van Wagenen, Sioux City, Iowa, assignor to the Clark Automatic Telephone Switchboard Company, Providence, R. I. Application filed April 30, 1896.

In a transmitter are combined circuit-varying mechanism having an automatically returned actuating member and an indicator arranged to arrest the movement of the actuating member at predetermined points.



NO. 804,344.—ELECTRICAL SWITCHING DEVICE.

804,280. Transmitter. Anthony Van Wagenen, Sioux City, Iowa, assignor to the Clark Automatic Telephone Switchboard Company, Providence, R. I. Application filed May 4, 1896.

Circuit-varying mechanism and power-storing mechanism for driving it are associated with an operating device for operating the power-storing mechanism, and a detent for the circuit-varying mechanism which the operating device engages in its movement, thereby releasing the circuit-varying mechanism.

804,291. Electrical Apparatus for Producing Ozone. Albert C. Wood, Philadelphia, Pa. Application filed February 17, 1905.

Apparatus for the production of ozone embodies a tubular conduit, an electrode composed of sheet metal bent along its length intermediate of its edges to provide a number of discharges and insulating supports for holding the electrode in the conduit.

804,297. Safety Crossing System for Railways. Walter J. Bell, Los Angeles, Cal., assignor of one-half to Leon F. Moss, Los Angeles, Cal. Application filed May 15, 1905.

Crossed operating circuits, each having an insulated safety block, are associated with a feeder connected with each safety block. A feeder switch is adapted to disconnect all but any one of the feeder connections, a number of independent magnets operating the switch. A magnet-actuating circuit for each magnet and its related safety block, a magnet-sustaining circuit, an electric signal connected in the magnet-actuating circuit, means operated by a car for closing the magnet-actuating circuit and means operated by the car for breaking the magnet-sustaining circuit are provided.

804,298. Automatic Safety Crossing System for Railways. Walter J. Bell, Los Angeles, Cal., assignor of one-half to Leon F. Moss, Los Angeles, Cal. Application filed June 1, 1905.

Details are described.

804,331. Firing Attachment for Guns. John F. Meigs and Herman G. Jacobsson, South Bethlehem, Pa., assignors to the Bethlehem Steel Company, South Bethlehem, Pa. Application filed August 19, 1903.

Combined with the hand wheel of a gun is an operating handle and an electric-circuit closer or switch inclosed in the handle and having one member extending through an end of the handle. An electric circuit includes the circuit closer or switch, for the purpose of firing the gun.

804,344. Electrical Switching Apparatus. Walter J. Richards, Milwaukee, Wis. Application filed November 4, 1904.

Pivoted contact fingers have an adjustable stop for each finger. An oscillating contact plate is provided; also electromagnetic means for causing the movement of the contact plate. Retarding mechanism serves to retard the movement of the contact plate upon energization of the electromagnet. (See cut.)

804,355. Dynamo-electric Machinery. William L. Waters, Milwaukee, Wis. Application filed December 5, 1904.

Teeth in the armature frame have unbroken edges throughout their entire length, and are held by end plates on the frame. The plates have teeth registering with the teeth of the frame.

804,356. Fire Alarm. William D. Watkins, Scranton, Pa. Application filed October 6, 1904.

Connection of an alarm circuit is closed by a weight which is let drop by the fusion of a fusible member.

804,365. Device for Preventing Contact in Telegraph Line Wires. William L. G. Appleby, Germantown, Md., assignor of one-half to Isaac N. Simpers, Germantown, Md. Application filed October 7, 1904.

A method of stringing protective wires beneath telephone circuits is described.

804,371. Electromagnetic Wheel. Hugh Behan, Seattle, Wash. Application filed January 6, 1905.

Apparatus described in this patent specifies electromagnetic devices to be placed in a driving wheel by which to increase the adhesion between the wheel and rail.

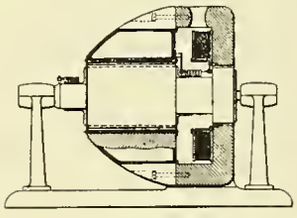
804,381. Snap-switch Contact Mechanism. Charles A. Clark, Hartford, and Ellsworth A. La Har, New Britain, Conn., assignors to the Perkins Corporation, Hartford, Conn. Application filed March 25, 1904.

Mechanical parts and principles form the basis of this patent.

804,387. Locking Device for Incandescent-lamp Bulbs. Ralph E. Davis, Alton, Ill. Application filed February 18, 1905.

A locking device for securing incandescent electric lamp bulbs to their sockets comprises a pair of members hinged to each other at the ends, and catches carried by the members and arranged for engagement with each other when the free ends of the members are brought together.

804,389. Electric Circuit-closer. Alex Dow, Detroit, Mich. Application filed January 22, 1904.



NO. 804,440.—DYNAMO-ELECTRIC MACHINE.

An electric circuit-closer comprises two flat circular connected insulating disks yieldingly spaced apart in parallel relation and contact plates fixed to the inner opposing faces of the disks.

804,428. Paper Cup. Charles G. Perkins, Hartford, Conn., assignor to the Perkins Corporation, Hartford, Conn. Application filed October 18, 1904.

An insulating paper cup for electric switches is described.

804,429. Process for Making Contacts. Franz Petz, Nuremberg, Germany. Application filed October 20, 1904.

Making good electrical contact between two or more conductors may be done by confining the conductors in contact with each other within a rigid retaining medium, surrounding the conductors with an adhesive material and finally allowing the adhesive material to expand as it solidifies.

804,431. Telephone Instrument. Egbert A. Reynolds, New York, N. Y., assignor to the Iron Telephone Company, New York, N. Y. Application filed August 19, 1904.

In a telephone instrument, the combination with a box or casing comprising a fixed back, bottom and sides, a top and front portion secured together and hinged to the main fixed portion, and a removable diaphragm fitted to the main fixed portion dividing the casing into two compartments, of telephone elements, including a telephone hook, induction coil, ringer coils and a clapper supported by the diaphragm and removable therewith, bells secured to the main portion of the casing at the exterior thereof, and a transmitter secured to the hinged portion of the casing is one claim.

804,440. Dynamo-electric Machine. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed April 22, 1904.

A drum armature, conductors carried at or near the periphery of the armature, a field structure having like poles extending radially inward and surrounding the armature are the main features. The poles extend into close proximity to each other adjacent to the armature so as to form a "homopolar" field and diverge from each other as they recede from the armature. (See cut.)

804,595. Electrical Controller. Nathan K. Garhart, Indianapolis, Ind., assignor to the Garhart Dental Manufacturing Company, Indianapolis, Ind. Application filed May 25, 1905.

A controller adapted to be operated by the foot by two levers is described, one lever for causing the motor to rotate in one direction and the other for the opposite direction of rotation.

804,603. Branch Block for Electric Wiring. Nathan B. Hoyt and James H. Martin, New Haven, Conn., assignors to the Elm City Engineering Company, New Haven, Conn. Application filed November 14, 1904.

A branch block has three longitudinal main grooves and two branch grooves arranged at a right angle thereto. Connection is situated between the central groove and one of the branch grooves; also connection between the outside grooves and the other branch groove.

804,628. Electrical Generator. Morris Schwartz, New York, N. Y., assignor to the New York Electrical Generator Company, New York, N. Y. Application filed March 7, 1905.

An electric generator has an armature mounted to rotate on a vertical axis, the armature having helically wound inclined conductors. Pole pieces have their axes inclined whereby they are substantially parallel with the adjacent parts of the conductors. (See cut.)

804,648. Trolley. Michael Baker, Chicago, Ill. Application filed August 31, 1904.

A trolley having a main wheel and an independent inbreaking wheel is described.

804,689. Automatic Blast-regulating Apparatus. Samuel W. Vaughen, Lorain, Ohio, and John W. Cabot, Boston, Mass. Application filed April 4, 1904.

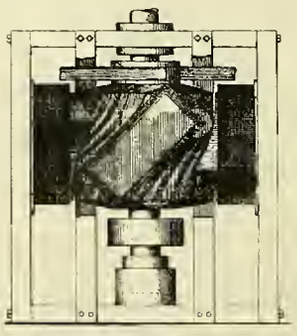
Electrically controlled mechanism regulates the air pressure.

804,741. Fuse Plug. Percy Q. Lawrence, Revere, Mass., assignor of one-half to Louis Greenburg, Boston, Mass. Application filed February 8, 1905.

A fuse plug has a cavity therein, one wall of the cavity being provided with an aperture. A luminous visible telltale fills the aperture and is detachably supported therin.

804,742. Push-button Switch Mechanism for Telephones. Burton L. Lawton, Meriden, Conn., assignor to the Connecticut Telephone and Electric Company, Meriden, Conn. Application filed December 5, 1904.

Details are described.



NO. 804,628.—ELECTRICAL GENERATOR.

804,759. Electrical Heater. John A. Noble. San Francisco, Cal., assignor of one-fourth to Edgar C. Gribble, one-fourth to Alonzo C. Gribble and one-fourth to James Davis, San Francisco, Cal. Application filed May 8, 1905.

An electrical heater comprises a tube or shell, a wire winding within it, an insulating block secured thereto and having passages in electrical communication with the winding and a removable cap having plugs adapted to fit the passages.

804,760. Electric Burglar Alarm. William E. Orr, Council Bluffs, Iowa. Application filed January 17, 1905.

Upon movement of the lock an electric alarm circuit is closed.

804,763. Process of Electrically Welding Rails. Carl Pahde, Breslau, Germany. Application filed July 11, 1905.

Electrically welding the ends of two contiguous rails is done by means of an electric arc. By passing an electric current therethrough after the joint between the ends has been filled in the lower portion with soft metal and at the heads of the rails with hard material the weld is made by melting the rail ends together.

804,783. Circuit Controller for Explosive Engines. Richard Varley, Englewood, N. J., assignor to the Autocoil Company. Application filed October 31, 1904.

A controller for the sparking circuit of a gas engine is described.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on November 20, 1905:

393,012. Metallic Connector for Electric Railways. J. Kames, Philadelphia, Pa.
393,013. Conduit for Electric Conductors. J. Kames, Philadelphia, Pa.
393,040. Electric-light Pole. E. Thomson, Lynn, Mass.
393,072. Electrical Apparatus for Preventing Corrosion of Steam Boilers. A. J. Marquand, Cardiff, County of Glamorgan, England.
393,073. Transformation and Distribution of Electrical Energy. W. J. McElroy, Pittsburg, Pa., and T. J. McTighe, New York, N. Y.
393,078. Electric-alarm System. Wm. F. Rosshach, Brooklyn, N. Y.
393,088. Instrument for Measuring Electric Currents. A. G. Waterhouse, Hartford, Conn.
393,123. Galvanic Battery. F. H. Root, Chicago, Ill.
393,125. Apparatus for Removing Frictional Electricity from Machinery. W. Schulte, Apollo, Pa.
393,132. Electric Meter. F. C. Wagner, Ann Arbor, Mich.
393,146. Mechanism for Changing Electric Circuits, etc. H. Edmunds, London, England.
393,147. Distribution of Electricity by Secondary Batteries. H. Edmunds, London, England.
393,165. Electromagnetic Shunt for Telephone Receivers. T. D. Lockwood, Melrose, Mass.
393,170. Apparatus for Electroplating. L. McMurray, Baltimore, Md.
393,183. Time Switch for Secondary Batteries. W. F. Stocker, Burrton, Kan.
393,192. Electrical Revolving Brush. R. Thayer, Philadelphia, Pa.
393,203. Gravity Battery. L. C. Bartley, Cambridge, Ohio.
393,224. Electric Railway. S. D. Field, New York, N. Y.
393,243. Telephone Apparatus. J. B. Ker, Harrisburg, and J. Crawford, Reading, Pa.
393,266. Electric Motor and Dynamo. A. L. Riker, New York, N. Y.
393,275. Closed conduit for Electric-railway Conductors. C. J. Vandepoele, Chicago, Ill.
393,276. Underground Conduit for Electric Conductors. C. J. Vandepoele, Chicago, Ill.
393,277. Turn-out and Crossing for Underground Conduits. C. J. Vandepoele, Chicago, Ill.
393,278. Switch for Overhead Conductors. C. J. Vandepoele, Lynn, Mass.
393,280. Electric-railway System. D. G. Weems, Baltimore, Md.
393,304. Electric Gas-lighter. C. H. Haskins, New York, N. Y.
393,315. Electric Meter. W. F. Stocker, Burrton, Kan.
393,323. Switch for Electric Motors. G. H. Condict, Philadelphia, Pa.
393,337. Electromagnet. F. A. Lane, New Haven, Conn.
393,346. Electrical Conduit. J. Whelan, Washington, D. C.

WESTERN ELECTRICIAN

EVERY SATURDAY

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LIBY OF ELECTRICAL ENGR.

Terminal Power Plant of the Chicago and Western Indiana Railroad.

Railroad experts have pronounced the new power plant of the Chicago and Western Indiana Railroad in Chicago an example of good engineering, well adapted to the peculiar needs of a railroad terminal. Furthermore, it possesses a number of original features which are of general engineering interest. The electrical equipment is up-to-date, and power is used in a number of applications which will be of interest to electrical engineers.

The plant is located on the railroad company's property just south of Forty-seventh Street, near Stewart Avenue, and the building which it occupies (Fig. 2) is 82 feet wide by 150 feet long, divided into a boiler room and generator room, with the piping and pumps located in a compartment between. The general layout of the system may be seen in Fig. 3, which is a plan of the plant.

Beginning with the entrance of the coal to the building, the installation will be described in regular order. At the very outset there is a feature which is out of the ordinary and deserving of attention. This is the coal-handling apparatus, which is shown in a general way in the sectional view, Fig. 4.

Rising to an elevation of over 90 feet on the east side of the boiler plant is a locomotive coal chute 17 feet wide by 50 feet long and having a capacity of 200 tons. The cupola surmounting this coal chute is located above the locomotive coaling hoppers and contains the driving mechanism of the coal-conveyor system, as shown in Fig. 4. Directly below the chute is a track upon which the coal cars may be run immediately over the hopper which delivers coal to the crusher, which is located in the basement. Locomotive furnaces are best adapted for burning bituminous coal in sizes varying from three-fourths to five-inch cubes. For this reason the coal at the station is divided into two grades—one for use on the locomotives that coal there and one to burn under the station boilers. This grading is done in the conveyor system in the following manner.

Mine-run coal is unloaded into the hopper over the crusher, which latter is motor-driven and self-contained. The crusher is adjusted to pass all coal of five-inch cubes or smaller, which is then elevated to the cupola. Here the buckets are tripped, and the coal runs over a grizzly, which discharges the pieces three-fourths to five inches into the locomotive coaling hoppers, while the pieces below this size fall through and are again returned to the conveyor system to be dumped into the hoppers for the various boilers. This method of handling the coal is unique, and as applied to railroad practice is economical, since it furnishes the locomotives with clean, uniform coal, best suited to their needs, while the smaller and poorer grades go to the station boilers, where they may be consumed with economy. The coal conveyor is also used to convey the ashes from the pits up to a hopper from whence they may be run into cars and drawn away. The conveyor buckets are 24 inches wide and 24 inches between centers.

There are six 300-horsepower Stirling boilers furnishing the necessary steam for the plant. These are arranged as shown in Fig. 3. The smoke flue runs the entire length of the boiler plant and discharges into a round brick stack nine feet in diameter and 182 feet three inches high above the grates. Foster superheaters are supplied, which are arranged in a somewhat novel manner, as shown in the sectional view, Fig. 5. The arrangement is such that the flue gases strike the superheater at almost maximum temperature. The position of the arch over the grate, as will be noted, is such, however, that the entire volume of the gases does not strike the superheater, part passing up back of it and directly through between the flues. Normally about 75 to 100 degrees superheat is obtained at the engine throttles.

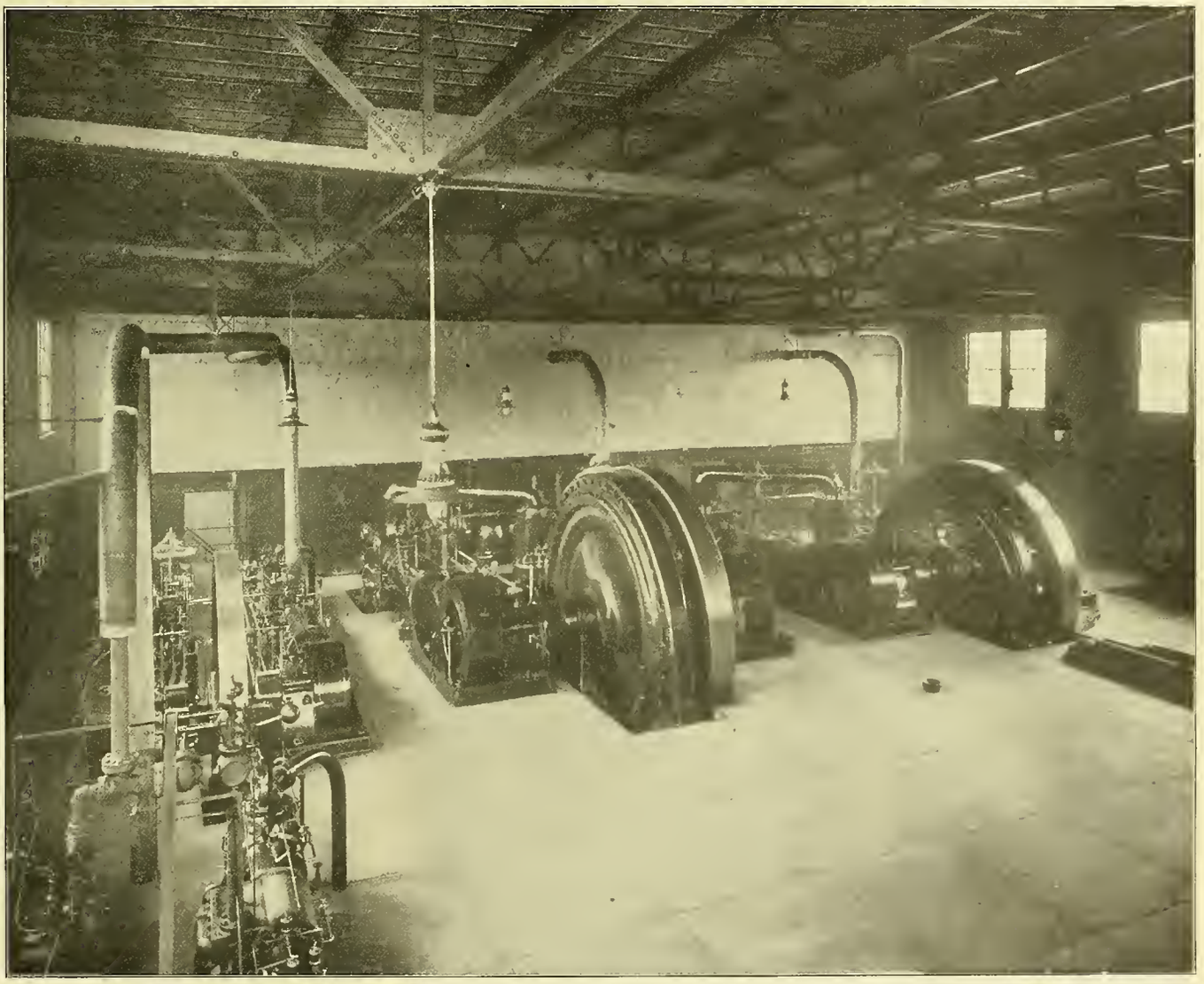


FIG. 1. ALTERNATING-CURRENT GENERATORS AND AIR COMPRESSORS IN TERMINAL POWER PLANT OF WESTERN INDIANA RAILROAD.

Inspection of Fig. 3 shows the arrangement of the steam piping. The main header, which is in two sections joined by an expansion loop, is located in the compartment back of the boilers. The diameter of this header is 18 inches and that of the loop eight inches. There is also a sub-header to which all the feeders to the various units are connected. One large feeder supplies steam to the yards for heating the coaches. The arrangement of the piping system, as will be noted in the diagram, is very flexible, and by use of the sub-header and its connections a total shutdown of the plant by failure of any part of the piping system is impossible. In the compartment with the steam piping are located the pumps. Fig. 6 shows two sump pumps driven by vertical induction motors.

Passing the engine room, the location of the

units is shown in Figs. 1 and 3. The generating equipment consists of one 300 and one 400-kilowatt star-connected 4,000-volt three-phase General Electric alternating-current generator direct-connected, respectively, to 16 and 28 by 42-inch and 18 and 32 by 42-inch cross-compound non-condensing engines, built by the Fulton Iron Works of St. Louis.

The exciter equipment consists of one 20-kilowatt 125-volt direct-current generator, direct-connected to a vertical marine-type automatic engine, and one 35-kilowatt 125-volt direct-current generator coupled to a 40-horsepower induction motor.

At the left in Fig. 1 are shown the air compressors which supply compressed air to the station and for various purposes about the railroad yards. One compressor is of the two-stage type, having cylinders 14 and 26 by 30 inches. It has a capacity of 1,500 cubic feet of free air per minute. The other is also of the two-stage type, 13 and 25 by 14 inches, and having a capacity of 750 cubic feet of free air per minute. Both are fitted with automatic by-passes from the high-pressure steam line to the low-pressure steam cylinders for starting the compressors after they have stopped on the high-pressure dead center. The governors on the compressors are controlled by both air pressure and the speed.

At present the station is operating with a temporary switchboard, but plans have been prepared and work is under way upon a large two-tier switchboard, which will be located as shown in Fig. 3. Each tier of the board is to be 36 feet two

FIG. 2. TERMINAL POWER PLANT OF CHICAGO AND WESTERN INDIANA RAILROAD.

inches long and made up of 13 panels 90 by 32 inches and one panel 90 by 18 inches. The material is blue Vermont marble and the finish of the instruments and apparatus a dull black marine.

Double-throw automatic oil switches connected to duplicate bus-bars are to be used, the automatic feature being operated by relays which close direct current from the exciter bus-bars through the trip coils of the switches.

Probably the most unusual feature of this switchboard is the method adopted for generator and engine protection. The conditions under which this plant is operated are widely different from those current in large electrical generating stations for city or traction purposes. It was considered by the engineers advisable that the generating units should be as thoroughly protected as possible.

To achieve this end, each of the generator panels is provided with a triple-pole, overload, time-limit

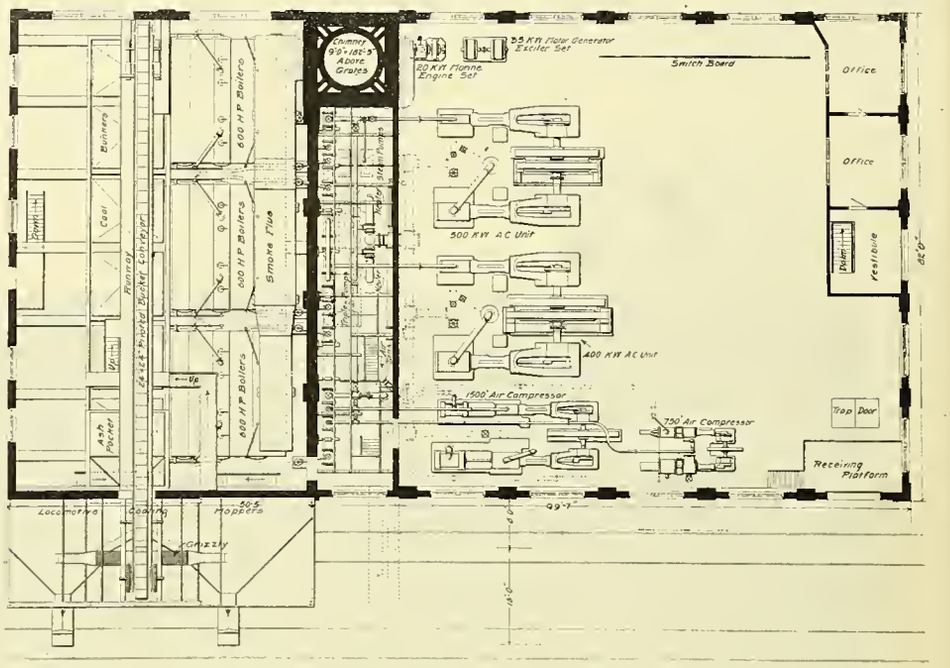


FIG. 3. PLAN OF TERMINAL POWER PLANT OF WESTERN INDIANA RAILROAD.

relay and also a reverse-current, time-limit relay, which, operating on emergency, close a direct-current circuit from the exciter bus-bars through the trip coil of the automatic switches. The overload relays are set for a high percentage of overload of short duration, all the feeder overload time-limit relays being set for slight overload of long duration.

The overload relays come into operation when such an overload occurs as may be detrimental to the windings of the generators or throw an undue strain upon the transmission rods and pins of the engines, or in case of dead short-circuits on the feeder lines or bus-bars and other connections of the switchboard. The reverse-current relay will come into operation when careless attempts at synchronizing are made and, with the generators operating in parallel, when any generator loses its field or becomes short-circuited, or in case of any engine losing its steam, or, due to hot bearings, slowing down and consequently causing the generators to fall out of synchronism.

Automatic switches are provided with an attachment which announces, by means of a bell, the automatic opening of any switch and also indicates, by pilot lamps, the opening of the circuit.

Current generated by this station will be used for many purposes about the railroad terminal, such as lighting stations, operating motors, etc. At present the principal feature in the transmission system lies in the supply of current to the Interstate Elevator in the Erie railroad yards, located about one-fourth of a mile from the generating plant. This elevator has been lately remodeled to use electric power. A three-phase three-wire line runs from the power house south along the yards and divides, one branch going to the elevator and the other to a supply house of the railroad company, where a number of motors are in use.,

Fourteen Westinghouse induction motors, aggregating about 500 horsepower, have been installed in the elevator. All these motors are controlled from a control board in the car-puller room in the south end of the elevator, which is shown in Fig. 7.

The control board is fitted with the necessary switches for operating all of the motors in the elevator plant, which is done by an operator at the board. The operator is informed when to start a given motor by an annunciator which is connected in a push-button circuit leading to the motor. When it is desired to start a certain machine or elevator the attendant pushes a button located at that point, which closes the annunciator circuit and rings a bell to draw the attention of the switchboard attendant, who then throws the proper switch. When the elevator attendant wishes to stop the motor he merely presses a second button, when the motor is thrown out of circuit automatically.

In Fig. 7 is also show a double-drum car puller operated by an induction motor. The apparatus is for drawing cars up to and from the elevator along the sidings. It is said that the puller will draw 20 loaded cars at a time.

Engineering work upon both the generating station and the elevator installation was done by Stephens & Tyler, mechanical and electrical engineers, of Chicago.

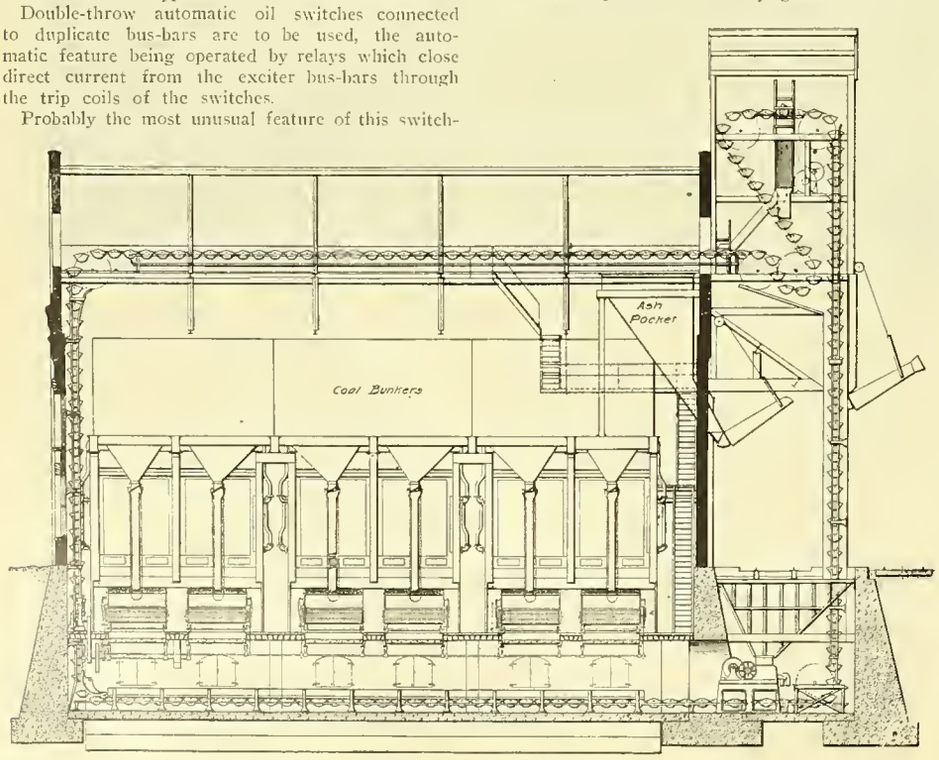


FIG. 4. SECTION OF TERMINAL POWER PLANT SHOWING COAL-CONVEYOR SYSTEM.

Berlin Underground Railways.

As announced in the Western Electrician last week, an underground-railway system, to cost $13,750,000, is contemplated for Berlin, Germany. Further information goes to show that the Grosse Berliner Strassenbahn proposes to construct two shallow subways which are to emerge to the surface at various points to connect with existing surface lines. Gradients of the approaches will be 1 in 30 to 1 in 20. One of the lines is to connect the Siegesallee with the Platz am Opernhaus, while the other is to run from the Potsdam bridge to the Ross Strasse.

Standardization and Testing of Apparatus.

Presentation of two papers at the meeting of the Institute on November 24th, the one on the "National Bureau of Standards," by S. W. Stratton and E. B. Rosa, and the other upon "A Testing Laboratory in Practical Operation," by Clayton H. Sharp, was productive of much valuable discussion in relation to standardization of apparatus and electrical testing.

Prof. W. E. Goldsborough of New York said that he was deeply interested in the subject and recommended that everyone visiting Washington inspect the National Bureau of Standards as one of the chief points of interest to electrical engineers in that city.

As indicative of foreign work in this line C. O. Mailloux of New York told of a visit which he made last year to the post of occupation of Prof. Kohlrausch at the Reichsanstalt in Charlottenburg, Germany. The laboratory itself is a wonderful example of precision and equipment. Shortly after his return to this country he went to Washington with the combined delegations of the English and Italian electrical societies as they were returning from St. Louis and visited the laboratories at Washington. It is true they were not in their completed form—one might say they were almost still in the chrysalis state—but he said he experienced a feeling of what amounted to almost exultation when he realized that at the very beginning we had outstripped the best work which they had done in London.

Prof. George F. Sever of New York said that

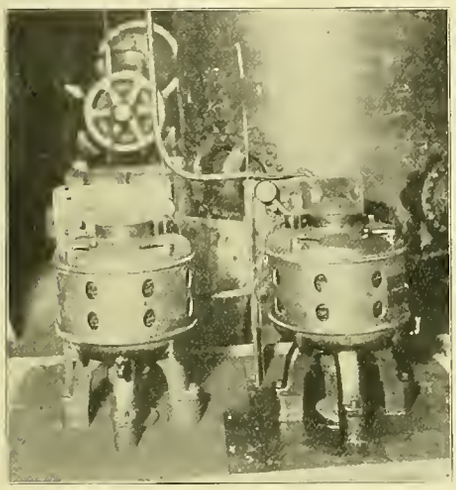


FIG. 6. INDUCTION-MOTOR-DRIVEN PUMPS IN RAILROAD TERMINAL PLANT.

the night before he had visited the Electrical Testing Laboratories and was deeply impressed by the work which the staff of that organization is doing. As it affects the electrical testing laboratories of the universities, it is extremely beneficial to them. In the olden days the electrical laboratories and physical laboratories of the various universities did the work very much less satisfactorily than the Electrical Testing Laboratories and the National Bureau of Standards are now doing it. One set of men had one set of standards and another set of men might have a different set of standards. One university had a certain set of standards, and the next university might have something a little different. There were no means whatsoever of getting together on some definite standard. Professors of electrical engineering and the professors of physics in the various universities were not able to get together on the exact thing at that time, and university men who are teaching should welcome and do welcome most heartily the establishment not only of the National Bureau of Standards but the establishment of the Electrical Testing Laboratories. The latter, speaking only for Columbia University, relieves the university staff of a lot of commercial work that completely disorganized and impaired the success of teaching by taking time, equipment and making the students not so well trained as they can be made under a purely academic standard.

Prof. C. A. Doremus of New York, speaking from the viewpoint of the chemist and the electrochemist, said that to the chemist the knowledge that his volumetric apparatus is of standard type is of greatest importance. Not only accurate weights are needed but also accurate measures. For instance, the standard United States gallon is standard at no particular temperature mentioned in the act which made it standard, and so it has been guesswork on the part of the officials ever since it was made a standard as to what temperature should be employed in the use of that standard gallon.

Introduction of the metric system into our laboratories has brought volumetric apparatus into constant use and we need not at present depend on the German government for a certificate of the accuracy of our standard meters or of the finer graduates.

When it comes to testing materials, such as steel and other things, pure chemicals are needed, and he was happy to say that the chemical manufacturer is beginning to recognize that it is worth his while to be able to put into the hands of those who need them chemicals of standard quality. They may not be absolutely pure; in some cases that is considered to be commercially impossible,

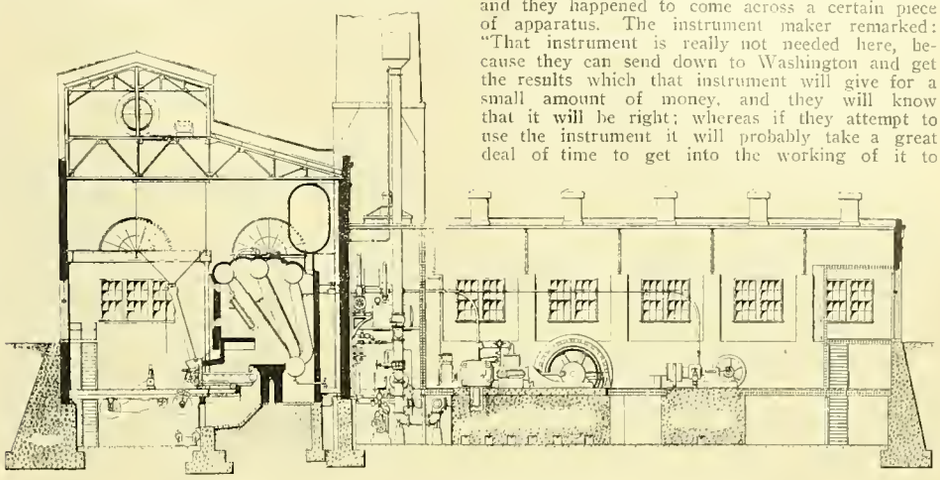


FIG. 5. SECTION OF TERMINAL POWER PLANT OF WESTERN INDIANA RAILROAD.

for a chemically pure material that is preserved in bottles acquires from the container sufficient impurity to reduce it to a lower standard, but it is of the highest importance for the chemist to know when he is using a particular acid or particular salt that it is not contaminated with other things, or if it is so contaminated how great the contamination is, and that is the feature which has been attempted to be realized by the chemical manufacturers.

There is one feature in connection with the Electrical Testing Laboratories which is of much importance, and that is that it is possible for an investigator to secure a room in which he may conduct his own investigations in his own way, being provided from the Electrical Testing Laboratories with such instruments and current as may be required for his work. Such an arrangement gives a flexibility of application which has not been found hitherto, for none of our institutions is able to put at the disposal of any man just such conveniences. Electrochemistry is so young in its development that we need just such conveniences in order to promote it.

William McLellan of Newcastle-on-Tyne said that it is well worth while to emphasize the value of the National Bureau of Standards to the universities and to scientific men generally. Take the old English and German catalogues of instruments and compare them with the catalogues of the American instrument makers—the best of them—a great difference in the kind of instruments listed will be found. While the makers across the water even now are producing instruments which enable the physicist or chemist to start right down at the elemental basis and build up everything that he needs to prosecute his work, the American instrument maker has ceased to do it, or rather, being young at the business, he has decided once for all that he will not make that class of instrument; that he will allow the work to start with a correct standardization of instruments. This was brought home to Mr. McLellan very forcibly while passing through a university laboratory some time ago, with a prominent instrument maker accompanying him, and they happened to come across a certain piece of apparatus. The instrument maker remarked: "That instrument is really not needed here, because they can send down to Washington and get the results which that instrument will give for a small amount of money, and they will know that it will be right; whereas if they attempt to use the instrument it will probably take a great deal of time to get into the working of it to know how to use it and to make accurate results."

John W. Lieb, Jr. remarked that it was his privilege to be present and take a part in some of the deliberations before the committee of Congress which had before it the consideration of the question of the establishment of the Bureau of Standards, and there seemed to be a grave doubt in the minds of some of the members of that committee as to the need of such an institution and as to the possibilities of either its misdirection or of its going out into fields of work which led no one knew where. It is therefore highly complimentary to Dr. Stratton's energy and ability to have enlisted so successfully the co-operation of the gentlemen of that committee and of the department of the government that had this institution under its jurisdiction and to be able to carry out the work with such success. Americans are apt to be taken to task for their utilitarian spirit, but in this institution there is good evidence that they have arrived at a point where the nation at large appreciates the importance of high standards, of careful scientific investigation and of experimental research. The Bureau of Standards in Washington is likely to play a very important part in enlisting the sympathy and co-operation of the mechanical industries in this country toward the bringing about of that great desideratum—the universal adoption of the metric system. It is in this line of work particularly that the profession of electrical engineering has the honor of having taken one of the leading parts in its introduction and its advancement.

F. B. Rosa of Washington said that it is very gratifying as an officer of the Bureau to hear such pleasant things said about the work of the Bu-

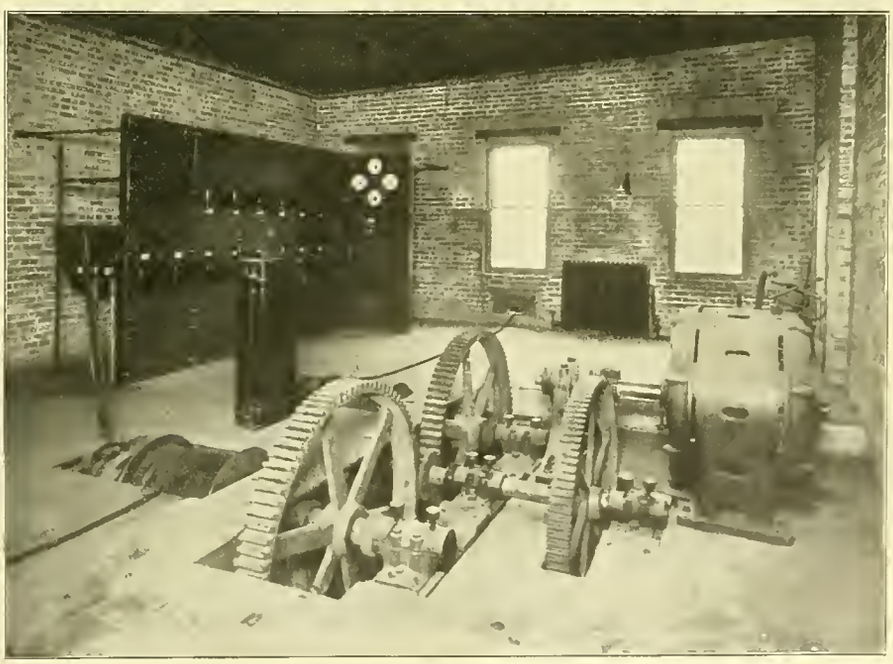


FIG. 7. MOTOR-CONTROL BOARD AND CAR PULLER IN ELEVATOR RECEIVING CURRENT FROM PLANT OF WESTERN INDIANA RAILROAD.

reau. If any of the members come to Washington and visit the Bureau he expected if they looked over the laboratory carefully they would discover many things not there that they might expect to find; in other words, the Bureau is not completely developed, not by a good deal; but it is well started. The Reichsanstalt equipment has cost $1,000,000, and probably more, for the grounds, building and equipment. It does not cover the whole country, however, for there is an institution for the testing of weights and measures quite distinct from the Reichsanstalt, which has a large building and employs a large force of men; and there is still another institution for the testing of engineering instruments and materials. The three institutions referred to represent an equipment cost of at least $1,500,000, and taking into account the greater cost of materials and labor in this country, probably could not be duplicated for less than $2,000,000, and that is a modest estimate. The total cost of the equipment of the National Bureau of Standards to date is not more than $600,000. It has not expended to exceed one-third of the amount that the Germans have expended in this work, and therefore cannot be held accountable to show everything that can be found in the German institutions.

The National Bureau of Standards.[1]

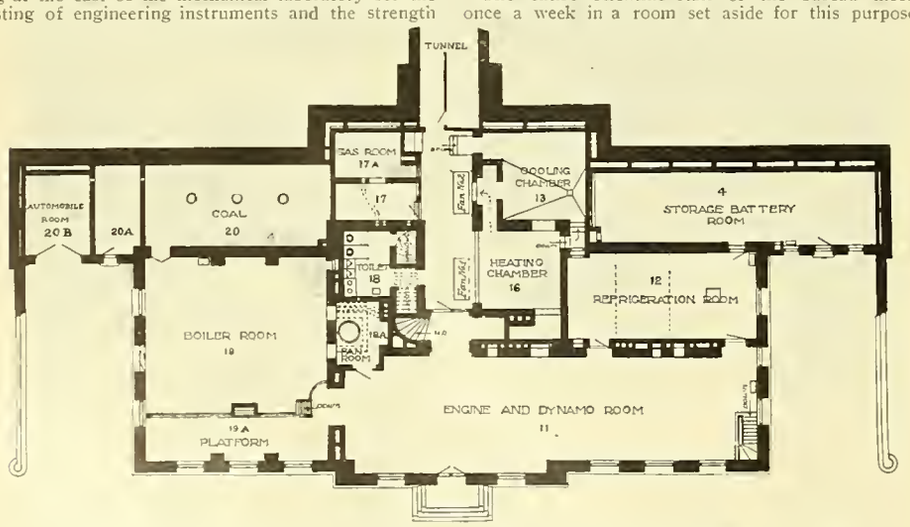
By S. W. Stratton and E. B. Rosa.

Immediately after the passage of the act establishing the Bureau of Standards, March 3, 1901, the planning of the laboratories was begun, as well as the selection of the scientific staff and the development of some of the more important methods

MECHANICAL BUILDING OF NATIONAL BUREAU OF STANDARDS, WASHINGTON, D. C.

of testing. It was decided to erect two buildings, one of which should contain the mechanical plant, instrument shop, and other work requiring heavy apparatus; the other, a physical laboratory, situated at some distance from the first, and, as far as possible, free from machinery or mechanical disturbances. The amount appropriated for the buildings, exclusive of the equipment, $325,000, would not permit of ornamental or expensive construction; nevertheless it was sufficient to erect two strong, substantial, fireproof buildings, of dark-red brick, trimmed with buff Bedford limestone, and of a style well suited for laboratories. They were designed by the supervising architect of the Treasury Department, according to general specifications drawn up by the experts of the bureau.

It is proposed to erect a similar but larger building at the east of the mechanical laboratory for the testing of engineering instruments and the strength



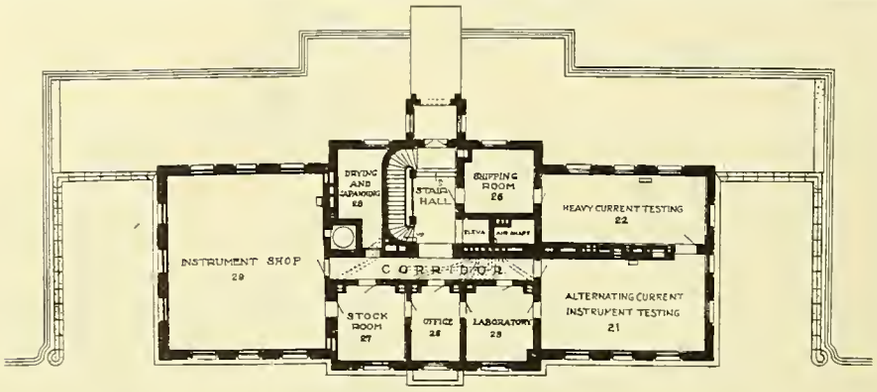
BASEMENT PLAN OF MECHANICAL LABORATORY, NATIONAL BUREAU OF STANDARDS.

and other properties of materials. At the east and west ends of the physical laboratory it is proposed

1. Abstract of a paper presented to the American Institute of Electrical Engineers in New York on November 24, 1905. Mr. Stratton is director of the National Bureau of Standards at Washington and Mr. Rosa is physicist of the Bureau.

to erect in the future two buildings, each about the size of the present physical laboratory, one to be devoted to electrical work, the other as a chemical and metallurgical laboratory.

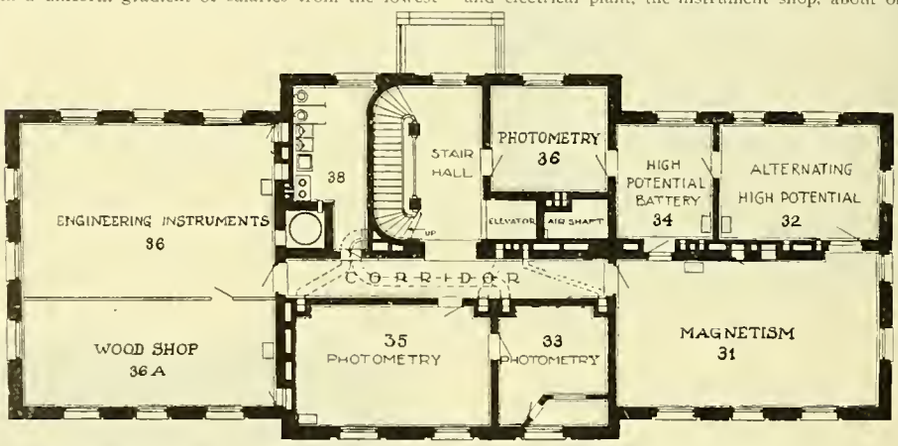
The entire personnel of the bureau, numbering 14 the first year, was increased to 24 the second year, 58 the third year, 71 the fourth year, and 87 for the present fiscal year beginning July 1, 1905, the fifth year in the history of the bureau. Over 75 per cent. of the personnel consists of scientific and technical men, the selection of which presented a



FIRST-FLOOR PLAN OF MECHANICAL LABORATORY, NATIONAL BUREAU OF STANDARDS.

difficult problem owing to the high standard that must be maintained by the bureau, and the great demand for the same classes of men by educational institutions and the engineering professions.

The grades, or ranks, in the scientific corps are: Laboratory assistant, assistant physicist or chemist, associate physicist or chemist, and physicist or chemist, with two or three different salaries in each grade. With a few of the higher positions yet to be provided, they constitute a series of positions with a uniform gradient of salaries from the lowest



SECOND-FLOOR PLAN OF MECHANICAL LABORATORY, NATIONAL BUREAU OF STANDARDS.

to the highest. Whenever possible vacancies or new positions are filled by promotion, new men being appointed to the lower places, but always selected with the educational qualifications that will permit of the advancement of meritorious men through all of the grades above.

The entire scientific staff of the bureau meets once a week in a room set aside for this purpose. This room is equipped with all the facilities of a first-class physical lecture room where papers intended for publication are presented and discussed. Current literature pertaining to the work of the bureau is reviewed, and reports made as to work contemplated or in progress. Leaders of the various sections of the bureau's work constitute a council which meets from time to time with the director for the discussion of matters pertaining to the policy, or administration, of the bureau.

The act establishing the Bureau of Standards provides for a board of visitors, to be composed of scientific or technical men who shall visit the bureau at least once a year and report on the work of the bureau, its equipment and personnel. It was thought by those interested in the establishment of the bureau that a board of this kind would serve to guard the character of its work, and advise as to the policy of the institution, especially as to its relations to the public. The board of visitors consists of five members, each appointed for a period of five years, the original appointments being made for one, two, three, four and five years, respectively.

Mechanical Equipment.

The mechanical building contains the mechanical and electrical plant, the instrument shop, about one-half of the electrical work, photometry and engineering testing. It stands on ground sloping toward the north, so that the north part of the basement story is wholly above ground, but projects only a few feet above it on the south. The accompanying view of the building was taken before the grading of the grounds was completed. The building is 135 feet long east and west, 48 feet wide at the ends and 58 feet wide in the center. An extension of the basement wholly below the ground level on the south is 20 feet wide and projects 25 feet east and west beyond the main portion of the building. This increases the floor area of the basement by 50 per cent., affording ample accommodation for the mechanical and electrical plant on this floor.

The boiler room is 42 feet square and 19 feet high, the floor being five feet below the engine-room floor and, like the engine and dynamo room, it is lined with white-enameled brick. Two water-tube boilers of 125 horsepower each have been installed, together with an economizer and forced draft. Space is reserved for additional boilers, with a final capacity of 500 horsepower. The platform along the north side of the boiler room accommodates the filters, electric and steam high-pressure water pumps, boiler feed pumps, feed-water heater and other auxiliary machines. Under the platform are located the heater for the hot-water service, pressure tanks for the cold-water service, storage tank, etc.

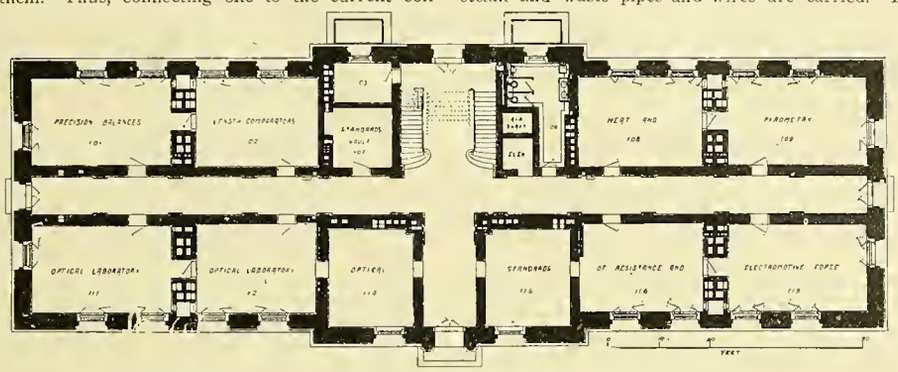
The engine and dynamo room is 87 feet long and has an average width of 24 feet. The larger of the two engines is a tandem compound of 120 horsepower, driving two direct-current 37.5-kilowatt generators, each giving 300 amperes at 120 volts connected in a three-wire system. The smaller engine has a capacity of 40 horsepower and, like the larger engine, drives the two direct-current generators. Beyond the engines are the following machines:

1. A double motor-driven booster for charging storage cells, having a capacity on each side of 200

amperes at 30 volts and which is also used alone to charge storage batteries of relatively low voltage and large current capacity.

2. A pair of two-phase alternators, surface-wound, and giving an electromotive force of nearly sine-wave form, direct connected to a driving motor. One machine gives 60 cycles and the other 180; the two may be placed in series and the wave form varied through wide limits by varying the relative amplitudes and phases of the two waves. By using them separately and varying the speed considerable ranges in frequency may be obtained.

3. Another three-machine set contains two 60-cycle, three-phase alternators, the relative phases of which may be varied by shifting the field of one of them. Thus, connecting one to the current coil



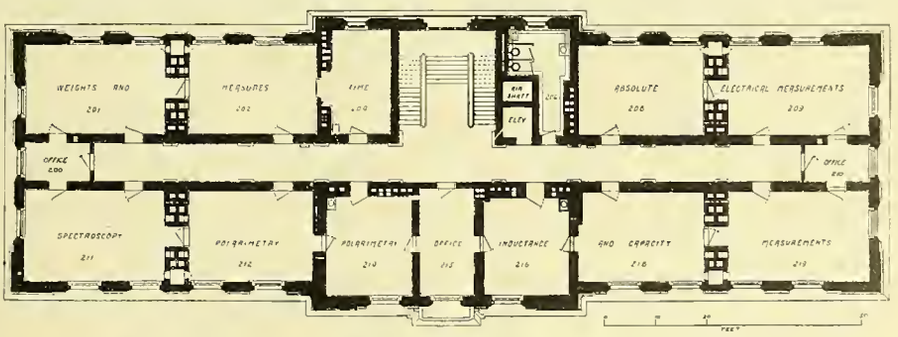
FIRST-FLOOR PLAN OF PHYSICAL LABORATORY, NATIONAL BUREAU OF STANDARDS.

and the other to the voltage coil of any instrument, any required power factor may be obtained.

4. A second smaller set of a similar kind gives two 60-cycle currents of adjustable phase relation. This is useful in calibrating phase indicators as well as testing power-measuring instruments.

5. A three-phase 120-cycle alternator, driven by an inverted synchronous converter used as a motor, giving alternating current at 60 cycles.

6. A 10-machine set has been built and is soon to be installed. This set contains eight alternators and two driving motors, all direct-connected, but capable of being uncoupled in the middle and operated as two independent sets. One set has, besides the driving motor, three alternators of six, 18 and 30 poles, respectively, giving 60, 180 and 300 cycles, sine-wave form, and capable of being joined in series, so varying the wave form. The second set has a driving motor and five alternators giving 420, 540, 660, 780 and 900 cycles, respectively. All the machines may be joined in series, as they have the same current capacity, namely, 20 amperes. The voltages, however, decrease gradually from 250 for the largest to 10 for the smallest. When joined in series all the odd harmonics to the fifteenth will be present in the electromotive force, or any may be quickly cut out. The wave form can be varied indefinitely by varying the number of harmonics employed and their relative intensities and phases. This machine will be very useful in testing and research, not only for varying wave form, but for obtaining a great variety of frequencies. The switchboard, which is now building, will be equipped with hot-wire instruments arranged to show what components enter into the resultant electromotive force. The operating switches give quick and complete control over the various possible combinations.



SECOND-FLOOR PLAN OF PHYSICAL LABORATORY, NATIONAL BUREAU OF STANDARDS.

In the sub-basement under the engine room are located the high-pressure steam mains, exhaust-steam pipes, air ducts, water, gas and other piping and the wiring. This gives an engine room practically free from piping, affording free travel for the crane and giving a very pleasing appearance.

The refrigeration room is 41 by 18 feet and contains a 30-ton ammonia refrigerating machine of the absorption type. Its capacity is equivalent to the melting of 10 tons of ice in eight hours.

The storage-battery room is 61 feet long and contains the following chloride cells:

Four batteries of 66 cells each, 200 ampere-hour capacity; two batteries of 66 cells each, 400 ampere-hour capacity; two additional batteries of the 400-ampere size will probably be installed next year.

The heating and ventilating plant is located near the engine room. The forced-draft, double-duct system is used, with thermostatic dampers to control the proportion of hot and tempered air in each room, so as to secure constant temperature.

Low-temperature Building.

The low-temperature building is being erected to accommodate the machinery and apparatus necessary for the liquefaction of air, hydrogen and other gases, and to provide space and facilities for low-temperature experiments. The building is about 28 by 58 feet, and two stories high, being built of dark red brick, trimmed with limestone to correspond with the main buildings. It is connected with the sub-basement of the mechanical laboratory by means of a tunnel, through which water, gas, steam and waste pipes and wires are carried. The bureau purchased from the British government a complete plant for the liquefaction of air and hydrogen; this was built in London and exhibited last year at the St. Louis Exposition. The apparatus consists of a hydrogen generator and gasometer for storing the gas, power pumps for compressing air and hydrogen to 3,000 pounds per square inch and heavy cylinders for storing hydrogen at this pressure, a combined air and hydrogen liquefier, and a machine for liquefying carbon dioxide, which is used as an auxiliary refrigerant in the process of liquefying air. In liquefying hydrogen, both liquid CO_2 and liquid air are employed as auxiliary refrigerants, the compressed hydrogen being thus cooled to the temperature of liquid air and then suddenly expanded, and thereby suffering a reduction of temperature sufficient to liquefy a portion of the gas. The liquefied hydrogen may be frozen in a separate apparatus, its temperature being reduced to about 16 degrees absolute. This is the only apparatus in America for liquefying hydrogen, and probably the only one outside the Royal Institution of Great Britain for producing liquid hydrogen in considerable quantities; that is, by the liter. It will be of great service to the bureau in research work and also in the testing of low-temperature thermometers. In the near future a second air compressor of larger capacity will be installed and a second liquefier for air will be added.

Equipment of the Physical Building.

The physical building is 172 feet long, 55 feet wide and four stories high, besides a spacious attic. It faces the south, overlooking the city of Washington.

In one of the basement rooms a subdivided storage battery has been installed for use in this building. Six other rooms of the basement will be used as constant-temperature rooms as they may be needed.

The entire first and second floors are given up to laboratory work. And in order that the changes in temperature may be a minimum double windows have been provided, and automatic temperature control secured by means of thermostatic dampers, controlling the supply of hot and tempered air. This, of course, regulates the temperature only in winter or in cool weather; in summer the temperature is controlled in some rooms when necessary by means of brine coils.

Between rooms 101 and 102, next to the outer wall, is a vertical shaft three feet square, extending from the basement to the attic, and in corresponding positions there are three similar shafts in the other three-quarters of the building. All the pipes for distributing hot and cold water, ice water, cold brine, gas, compressed air, vacuum and all electric wiring for lighting and experimental purposes are carried up through these shafts. A door opens into each shaft on each floor, making all main pipes and wires accessible without having them exposed in the laboratories. On each floor branches are brought out from the water and waste pipes to the sinks, from the air and gas pipes to the work tables, from the brine pipes to any cold boxes or other apparatus requiring it and from the distributing wires in the shafts, to the small local switchboards, of which there is one for each suite of laboratory rooms in the building. The wires connected to these small switchboards run to a main switchboard near the north door of the first floor, and thence trunk lines run through the tunnel connecting the two buildings to the main distributing switchboard of the dynamo room. Thus through these two main switchboards and a local laboratory board any circuit in any laboratory room may be joined to any circuit of any other laboratory room or to any battery or generator in the mechanical building. By means of a subdivided battery wired to the switchboard and an auto-transformer at the switchboard any direct or alternating voltage less than the regular line voltages (120 and 240) can at any time be obtained.

Great pains have been taken to equip every laboratory with the conveniences necessary for the most efficient work.

Instrument Shop.

An instrument shop equipped with suitable machinery and provided with expert mechanicians, is an essential feature of any laboratory; this is especially true in institutions where precise measurements and original investigations constitute the greater part of the work. The shop of the bureau is equipped with modern machinery, each machine separately driven by an electric motor. It is both an instrument shop and a machine shop, capable of

PHYSICAL BUILDING OF NATIONAL BUREAU OF STANDARDS.

handling a wide range of work. A supply of metal sheet, rod, tube and wires, as well as a great variety of other materials used in the construction of apparatus, is kept in stock. The mechanicians have been carefully selected, both as to personal and technical qualifications; they have been trained in the best American and foreign instrument shops.

Division of Work.

The duties of the section of weights and measures include the comparison of standards of length, mass and volume with the official standards of the United States, all of which are in the custody of the bureau. These measures are submitted by the government departments, by state and city inspectors of weights and measures, by manufacturers, and by scientific and technical institutions and individuals.

The construction in the shops of the bureau of a special comparator for directly comparing end standards and gauges with a line standard has just been completed. The bureau is well equipped to test bars of one meter or less, and is rapidly completing a 50-meter comparator for testing tapes and geodetic base apparatus. When these comparators are finished it will be possible to measure 50 meters or yards with a probable error not exceeding the one five-millionth part of the total length.

The bureau possesses two platinum-iridium copies of the international meter to which all length measurements, both customary and metric, are reduced. For the comparison of masses, the bureau possesses a complete series of the very best balances, duplicates of which will only be found in the standardizing laboratories of a few of the first-class countries. All mass comparisons are referred to the international kilogram, two copies of which are in the possession of the bureau. Like the meters, they are made of platinum-iridium.

The work carried on by the section of thermometry, pyometry and heat measurement includes the testing of thermometers of all kinds and of the various forms of pyrometers for the measurement of high temperatures, the determination of calorific values of fuels, and investigations bearing on the establishment and control of the temperature standards of the bureau.

While the work of the section of optics is chiefly

[Continued on page 432.]

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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DATES AHEAD.

American Society of Mechanical Engineers (next meeting), Edison building, New York City, December 5th to 8th.

New York Electrical Show, Madison Square Garden, New York city, December 12th to 23d.

Independent Telephone Association of Wisconsin (annual convention), Hotel Pfister, Milwaukee, December 20th and 21st.

Automobile Club of America (annual exhibition), Sixty-ninth Regiment Armory, New York City, January 13th to 20th.

Chicago electrical exhibition (first annual exhibition of Electrical Trades Exposition Company), Coliseum, Chicago, January 15th to 27th.

ACCIDENTS due to the use of electricity to the number of 62 happened in Switzerland in the year 1904, according to the inspector of electrotechnical installations in that country, as reported in a French journal. Of this number of accidents 36 affected human beings and 26 involved injuries to property. The 36 cases of accidents to persons are thus classified: Sixty-three per cent. were caused by carelessness or imprudence; 16.6 per cent. arose from defects in the plant; 10.2 per cent. were caused by the non-observance of regulations; 6 per cent. by malice, and 4.2 per cent. were brought about by unknown causes. Six accidents with three deaths happened with voltages between 110 and 250, eight accidents and six deaths with voltages between 350 and 500, and 22 accidents, involving 14 deaths, arose with high-tension currents. It is gratifying to observe that less than 17 per cent. of the accidents to persons were due to defects in plant. The casualties due to carelessness and non-observance of rules may be put together, making 73 per cent. of all accidents to persons due to negligence. Probably the proportion in this country is about the same; that is, three out of four accidents in which human beings are hurt by electricity are due to the carelessness, bravado or heedlessness of the person injured. The lesson to be drawn is an obvious one.

AN IMPORTANT work has been undertaken by the National Bureau of Standards in Washington, and in spite of the fact that Congress has seen fit thus far to appropriate but $325,000 for buildings in which to carry on the researches of the Bureau, results obtained in this country compare very favorably with what has been done in European nations, where money has been more liberally expended. Elsewhere in this issue an abstract is given of a paper prepared by S. W. Stratton and E. B. Rosa upon "The National Bureau of Standards" and presented at the most recent meeting of the American Institute of Electrical Engineers in New York. This paper is an interesting one, as it gives the present status of the Bureau, with something of the plans which are being made for future extensions.

The Bureau has already entered upon the fifth year of its existence. The personnel at first numbered but 14, but now there are 87 persons required to carry on the work. These are graded and ranked in regular order, and men of sufficient educational qualifications are selected in the beginning to permit of their advancement through all the various grades. With regard to equipment, the Bureau is well provided for, especially in the line of standards of weight and measurement. There is also a complete series of the very best balances, duplicates of which can only be found in the standardizing laboratories of a few other countries. Although this institution is comparatively young and in a stage of development, Americans may well be proud of the success which it has already achieved.

COMMENTING on the death of James C. Warner, in the Western Electrician of last week we spoke of the old type of highly trained mechanicians as a fast disappearing class. It is interesting to observe that the technical schools, or some of them, offer training to young men which shall provide substitutes for the skilled instrument-makers of other days. In a recent paper on "The Engineer in Manufacturing Industries," Mr. W. S. Graffam of the Clarkson School of Technology says: "The designer works up the inventor's idea and carries it through the next stage of development necessary for workshop production. He puts it into tangible shape so that it will be of value to the world. * * * The mechanical designer, as he may be called, is to be found in nearly all manufacturing establishments. In most instances he will be a graduate of some reputable engineering school. He will be trained to grapple with the new and difficult problems incident to building up manufacturing industries. He will know how to go to work, and to set about solving a problem in a rational and logical manner. He will be quick to discern where the fundamental principles may be applied, and recognize that it is with these that he must begin. In time he will have acquired power to master each successive step; otherwise, he cannot arrive at any reasonable conclusion of the problems presented which shall be at once satisfactory to inventor and designer. Similar preparatory work he has had to do under instruction, in his engineering course, and it now comes into play."

Thus the old order gives way to the new; the apprenticeship-trained mechanic to the graduate of an industrial or technical school. The change is inevitable, perhaps, but with it comes a loss of individuality and possibly of craftsmanship that brings something of regret.

DURING the fiscal year ended June, 1905, the United States exported electrical machinery valued at $182,314 to Germany. In the same period the exports of electrical appliances, including telegraph and telephone instruments, from this country to Germany, amounted to perhaps $270,000 more. The total value of our electrical export trade with the kaiser's empire last year was thus about $450,000; the figure is not exact, but is approximately correct. It is therefore of some importance, although not of very great importance, to consider what effect the new German tariff, which, with its many amendments, will become operative on March 1, 1906, will have on the American electrical export trade.

The new tariff makes many changes, but usually the new rate will be higher than the old. In many classifications in the new tariff there are two rates —the standard or general rate and the special or conventional rate, which is much lower. The conventional rates are to be granted to eight countries —Russia, Austria-Hungary, Italy, Switzerland, Belgium, Roumania and Servia—which have entered into new treaty arrangements, making concessions on their part. Without such a treaty between the United States and Germany the products of this country imported into Germany will be subject to customs duties at the higher rate. The question of a new commercial treaty with Germany will perhaps be taken up by Congress this winter, although under one section of the Dingley tariff law it is contended that the president has authority to negotiate a provisional arrangement, to avert a "tariff war," without reference to Congress, if he sees fit.

The higher rates with which this country is threatened by Germany's new tariff, if a satisfactory arrangement with the Fatherland is not made before March 1st, are in many cases very high. In the space available here a detailed analysis of the new tariff cannot be attempted, of course. But a few examples may be cited. Electric insulators of white porcelain are to be assessed at $2.38 per 100 kilograms (220 pounds). Silk-insulated wire is to pay $8.56 per 100 kilos; other insulated wire, $3.57. Dynamos, motors, rotaries, finished armatures, etc., are on the list at from 95 cents to $2.14 per 100 kilos, depending on size and whether the rate is general or preferential. Storage batteries not combined with celluloid, vulcanite or similar materials are to pay $1.42 per 100 kilos; if so combined, $5.71. Underground or submarine cables with metallic covering are dutiable at $1.00 per 100 kilos. Arc lamps are to be taxed $9.52 and incandescent lamps no less than $19.04 per 100 kilos. Evidently the German lamp industry is to be protected effectively. Telegraph and telephone apparatus, electrical appliances for surgical and dental purposes, galvanic and dry batteries and thermoelectric couples are classed together and put down at the respectable figure of $14.28 per 100 kilos. Electrical apparatus for illumination and transmission, measuring apparatus and other appliances not especially mentioned are to pay from 95 cents to $14.28 per 100 kilos, depending on various modifications. Thus, if such an apparatus weighs over 1,000 kilos it will pay $14.28 per 100 kilos according to the regular rate and only 95 cents according to the special treaty rate. This is "quite some" of a difference.

Many other instances might be given to show the characteristics and menaces of this new tariff, which is, in fact, a mighty weapon, carefully fashioned with the single aim of furthering the manufacturing interests of Germany, no matter what outsider is hurt. Americans cannot consistently make a wry face at a customs tariff of any other nation, of course. Germany has the right to fix its own tariff, and it is likely that an arrangement will be made by which the United States will be admitted to the "most-favored-nation" privilege. But if it should prove otherwise, Germany demanding too high a price, the nature of the trade relations between the two nations is such that the people of the United States will view the situation with entire composure. We hope that there will be no "tariff war" with Germany, but if there should be, the electrical interests of the United States, as the export figures show, will not be vitally interested.

Chicago Street-railway Situation.

The local transportation committee of the Chicago City Council and the two large traction companies, the Chicago City and Union Traction, seem finally to have reached an agreement on all points and their negotiations have resulted in the completing of a franchise extension ordinance for both companies which will probably be presented to the City Council at its next meeting. The main features of the ordinance which was submitted by the traction companies have been printed in the Western Electrician. On many points the committee held different views from those of the traction officials, but all differences have been adjusted, and when the final document is given to the council and the public it will represent what the majority of the committee considers the best means of settling the traction question.

The committee now proposes to consider Mayor Dunne's communications in reference to acquiring and operating the street railways by the city, and will probably make a report or recommendation to the council. It is known that the majority of the council approves the actions of the transportation committee and some definite action in the way of settling the traction problem may now be looked for from the aldermen.

The principal difficulty in reaching an agreement between the traction companies and the council's traction committee was the amount of compensation which should be put into the ordinance as the amount to be paid by the companies for the 20-year franchise. In determining this the report of Bion J. Arnold as to the probable future earnings of the properties was of much assistance. The companies offered to pay an average of 7.42 per cent of gross earnings for the 20 years but an agreement was finally reached at 8.50 per cent. This will be distributed about as follows: For the first three years, 4.04 per cent; for the next two years, 6.08 per cent; for the next 10 years, 8.08 per cent, and for the last five 11.08 per cent. These figures, it is estimated, will bring the city about $5,280,000 more than the rate proposed by the companies.

The minority members of the transportation committee say they will present the mayor's "Mueller certificate ordinance" (one of the municipal-ownership projects) as a minority report and will demand that both plans be submitted to a vote of the people at next spring's election. Should the council adopt the 20-year franchise ordinance which has just been completed, and the people approve it, the city, under its terms, would within five years have one of the finest street-railway systems in the world. Through routing to all portions of the city is provided, also general transfers, abolition of cables and a complete system of loops. The companies are to lower the tunnels and a thorough test of the underground trolley for the business district is to be made. None but the most approved rolling stock and equipment is to be permitted, and the city will have three chances to buy the property during the 20 years.

Proposed Municipal Electric-light Plant in New York City.

Dr. Cary T. Hutchinson of the engineering commission named by Mayor McClellan to prepare a plan for municipally owned and operated street-lighting plants for the city of New York has announced the plans for Brooklyn and Queens. The plans for Manhattan and the Bronx were submitted some time ago and were outlined in the Western Electrician of July 15th, page 51. The Brooklyn and Queens plans are now under consideration by the Board of Estimate.

For Brooklyn and Queens the commission favors a site at Nott Avenue, Hunter's Point, where it proposes to establish a plant of the same size and capacity as already planned for Manhattan and the Bronx. The report provides for alternate plans. The first would provide for all the present electric lights in the parks, streets and public buildings of the two boroughs, leaving the present gas lamps in those places undisturbed. The alternate proposition would in addition replace all the present gas lamps in the boroughs with electric lamps. Under the first plan the cost to the city would be $6,138,000 for the establishment of the plant, while the cost under the second plan would reach $9,485,000. This is comparatively a much greater cost than the establishment of the Manhattan and Bronx plant, which, under the first proposition, will cost approximately $4,000,000, and under the second proposition approximately $7,000,000.

It is also figured that it will cost $100,000 a year more to run the Brooklyn and Queens plant than it now costs the city to light the two boroughs by contract with the present lighting companies. This is because the plans of the Hutchinson commission provide for placing underground all wires in Brooklyn and Queens.

New York Electrical Society.

The latest meeting of the New York Electrical Society was held at 19 West Forty-fourth Street, Wednesday, November 22d. A most interesting lecture was given by Mr. O. S. Lyford, Jr., electrical engineer, of Westinghouse, Church, Kerr & Co., on the "Electrification of the Long Island Railroad."

All the great railway systems centering in New York are becoming electrified. The first system to show definite results is that of the Long Island Railroad Company, whose work is an admirable exemplification of all the latest developments in electrical train operation, current distribution and third-rail methods. Mr. Lyford, who has been actively connected with this important work, after detailing some of the special conditions which had to be met in the construction of the road, emphasized the following requirements:

Public safety, safety of employes, continuity of service, prompt action in emergencies, permanence, economy of operation and highest class of construction. Such an undertaking, in fact, calls for the latest and best engineering practice in every detail and utmost diligence in construction. The requirements are not new, but a project of this character presents them with unusual emphasis. Likewise, the solutions adopted are not radically different from the best that have preceded, but they are more perfectly worked out and better harmonized than ever before. The pictures shown illustrated the fact that there is uniformity in the engineering, and every detail is substantial, rugged and permanent in character. The equipment and structure are fireproof to an unusual degree. The buildings and cars and their equipment and to a large extent the transmission system contain no combustible material except that necessary for insulation purposes. As far as possible the same general factor of safety has been applied throughout.

The initial plant contemplated the electrification of about 200 miles of single track, of which 100 miles has now been equipped and is in operation. An equipment of 400 cars is contemplated, and of this number 219 are completed.

The interchange of traffic with the Brooklyn Rapid Transit and possibilities of further interchange of traffic with other roads have had much to do with the selection of the electrical characteristics of equipment. Direct-current 650-volt motors are used, and the power is generated and transmitted at 12,000 volts three-phase, and distributed from rotary-converter sub-stations by means of third rail. The location of the power station is at Long Island City, and the adoption of this site made it practicable to consolidate at this point the equipment for supplying power to the Pennsylvani Railroad tunnels and to the Long Island Railroad system. The transmission system from power station to sub-stations is partly overhead and partly underground. Steel motor cars are used, and the electro-pneumatic system of multiple-unit control.

The sub-stations are simple in design and very permanent in character. These sub-stations are located at the junction points. At Hammel the sub-station installation includes a 3,200-ampere storage battery. This is one of the first installations where the type R plate of the Electric Storage Battery Company has been used. One of the most interesting features of the sub-station equipment is the portable sub-station unit provided for handling the temporary loads at race tracks and for relay purposes at the sub-stations.

The underground-conduit construction for transmission cables on a railroad right-of-way meets with many unusual obstructions. For the principal sections of overhead-feeder lines steel towers are used.

Referring to the power station, attention was called to the fact that it is entirely dependent on steam turbines. Three 5,500-kilowatt units are in service. The most striking feature of the electrical installation in the power station is the arrangement of switch galleries, which are entirely isolated from the engine room, except that the operating gallery has a balcony which extends into the engine room. This balcony is provided with windows, from which the engine room can be viewed. The operating room is well lighted, cool in summer and warm in winter, absolutely quiet and perfectly safe at all times, as it contains none of the high-tension conductors, and there is no possibility of steam escaping into it.

The following-named gentlemen were elected members of the society: W. H. Warren, Albert Roe, Bernhard Hoffman, Charles Rogalsky, Walter Neumuller, E. A. Skehan, Albert Baldwin Hoffman, B. P. Wiltberger, Robert A. Broadfoot, Arthur J. Arwine, Felix Preston, Frank Davidson.

Overhead Transmission Demanded in England.

Discussing the subject of cheaper electric power for Great Britain, an engineering correspondent of the London Times dwells on the advantages of overhead construction and concludes as follows: "Of course, any system of extra high-tension overhead transmission must necessitate special precautions; but no engineer worth the name would neglect taking them. A small extra cost will make any such system absolutely secure, and it may be said that the higher the pressure employed, the safer the system, because with a very high pressure the precautions taken will be ample to the last degree. The cost of underground as compared with overhead transmission will be, power for power, as 9 is to 4. Overhead wires extending tens of thousands of miles and in operation for many years have been proved to be fully as safe as underground mains; and it is imperative for Great Britain, if she intends to keep her pre-eminent commercial position in the world, to insist upon being given the right to have the cheap, safe and certain transmission that her industries demand."

Death of William H. Edgar.

William H. Edgar, president of the Dearborn Drug and Chemical Works of Chicago, died of Bright's disease at Hot Springs, Ark., on November 26th. He had been ill for six weeks. Mr. Edgar was the founder and the first and only president of the well-known chemical institution to which he devoted the best years of his life. He was a good practical chemist and was well known among the leading chemists of the country. His knowledge in this direction was, however, principally applied to his own business, which largely consisted in treatment of boiler feed waters for power houses. Mr. Edgar also took a lively interest in electrical matters, particularly in power-house engineering, and at the time of his death was a member of the Northwestern Electrical Association. He was also a member of the American Chemical Society.

WILLIAM H. EDGAR.

Mr. Edgar was born in Chicago on November 25, 1865. He received his professional education at Northwestern University. Subsequently he founded the Dearborn Drug and Chemical Works, to which he had since devoted his energies. He was married four years ago to Miss Elizabeth Winthrop of Davenport, Iowa, who survives him. His mother and two sisters are also living. He was a member of the Chicago Athletic Association and the Bohemian Club of San Francisco, was a prominent Mason and belonged to the Elks. The remains were brought to Chicago for burial.

Of slight physique, "Doc" Edgar, as he was affectionately called by his friends, was a man of keen mind and warm heart. He possessed unusual business as well as technical ability and made a conspicuous success in building up to large proportions the enterprise in which he was engaged. He was a generous man, greatly attached to his friends, and he delighted in doing unobtrusive kindnesses for others. His untimely death will be lamented by all who knew him.

Ohio Interurban Meeting.

The November meeting of the Ohio Interurban Railway Association was held at the Todd House in Youngstown on November 23d, with a very good attendance. The greater part of the time was taken up with the discussion of the topics that had been assigned by the committee. The subject of car wheels for suburban cars was thoroughly discussed in all its phases. The various kinds of steel wheels and steel tires were mentioned, with some of their good points and their faults. It was shown that most of the large cars are equipped with some kind of steel wheels.

W. H. Abbott gave an interesting discussion of the use of recording and other instruments. Others discussed the subject. This was considered an interesting part of the proceedings for the day.

The association wishes to secure a more simple form of inter-line ticket. Where joint agencies are maintained the agents sometimes have trouble in making out these tickets. A committee will study the matter and report at a later meeting. Thirty-three lines are now using the coupon books to good advantage.

Handling foreign cars and charges for the same was one of the subjects assigned by the committee, but the time was so taken up with other matters that it received but little discussion.

The December meeting will be held at the Chittenden Hotel, Columbus, on December 28th.

Books Received.

"Real Electric Toy-making for Boys." By Thomas M. St. John, Met. E. Published by Thomas M. St. John of New York. (Price, $1.)

"Modern Turbine Practice and Waterpower Plants." By John Wolf Thurso. Published by D. Van Nostrand Company, New York. (Price, $4.)

"The How and Why of Electricity." By Charles Tripler Child. (Second edition.) Published by Electrical Review Publishing Company of New York. (Price, $1.)

The National Bureau of Standards.

[*Continued from page 429.*]

related to the determination of physical laws and constants, considerable testing has been done, especially in connection with polariscopic apparatus and standards. The spectroscopic work has been confined to the determination of the laws and conditions governing the production of pure spectra, with a view to their application in spectroscopic methods, the determination of standard wave lengths, and their use in optical methods of measurement.

It has been impossible to assign to the section of engineering instruments and materials laboratory space and assistance commensurate with the importance of the work and the demand for testing. The bureau is in a position to study and test water meters not larger than two inches, gas meters, speed indicators and pressure gauges. Designs have been completed for an anemometer testing machine, which is now in process of construction.

Work of the section of resistance and electromotive force consists in the construction and verification of resistance standards and standards of electromotive force, the calibration of precision rheostats, Wheatstone bridges, potentiometers and other resistance apparatus, the verification of resistance standards for current measurement, and the determination of the electrical properties of materials.

The permanent equipment for this work, the installation of which has recently been practically completed, has been planned with the view of facilitating the routine testing work by the application wherever possible of direct-reading methods and the use of specially designed apparatus; so that several fundamental investigations relating to the mercurial resistance standard and the standard cell can now be seriously taken up.

One of the rooms has been fitted up for the verification of resistance standards of precision, the results of which are, at present, based on the mean value of a number of coils as determined through one-ohm standards reverified from time to time at the Reichsanstalt. The results are thus based upon the primary mercurial standards of that institution pending the construction of similar standards by the bureau, which work is now under way. A considerable number of standards, including the master standard of the leading American manufacturers of electrical apparatus, have already been verified.

By the aid of new western high-sensibility d'Arsonval galvanometers resistance standards are readily compared by the Kelvin double-bridge method to one part in a million.

For the calibration of resistance boxes, bridges, potentiometers, etc., a direct-reading apparatus has been designed, based on the proportionality of the resistances included between two points in a circuit and two points having the same potential in a parallel circuit. By this method all errors due to plug-contact resistances are obviated and much time is saved. A direct-reading substitution method has also been employed with entire satisfaction.

Inductance and Capacity and Absolute Measurements.—This work includes the investigation of methods of measurement, of inductance and capacity, the construction and testing of the bureau's standards of inductance and capacity, the testing of capacities and inductances for the public and the measurement of the inductances and capacities of instruments. The bureau possesses a series of standards of inductance and capacity, the values of which have been fixed with high precision, using several different methods of measurement.

Very few standard condensers are provided with thermometer holes, the idea being that the temperature coefficient is too small to be taken into account. This is a serious error. Provision should be made for inserting the bulb of the thermometer, not simply into the box containing the condenser, but into the mass of paraffin in which the condenser is imbedded, or at least in contact with the condenser. The temperature lag is considerable, but a thermometer used in this manner gives the mean temperature of the condenser very nearly and if the capacity is known at different temperatures it is not necessary to bring the condenser to a particular temperature.

The equipment of the bureau for measurements of inductance and capacities is very complete. Much use is made of tuned galvanometers, which are very sensitive and which do not respond to the harmonics contained in the test current. This gives results free from error due to such harmonics, which error is present in some of the best-known methods and is often serious. A very thorough study has been made of the sources of error in inductance measurements, particularly the errors due to residual inductances and capacities of the wire resistances employed, and methods have been developed for eliminating these errors. The bureau is prepared to measure these residual inductances and capacities in the "non-inductive" coils of resistance boxes or resistance standards so as to permit their use with alternating currents in inductance measurements. This important source of error has been too generally ignored.

The work of the section of electrical measuring instruments includes the investigation and testing of instruments of precision for measuring electric current voltage and power (both direct and alternating) and the testing of laboratory and commercial instruments designed for such measurements such as ammeters, voltmeters, wattmeters and watt-hour meters for direct and alternating currents, and special alternating-current instruments such as frequency meters, phase meters, curve tracers, etc. A considerable amount of work of investigation of instruments and methods of measurement has been done as well as some testing of instruments. The facilities required for handling and measuring alternating currents up to 1,000 amperes and direct currents of several thousand amperes are of course much more difficult to provide than those required for smaller currents. A battery of four large storage cells has been installed and so connected that by means of switches the cells may be used in series or in parallel, furnishing current up to 10,000 amperes at two volts, 5,000 amperes at four volts, or 2,500 amperes at eight volts. At present current shunts up to 5,000 amperes capacity are tested. A new controlling rheostat and current standard have recently been designed and when completed will increase the capacity to 10,000 amperes, the resistances of the conductors, switches, rheostat and standards being low enough to give a current of 10,000 amperes with an electromotive force of two volts.

The work in magnetism has not been developed so far as the work of the other electrical sections. A considerable number of instruments for testing the permeability and hysteresis of specimens of iron have been secured and comparisons made by testing the same sample with different apparatus.

Photometric work of the bureau comprises the testing of incandescent lamp standards for candlepower and distribution of light, the commercial testing of lamps as to life, candlepower and efficiency for various departments of the government and the study of special problems in photometry.

Among other things a commercial photometer has been designed and constructed for the rapid testing of incandescent lamps. This includes a horizontal and an end-on rotator, Bunsen screen with Leeson disk, variable sectored disk, by the use of which lamps ranging from four to 100 candlepower can be read without readjustment of the comparison lamp. An efficiency meter, by means of which efficiencies or watts per candle can be read directly, has recently been designed and built and added to this photometer.

The chemical laboratory is located on the fourth floor of the physical building, occupying nine rooms and possessing an excellent equipment. The work is carried on by Prof. W. A. Noyes, chemist of the bureau, an associate chemist and three assistant chemists. This work was not begun as early as the work in the other divisions for lack of suitable quarters, but was taken up actively shortly before the physical building was completed.

In addition to the planning and installing of the permanent equipment and apparatus of the chemical laboratories a number of investigations have been undertaken which were considered important from a commercial or scientific standpoint, or have been necessary in connection with the work of this and other government bureaus.

The bulletin contains the more important investigations carried out in the various sections of the bureau. Three numbers of the bulletin so far have been published together, constituting Vol. I.

Wagor Protector Lamp Guard.

Ten years of experience in the making of lamp guards has enabled the P. R. Wagor Manufacturing Company of Springfield, Mass., to produce the guard which is illustrated herewith. The company believes that it has evolved a protective device which approaches perfection for the following reasons:

The guards are easily put on and they will not shake off, or partly off, to one side.

WAGOR PROTECTOR LAMP GUARD.

They will not become charged as they cannot touch the metal part of the lamps (lamps with Edison base).

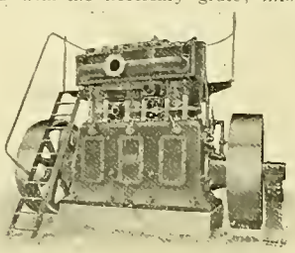
Wires are small and will spring, being near to the lamp and to each other, with no lateral wires at the best point of radiation. All these conditions contribute to make a good protection for the lamp, together with least obstruction of light.

Three styles of guard are manufactured, A, B and H, and the company also makes a 32-candlepower size. Since the company devotes its entire attention to the manufacture of these guards it is only natural that they are of a high-grade character.

Gas Engine for Milling Operations.

A 250-horsepower gas engine will be hereafter used by the Alexander Milling Company of Brandon, Manitoba, for producing the necessary power in its milling operations. Thus far the plant promises to be a very economical one.

The plant is simple in arrangement and consists of a gas-producing apparatus and the engine, which is shown in the accompanying picture. The producer is a cylindrical apparatus lined with firebrick and fitted with the necessary grate; into this the



GAS ENGINE FOR MILLING OPERATIONS IN BRANDON.

coal is fed from the top, where it is supplied by means of a hopper. To the producer a blower is attached. The gas is driven, or rather drawn, into a generator, and thence into a cylindrical cooler and scrubber, where it goes through a washing process before being delivered to the gas receiver, where the finished product is ready for the engine.

The engine (three-cylinder vertical) weighs 70,000 pounds and is governed with a ball governor actuating a special intake valve which acts directly upon the air and upon the gas. The governor is of the throttling type, assuring uniform speed.

Provision is made for ample water space in the cylinder jackets and cylinder heads; the valve chambers are also entirely surrounded by water and the exhaust valves are themselves internally cooled by water. In this way the temperature is controlled on the vital parts of the engine. An air compressor furnishes air at a pressure of 110 pounds for starting the engine, making the starting as easy as that of a steam engine.

Saving in fuel is not the only economical feature of the plant, however; the space occupied is said to be much smaller than is necessary to produce the same amount of power by steam, and requires much less attendance. Another feature that makes the plant desirable is that it emits no smoke. The Alexander Milling Company's is believed to be the largest flour mill in America to be operated by gas power, and the plant is the largest gas-producer engine plant in Canada. The consumption of low-grade lignite coal does not exceed 2¼ pounds per horsepower per hour. In an 80-hour run the mill exceeded its regular output every 24 hours by 20 barrels of flour.

The Weber Gas and Gasoline Engine Company of Kansas City, Mo., furnished the installation through its Canadian representative, the Cooper Gasoline Engine Company of Winnipeg.

Naval Architects and Marine Engineers At Schenectady.

Following the final event of the general convention of the Society of Naval Architects and Marine Engineers, held in New York on November 16th and 17th, invited guests to the number of 135 boarded a special train at the Grand Central Station on Saturday morning, November 18th, for Schenectady, shortly after the closing banquet at Delmonico's. The banquet was very successful and a fitting climax to the preceding two days' business session.

Among the speakers at the banquet were General Eugene Griffin, first vice-president of the General Electric Company; Rear-admiral Evans, U. S. N.; H. D. Goulder, head of the Merchant Marine League, Cleveland, Ohio; Senator Gallagher of New Hampshire, and others.

The special train arrived in Schenectady Saturday morning, and was switched into the yards of the General Electric Company where breakfast was served on the train. The visitors were then escorted in groups through the works in charge of representatives of the company. For the information of the visitors, a handsome pamphlet was distributed, which illustrated the marine section of the company's products and works, including a diagram of the route of inspection, which was much appreciated. Many prominent marine engineers and others prominent in the ship-building industry and steel trade were among the party. The Society members of the General Electric Company were in charge of the trip, headed by J. W. Kellogg, of the marine department of that company. The guests returned to New York in the afternoon.

Novel Electrical Water Hoist.

Unwatering a mine is always a serious problem to the mine management, especially when the water is highly impregnated with acids. When the amount becomes excessive the means to be employed for disposing of it taxes the ingenuity of all concerned to the uttermost. In the anthracite regions there

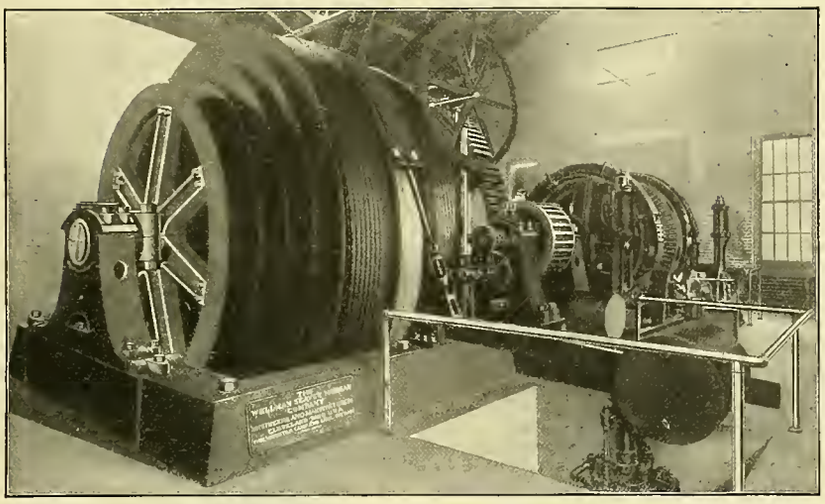


FIG. 1. FRONT VIEW OF ELECTRICAL WATER HOIST.

are mines in which, for every ton of coal raised, as high as 14 tons of water must be pumped, and this pumping must be done at a minimum of expense. Nowhere, probably, has a greater variety of pumps and lifting devices been tried. The most satisfactory type, until lately, for handling large quantities of water at comparatively low heads has proved to be the large bailer operated by a steam engine. These, however, lack the mechanical regularity inherent in a pump, as they are necessarily operated by men.

The Delaware, Lackawanna and Western Railroad Company and its electrical engineer, Mr. H. M. Warren, have finally developed a water-hoisting equipment which apparently preserves all the valuable points of the steam hoist and at the same time operates automatically. The carrying out of the mechanical details of the hoist and its automatic devices was confided to the Wellman-Seaver-Morgan Company of Cleveland, Ohio.

In the original specifications the Delaware and Lackawanna company called for a hoist to be operated by an alternating-current motor of 800 horsepower, and the question of starting, stopping and reversing so large a motor had, at the outset, to be met. The duty to be performed by the hoist called for the raising of 4,000 gallons of water per minute to a height of 550 feet.

$$4{,}000 \times 8.27 = 33{,}180 \text{ pounds,}$$

550 feet 2-inch rope $\times$ 6.3 = 3,465. 33,180+3,465=36,645 pounds to be raised 550 feet per minute.

$$\frac{36{,}645 \times 550}{33{,}000} = 610 \text{ net horsepower.}$$

The weight of the bucket equals one-half the weight of the water, so that the weight on the rope equals 53,235 pounds, or nearly 27 tons, requiring a two-inch steel rope.

It was decided in carrying out the design that it would be impracticable to design the hoist other than to have a motor running continuously in one direction, as it is a well-known fact that the amount of current required to accelerate a large motor of this type is great, and greatly interferes with the proper running of the power plant. Since the railroad company desired to use an alternating-current motor directly at the hoist, and as the motor was to run continuously in one direction, this necessitated the use of friction clutches for accelerating and reversing the load.

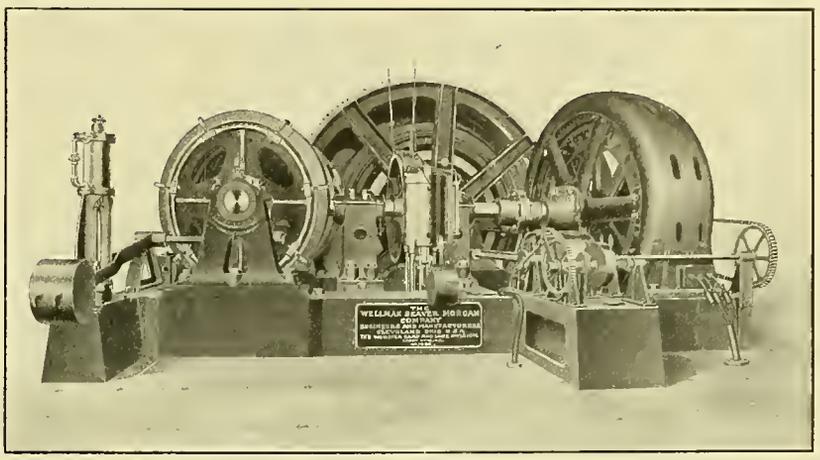


FIG. 2. WATER-HOISTING DRUM AND MOTOR.

Figs. 1 and 2 show a front and side view of the hoist, respectively. As will be noticed, the general arrangement consists of a motor driving a pair of bevel wheels through a single bevel pinion. The bevel wheels run loose on a shaft and are fitted with Webster, Camp & Lane friction clutches. The operating mechanism for the clutches is so designed that only one clutch can be thrown in at a time, but both clutches can be out at the same time. Throwing in one clutch runs the drum in one direction; throwing in the other clutch reverses the motion of the drum.

To the shaft on which the bevel wheels run there is keyed a pinion meshing with the main gear on the drum shaft. The drums are of the cylindro-conical type, 10 feet at the small diameter and 16 feet at the large diameter. At a hoisting speed of 550 feet per minute the drum makes about 15 revolutions per minute. There is one main brake located between the drums. All of the clutches and brakes are operated by auxiliary air cylinders fitted with oil-cushion cylinders, the compressed air being furnished by a motor-driven air compressor, and the necessary tanks located near to the hoist. The hoist is controlled by a mechanical device shown in Fig. 2. This device consists mainly of a drum rotated by means of a friction drive from the motor through a sprocket chain. The drum shaft transmits its motion to a secondary shaft fitted with variable-speed mechanism, which in turn operates a secondary stop.

The main hoisting-drum shaft operates a traveling nut, which is so located with respect to the controller drum that at either end of its travel it releases a stop and allows the controller drum to make a quarter turn; this movement, through suitable electrical connections, operates the solenoids on the clutch valve, releasing the clutch, and the solenoid on the brake valve setting the brake. Further movement of the controlling drum is arrested by the secondary stop. This stop is released by the variable-speed shaft and its connections, which has been given a predetermined time movement corresponding to the interval for emptying the bucket. The further movement of the controlling drum releases the brake and throws in the reversing clutch, thus starting the hoist in the opposite direction, and also starting the traveling nut on the controlling mechanism in the opposite direction. At the end of the hoist the cycle of controlling movement is repeated, and so on, making the hoisting operation continuous and automatic. Every attention has been given to the safe operation of the hoist. The main brake is of the gravity type, and to be released the current must be on the solenoid operating the valve, so that air can be admitted to the under side of the brake piston.

If, for any reason, either the supply of current or of air pressure is interrupted, the valve drops, and the weights on the brake lever set the brake. The clutches are designed so that they are thrown out by weights. As is the case with the brake, either clutch can only be thrown in when the current is on the solenoid, and the air pressure admitted under the piston; if either current or pressure fails the clutch is off. The motor shaft is fitted with an emergency brake operated by a weight controlled by a solenoid—any interruption in the flow of current to the motor sets the brake and stops the motor. Any interruption of the flow of the current stops the machine, throws out the clutches and puts on the brake. A safety cut-out is provided for in the head frame, so that in case a bucket is carried beyond the proper height, the current is cut off.

Fig. 3 shows the head frame. The head frame is 93 feet from the base to the center of the sheave at the top. It is built of structural steel, roughly in the shape of an A. From the head frame are suspended two buckets six feet in diameter and 19 feet six inches deep. The capacity of each bucket is 17 tons of water. In the bottom of the buckets are located two lift gates with an area practically equal to the cross-section of the bucket. These gates are lifted automatically when the bucket reaches the top, and the water is discharged through the bottom into a spout fitted below the bucket, and which deflects it to either side of the shaft. Each bucket makes a complete round trip in one minute and 50 seconds, the total lift being 535 feet.

FIG. 3. VIEW OF HEAD FRAME OF ELECTRICAL WATER HOIST.

Improved Flasher for "Talking" Signs.

Mechanism for the control and operation of so-called "talking" signs sometimes has the disadvantage of being bulky and requiring a skilled workman to make the necessary changes when a sign is to be altered from one reading to another. John C. Lion of St. Marys, Pa., recently took out a patent upon a flasher for such signs which is particularly compact. Fig. 2 is a view showing the mechanism of the sign flasher, which is mounted on a marble shelf on brackets across a window. The slab only extends 12 inches in from the window, and its length may be judged from the pic-

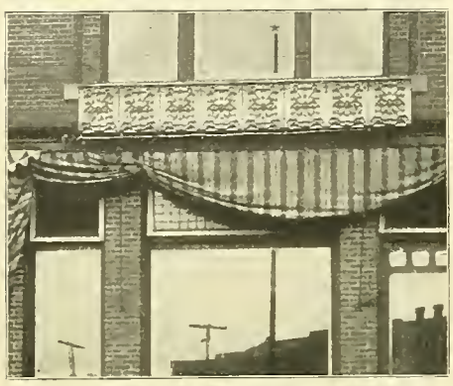


FIG. 1. "TALKING" SIGN ABOVE STORE FRONT.

ture. The weight is 200 pounds. Fig. 1 shows the "talking" sign itself above a store front. The mechanism of Fig. 2 is placed behind the window of this store front, and can be made a part of the attraction to the public if desired.

The invention consists of a base of slate or marble, upon which are mounted two bearing pedestals, supporting a roller of brass or other good conducting material, the roller having a steel shaft inserted at each end, the shafts resting in the bearing pedestals.

Insulated from each other and arranged on a suitable support are a row of V-shaped spring clips, which are supported on suitable braces alongside the roller and at a proper distance to make proper contact with the switch points on the roller, which will be more fully described. Each of these

FIG. 2. FLASHER MECHANISM FOR "TALKING" SIGNS.

spring clips connects with one certain lamp in the face of the sign. The connecting cable is arranged according to a standard diagram, which is identical for each letter space on the sign face.

The roller is divided into sections lengthwise, conforming to the number of sections or letter spaces in the sign, so each section of the roller represents a letter space. Each of these sections contains two circles of holes tapped for a suitable size of screw, and all sections are drilled to a standard jig, which makes the positions of respective holes in each section identical.

Letters, or rather the contact strips, which (upon being placed in position on the roller) form the letters on the sign, are punched from strips of angle brass, one web of which has a slight curve to conform to the contour of the roller so as to provide a firm seat for itself when in position. The other web is punched into small fingers, certain ones of which on being cut off enable the remaining ones to form the proper connections (when in position) to display a given letter in one of the sign spaces. These strips, after being prepared, are each stamped with a small letter identical with the letter they represent. Each of the strips has in its curved web two screw slots which open to the side, thus allowing the strip to be slipped into position in any part of the circumference of any of the letter sections of the roller. Consequently any word or number of words may be placed in position in a very short time by merely selecting the proper strips, placing them in position and tightening the screws.

To change the sign it is only necessary to loosen the screws about two turns each, slip the words out and substitute the new words, the strips being arranged in a little indexed rack; they can be readily assembled into a word, just as type is set for printing. The wording on the roller when set reads the same as a column of printed matter, each strip, as before said, being stamped with its respective letter. This enables anyone who can read and spell and use a screw driver to put the sign in working order.

The roller, when the mechanism is in operation, stands perfectly quiet except at the time of change from one word, or flash, to another. This does away with flickering of the lamps occasioned by constant gradual-motion flashers.

When the roller does move for a flash it does so almost instantly, and then is perfectly rigid once more. This gives the shortest possible interval between break and make.

Instantaneous movement of the roller is accomplished as follows: Upon the one end of the roller is secured a ratchet gear of proper size and strength. Beside this gear is another loose-ratchet gear, of such size that the bases of its teeth are just clear of the top edges of the former's teeth. A reciprocating radius arm working from the roller shaft has a pawl attached which normally engages the teeth of the loose gear. The reciprocating motion of this radius arm and pawl is produced by a crank and connecting rod. The crank shaft is geared to a small fan motor at such ratio as to give the crank about 150-200 revolutions per minute.

The bearings of this crank shaft are contained in an extension of the pedestal of the roller, thus insuring perfect alignment at all times.

The operation of the motor and crank causes the motion of the pawl, which engages, one by one, the teeth of the loose ratchet. A certain number of the teeth in this ratchet, however, located uniformly in its circumference, are cut deep enough to allow the pawl to engage a tooth of the roller ratchet as each one comes under the pawl. This imparts a sudden positive movement to the roller which carries it forward a distance sufficient to break the flash or word then being shown, and to make the next one. The speed of change is varied according to the number of deep teeth in the loose ratchet.

The machine in the illustration (Fig. 2) is operated by a boy of 13 years. It contains 30 different flashes or word spaces and requires about 15 to 30 minutes a day to set up for an evening's display. It operates a sign on the front of the building (Fig. 1) with letters 20 inches high by 18 wide, and the cost of operation runs from $3.20 to $3.50 a month. The whole mechanism is driven by the motor from a 12-inch desk fan.

This machine can be attached to any of the present forms of talking-sign faces.

4,500-horsepower Gas-engine Plant for Cement Works.

The Iola Portland Cement Company of Iola, Kan., has recently placed an order with the Westinghouse Machine Company of East Pittsburg, Pa., for three 500-horsepower horizontal double-acting gas engines and one 125-horsepower vertical single-acting gas engine, to increase the capacity of its already large gas power plant. The three horizontal gas engines now on order will be the first of this type to be installed in the power house, the remainder being of the vertical type. After the installation of the engines now on order the power equipment will comprise 15 engines of the Westinghouse vertical single-acting type and three of the horizontal double-acting type, aggregating about 4,500 horsepower. The company operates its plant upon Kansas natural-gas fuel, and is one of the largest users of gas power in the cement-manufacturing field.

Sangamo Alternating-current Wattmeter.

Alternating-current wattmeters, outside of those built on the split-phase induction principle, have so far been undergoing development. The type D Sangamo integrating wattmeter illustrated herewith has been put upon the market after a number of years of experiment, both on the use of mercury in meters of various kinds and also on the several details involved. The meter works upon radically new principles in alternating-current measurement, and, owing to its design and construction, it has been found possible to elimi-

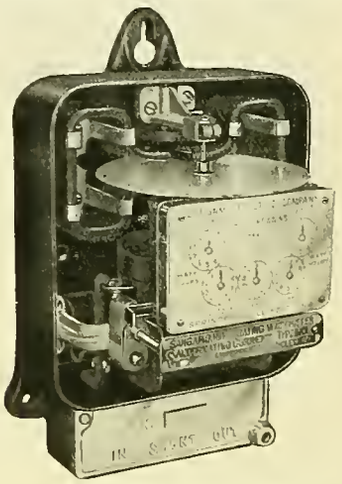


FIG. 1. FRONT VIEW OF SANGAMO ALTERNATING-CURRENT WATTMETER.

nate practically all chance of trouble from jewel wear or bearing friction, and at the same time to develop a meter with high torque, great accuracy on all loads, large overload capacity and the ability to work accurately with shunts of any capacity.

In the first place, the method of operation of the meter on alternating current is interesting. In series with the shunt coil of the meter, which is carried on a laminated iron yoke, shown plainly in Fig. 1 at the lower part of the meter, is a condenser which is readily accessible. This condenser has the effect of changing the phase of current in the shunt coil in such a way as to bring the magnetism of the shunt field in phase with the pressure on the circuit to which the meter is connected. The main current passing to the load goes directly through the copper-disk armature, shown in Fig. 2, which is completely enclosed in the mercury-tight insulating chamber, somewhat similar to the mercury chamber of the type C Sangamo meter. The current is led in and out from the disk chamber by means of contact ears on each side, which can also be seen in Fig. 1.

Passage of the load current across the strong shunt magnetic field causes rotation of the armature, the motion being transmitted to the recording train in the usual manner. The armature spindle or shaft, shown in Fig. 2, projects through a ring-shaped sapphire jewel set in the upper cover of the mercury chamber, which is formed in such a way that absolutely no mercury can get out, no matter in what position the meter is turned. The upper end of the armature shaft proper keys freely into an external shaft or spindle which carries the aluminum damping disk, plainly shown at the top

FIG. 2. COPPER-DISK ARMATURE OF SANGAMO ALTERNATING-CURRENT WATTMETER.

of the meter. This outer shaft also carries the worm for driving the recording train, this being underneath the disk, so that the worm wheel is well protected from accidental injury.

Adjustment of the meter on light load is obtained in a manner similar to that used in the Gutmann meter, by means of a small soft-iron piece, slid back and forth on the face of one of the shunt-field poles just below the disk chamber.

Adjustment for speed is obtained by moving a

small soft-iron disk above the upper poles of the two magnets facing each other, this disk being carried on a fine pitched screw working in the bracket above. The shunting of more or less lines of force between the upper poles of the two magnets and away from the disk gap below, causes a wide variation in the damping effect, and consequently great ease of speed adjustment.

Elimination of friction and wear on the bearings is probably the most interesting point about this meter, except the use of the condenser to obtain the necessary torque. The armature, as shown in Fig. 2, has a dome of closed-cup form at the center, this constituting the air-float when the armature is immersed in mercury. The displacement of this float and the armature in the mercury is sufficient to buoy up the armature, the disk shaft and the outer aluminum damping disk, plus a very slight but positive thrust upward.

There is no jewel bearing and, in fact, no bearing in a true sense inside the disk chamber at the bottom of the armature spindle, there being simply a soft-steel guide at this point for holding the shaft laterally. At the top the shaft presses upward against a carefully selected flat sapphire jewel, the proportioning of the float on the armature being such that this thrust does not exceed 30 to 35 grains.

The top bearing is adjusted by a micrometer screw and is set so that the end-shake between the top bearing and the spindle cannot exceed a little over 0.01 inch.

Type D meters are said to be accurate on inductive loads, down to low power factors, as the best induction meters, and the adjustment for inductive load is obtained in somewhat the same way as the light-load adjustment.

The drop through the series element of the meter is extremely small, as there are no series windings. In a 10-ampere 100-volt meter the drop between binding posts is not over 0.02 volt at full load. In larger capacity meters, where a part of the current is shunted across the binding posts, the drop through the disk is increased by means of resistance wires in series with it, so as to eliminate the effect of variation in the joints or contacts, either in the shunt across the binding posts or in the disk circuit.

Between posts, in meters from 20 to 60 amperes capacity, the drop will not exceed 0.08 to 0.10 volt. Sizes from 80 amperes and upward are shunted externally in the same manner as the type C Sangamo meter for direct current. For three-wire work the meters are made with small series transformers, properly constructed, so as to measure the total power on both sides of the system.

The meter is manufactured by the Sangamo Electric Company of Springfield, Ill., and is sold by it and its general selling agent, the Electric Appliance Company of Chicago.

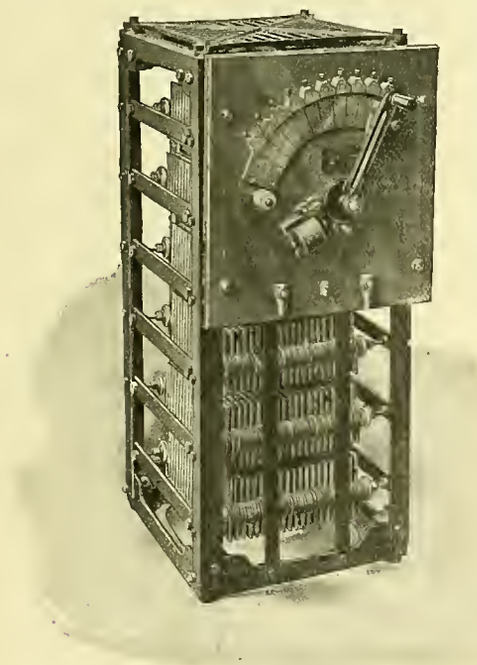


Fig. 3. Machine-type Controller with Grid Resistance.

Dial-type Controllers for Electrically Driven Machine Tools.

One of the most important parts of a machine-tool equipment is the controller, and on its proper design depends in a large measure the successful operation of the complete motor drive. The best results can be obtained only when the motors and controlling apparatus are designed in conjunction. The General Electric Company has made a thorough study of both motors and controlling apparatus for machine-tool drives, and following is a brief description of several dial-type controllers of many manufactured by this company.

In general motor speeds may be controlled either by variation of resistance in the shunt-field circuit or the insertion of resistance in series with the armature circuit. Two forms of controllers of the first-mentioned variety are known as types SF (non-reversing style) and RSF (reversing style). These are shown in Figs. 1 and 2. These are compact speed-regulating rheostats and are made for motors of capacities from one-quarter to 15 horsepower, inclusive, 110, 220 and 500 volts, and designed for 2 to 1, 3 to 1 and 4 to 1 speed variation by field control. In all sizes of these controllers the field resistance is self-contained and is within the controller; in large sizes the armature resistance is external. The reversing style has the same number of contact points for either direction of speed. Above three horsepower a magnetic blowout coil is connected on the back of the controller front to protect the first starting points from burning, while in the non-reversing style (Fig. 1) this is accomplished by an auxiliary quick-break device. Renewable segments are used for all starting contacts in both reversing and non-reversing styles. Variation in speed for these types is obtained entirely by field control, and the armature resistance is not designed for continuous service, although it is liberally rated and will stand unusually severe service without injurious heating or burning.

Fig. 1. Non-reversing Type of Controller.

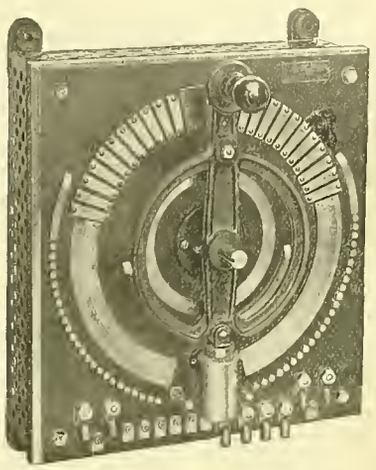


Fig. 2. Reversing Type of Controller.

DIAL-TYPE CONTROLLERS FOR MACHINE TOOLS.

If controlling rheostats of this type are operated where chips are apt to fly from the work, a cover for entirely enclosing the front can be furnished. An insulated sprocket wheel or gear can also be supplied so that the controller can be mounted in any desired location. Fig. 4 shows one of these regulating rheostats enclosed in iron casing, complete with circuit-breaker equipped with no-voltage release.

For the second class of motor-speed control, as above mentioned, a type of rheostat known as the machine type RA Figs. 3 and 5), is manufactured. This line of rheostats is designed for controlling the speed of shunt or compound-wound motors from one-eighth to 20 horsepower at 125, 250 and 500 volts direct current. Larger sizes are furnished when desired. In this type a speed reduction of 50 per cent. under normal full-load conditions and 25 per cent. at half load can be obtained by inserting resistance in the armature circuit. Nine divisions of resistance are provided in these regulators so that 10 different motor speeds may be obtained. In the smaller sizes the resistances are wound on tubes, while in the larger capacities cast-iron grids are used. These rheostats will carry currents corresponding to 25 per cent. overload on the motor without injurious heating.

Aside from the points mentioned this latter type of controller has several especially desirable features. It is equipped with a no-voltage coil connected in series with the shunt fields, so that if the voltage fails or the shunt field of the motor be broken the contact arm returns automatically to the starting position and stops the motor. When this no-voltage coil is enlarged the tension of a band brake around the base of the switch is increased and holds the contact arm in whatever position it is left. This method of holding the contact arm in any position is simple and durable, as the tension on the band brake can be easily adjusted for wear. For the smaller capacities the switch arm is mounted on the top, while in the larger sizes it is mounted on the sides of the box as shown in the illustrations.

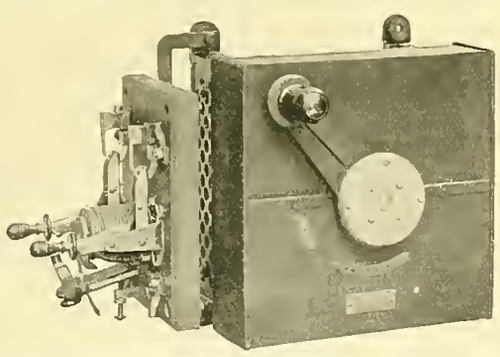


Fig. 4. Enclosed Regulator Controller with Circuit-breaker.

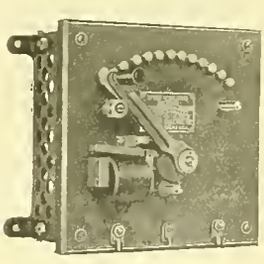


Fig. 5. Machine-type Controller with Tube-wound Resistance.

DIAL-TYPE CONTROLLERS FOR ELECTRICALLY OPERATED MACHINE TOOLS.

Chicago Commercial Association.

Since the Chicago Commercial Association has moved into its new headquarters in the Great Northern Building it has been particularly active. It now has ample space and accommodations for committee and association work and for the reception of visiting merchants. Through the efforts of its excursion bureau it has brought to the city during the last year over 18,000 wholesale buyers, and the Convention Bureau estimates that during the coming year it will bring 500,000 people to the city.

The purpose of the association is to upbuild and maintain the commercial and manufacturing supremacy of Chicago, and to inculcate a supreme respect for law and order. To carry out this work there is a local division, an interstate division, foreign division and convention-bureau subdivision. Besides, there are 32 trade sections, including, of course, electrical supplies and kindred lines. With a full complement of officers, directors and committees, all chosen because of a fitness for the work in hand, the association is working effectively to enhance Chicago as "the great central market."

Trade-extension committees are sent out occasionally, and at present such a committee is touring the Southwest, where it is meeting hearty welcomes and gratifying co-operation among the merchants and manufacturers in the principal cities. At Chattanooga the hydro-electric power-development and

City Electrician Carroll of Chicago is making preparations to place signs at 15,000 street intersections before March 1st next. Of these, 4,000 signs will be of the vertical variety and will be placed on the electric-light poles. On the 6,000 or 7,000 gas lamps in the city which are now unprovided with street signs horizontal signs will be placed, and also on the 5,000 gasoline lamps. There is an appropriation of $10,000 for the work.

river-improvement work, recently described in the Western Electrician and now in process of installation, was inspected.

Among the members of the association engaged in electrical and allied pursuits are the following-named: American Steel and Wire Company, Bryant Electric Company, Ernest Freeman Company, Guarantee Electric Company, Harvard Electric Company, Illinois Electric Company, Monarch Electric and Wire Company, Moon Manufacturing Company, James Wolff, Thomas G. Grier, Roth Bros. & Co., Dearborn Electric Company, Kellogg Switchboard and Supply Company, M. B. Austin & Co., Porter & Berg, Gregory Electric Company, J. Lang Electric Company, Manhattan Electric Supply Company, Western Electric Company, Chicago Fuse Wire Manufacturing Company, Electric Appliance Company, Central Electric Company, Chicago Edison Company, George S. Searing, American Electric Fuse Company, American Electrical Supply Company, John A. Roebling's Sons Company, Belden Manufacturing Company, Swedish American Telephone Company, American Insulated Wire and Cable Company, Kohler Bros., American Electrical Works, B. E. Sunny, Chicago Electric Protective Company, H. M. Byllesby & Co., American Electric Novelty and Manufacturing Company.

New Power Plant of the Tonopah Mining Company at Mina, Nev.

A new transmission plant of high efficiency containing some novel features is now being completed for the Tonopah Mining Company of Nevada at Mina, about 13 miles from Tonopah, Nev. One unit is already in successful operation and the entire installation will soon be ready. The power is to be transmitted to the company's mines at Tonopah. The plant was originally designed for using coal fuel, provision therefore being made for large coal storage capacity, but on account of the fact that it was thought probable that within a short while oil would be used as fuel the boiler furnaces, etc., were arranged for changing over to oil fuel with the least possible expense.

The boilers are of the Babcock & Wilcox type, designed for 160 pounds working steam pressure, installed in four units of 200 horsepower each, three of these being sufficient for plant, allowing one reserve boiler. Each boiler consists of two 36-inch steam and water drums mounted over 12 sections of tubes, each section containing nine tubes 16 feet long. The boilers are equipped with Babcock & Wilcox superheaters, capable of superheating steam from 100 to 125 degrees above the temperature corresponding to boiler pressure. The boilers are fitted with extension furnaces and Wilkinson chain grate stokers with large grate surface. Particular attention is called to the extension furnace, as recent experiments have proved that the efficiency of boilers burning Rock Mountain coals is considerably increased by their use.

In the rear of boilers and between boiler room and engine room is installed one battery of Green's fuel economizers, each economizer consisting of 128 tubes, having a total heating surface of 1,536 square feet. Flue gases from boilers to economizers pass through a brick flue extending to the boiler room floor level with dampers so arranged that gases can be distributed through the economizers to stack, or by by-passing the economizer direct to the stack. There is one guyed steel stack 66 inches in diameter by 175 feet high, constructed of three-sixteenths-inch steel plates.

The generating units consist of three McIntosh & Seymour horizontal cross-compound gridiron-valve engines direct connected to three 250-kilowatt 2,200-volt three-phase revolving-field Westinghouse generators. Three 15-kilowatt exciters are driven by belts from the band wheels of the main engines.

The McIntosh & Seymour engines are fitted with electrically operated speed-changing mechanism and patent time-delayed dash pots for parallel operation, one of the requirements at this plant being that all engines should operate successfully in parallel. It was partly on account of the successful operation of this make of engines in parallel that this order was secured. The engines are fitted with metallic packing on both piston and valve rods for use with superheated steam. The engines will operate condensing, there being for each engine unit one Wheeler Admiralty surface condenser, rectangular type, operating in connection with Edwards suction valveless air pumps, motor driven and centrifugal circulating pumps also motor driven.

Condensing apparatus was guaranteed to give 27 inches of vacuum when operating under normal conditions. This was a far more difficult condition to meet than one would at first suppose, as conditions are extremely unfavorable for high vacuum, it being almost impossible to secure cool water, owing to the high summer heat and the absence of a large supply of water. There was consequently installed in connection with the condensing system a Barnard-Wheeler fan and water-cooling tower, the fan being driven by motor. This cooling tower consists of vertical woven mats of galvanized iron wire cloth, over which the cooling water trickles from distributing troughs placed at the top of the tower. This water in its passage over the mats to the tank at the bottom of the tower is met by the ascending currents of air and is thus cooled. The water necessary to make up that lost by evaporation is supplied from wells in the neighborhood of the plant. The circulating water can therefore be used over and over again, the only additional supply being that to make up for evaporation, which has been cut down to the minimum.

The only auxiliaries which are steam-driven in the plant are the boiler feed pumps and small pump for operating the Wilkinson stokers. By the use of the electrically driven auxiliaries the economy of the plant has been increased considerably beyond what could have been obtained with steam-driven auxiliaries. As economizers have been installed in this plant the question of low feed water temperature was not of great importance, for the feed water could be heated by the flue gases passing through the economizer to a very high temperature.

Considerable care has been exercised in the design of the steam piping to avoid interruptions to the service. The designers have therefore taken considerable pains in allowing for expansion and proper anchorage in both steam and exhaust piping.

Steam is taken from each boiler through long-radius bends into a steam-header of ample proportions, from which branches are taken to each engine, also through long-radius bends. Each boiler branch and engine branch is so valved that any part of the plant can be cut off from any other part without interfering with its operation. Chapman gate valves of the double-seated straightway type are used throughout.

Adjoining the power station is a transformer house, at which point the distributing system commences. The current, which is generated at 2,200 volts, is here transformed up to 22,000 volts, being transmitted at this voltage over 15 miles to the mine and mills of the Tonopah Mining Company, where electric power is used throughout. There are three 300-kilowatt oil-insulated air-cooled step-up transformers.

The power station is sheathed with corrugated iron. There are separate boiler and engine rooms of one story each. The transformer house is of rubble concrete, as is also the sub-station at the Tonopah end of the 15-mile transmission line.

The motors operated from the new plant include three type F variable-speed hoist motors wound for 400 volts, of 150 horsepower, 100 horsepower and 75 horsepower, respectively. There are five type C 400-volt induction motors of 100 horsepower, 50 horsepower, 30 horsepower, 20 horsepower and 15 horsepower, all being belted.

The 65-mile Tonopah railroad, built by the Tonopah Mining Company, has been broad-gauged and is kept busy hauling ore, the American Smelting & Refining Company having contracted to take 150,000 tons of this company's ores for reduction at the Salt Lake City smelter.

The Tonopah Mining Company of Nevada is controlled by Philadelphia capital, the president being John Brock of that city. It owns valuable properties at Tonopah and its new plant is the first of its kind to be installed in that district. Charles C. Moore & Co. of San Francisco are the contractors for the Mina plant and transmission line and also for the electric mining hoists.

An Electrically Driven Barge.

The Zeitschrift für Elektrotechnik gives some interesting particulars of an 1,100-ton electrically actuated barge which has been employed in transporting petroleum on the Volga between Rybinski and St. Petersburg (a distance of about 680 miles) for the last four months. The barge is an iron one, 74 meters long, 9.7 meters wide, with a draft of 1.8 meters. It is fitted with three propeller screws, each driven by its own direct-current motor, situated at the stern of the boat. There are three generating units, each consisting of a three-cylinder vertical Diesel engine driving a direct-current dynamo by means of a flexible coupling. These are situated in the center of the barge. The motors are separately excited from other dynamos mounted on the same shafts as the main dynamos. These exciting dynamos are also used for the lighting of the boat, and for driving pumps, a windlass, etc. The speed of the motors is regulated by varying the voltage of the generators, for which purpose a controller is fitted on the bridge by means of which the speed of the propellers can be varied between 30 and 90 revolutions per minute. About 12 seconds is required to change from full speed ahead to full speed astern. The electrical installation was carried out by a Swedish firm at a cost of about £6,000. If ordinary steam engines had been employed the cost would have been reduced to about £4,300, but greater efficiency, is asserted, while the carrying capacity of the barge is increased by some 10 per cent. The Diesel engines consume crude petroleum of a calorific value of 11,000 calories per kilogram, obtainable at St. Petersburg at 45 francs per ton. The barge is furnished with reservoirs at stem and stern of a total capacity of 56,000 liters, while the consumption of oil for the complete outward and return journey is about 16,000 liters. In case of emergency the propellers can be worked directly by the Diesel engines.

Telegraphing and Train Signaling.

John Gavey, in his presidential address before the British Institution of Electrical Engineers, made some interesting observations concerning the development of telegraphy, and particularly in relation to its application to railway signaling. Speaking of automatic signals in America, he said:

"In a recent journey across the American continent, where hundreds of miles of desert are traversed by single lines of railway with numerous sidings for the crossing of trains, I watched with great interest the perfect and regular working of the signals without the direct intervention of human agency. Each section was, of course, guarded by two signals, one for the up and one for the down traffic. As the train left one section for another, the signal guarding the former moved from danger to clear, while that guarding the latter moved from clear to danger. This method, of course, involves the necessity for bonding the rails throughout, although others have been designed which are actuated through special conductors. Automatic signals appear to meet a definite want on certain classes of railway, although no doubt the day is far distant when the trained signalman will be dispensed with at complicated junctions and stations. It is not too much, however, to say that without the various methods of electrical control that have been devised and which are in general use, it would be utterly impossible for great railways of the world to carry one-half the traffic they are now dealing with daily with safety and dispatch. In this branch of electrical work steady progress is being made, and apart from the question of haulage, the extension of the methods of electrical control will probably be considerable in the immediate future."

Speaking of the ordinary telegraph and the influences which had been brought to bear on its development of late years, Mr. Gavey observed:

"It is interesting to note how the practice in the ordinary telegraph service has materially benefited by the development of other branches of applied electricity. Thus, for testing and localizing faults, and in order to obtain control over the large mass of wires entering the principal offices in this country, these were formerly attached to screw terminals fixed in a test box, which was bulky and which occupied much valuable space in a costly building. The practice in the Post Office now is to terminate these wires on telephone jacks, and to provide for connections for testing, crossing or other purposes by means of plugs and flexible cords, the modern arrangement only occupying one-third the space of the old type. Again, the extended introduction of secondary cells charged from lighting plant by means of motor-generators, has resulted in the last few years in the abolition of about 150,000 primary cells in the Post Office service, this change leading to a proportionate saving of space and to a great economy in generating energy and in upkeep. Again, the great extent of modern London necessitates a very considerable amount of local telegraphic traffic. The number of inter-metropolitan messages, viz., those from one part of London to another, some time ago amounted to 18,000 per diem. These were all re-transmitted at the central office, for it was obviously impossible to provide direct connecting wires between every one of some 600 telegraph offices. The Post Office therefore determined to revert to the system of switching lines through to one another as required, a method which had proved a failure when tried on long and costly trunk circuits, as these could obviously deal with a much larger percentage of traffic when a constant stream of messages was fed into them than was possible when switching connections had to be made."

National Electric Light Association Proceedings for 1905.

The proceedings of the twenty-eighth convention —Denver-Colorado Springs—of the National Electric Light Association have been edited and published, the matter making two fine volumes of valuable information. The papers, reports and discussions are conveniently arranged and contained in Vol. I., making a book of 487 pages, besides

56 pages of general information pertaining to the association. Vol. II. contains the Question Box and Wrinkles, and is a book of something over 700 pages. Both books show careful work in their preparation—not a little of which is due to Miss Billings, the assistant secretary—and are a credit to the association.

Independent Telephone Men Meet in Cleveland.

All sections of the country were represented in a gathering of independent telephone men that took place in Cleveland last week. A joint meeting of the executive council and the committee on litigation and legislation of the National-Interstate Telephone Association was held on Friday, November 24th, and there was also a meeting of a committee of the Ohio Independent Telephone Association. Other gentlemen had been east and happened to be returning at the time and the result was an informal gathering which was entertained by the local men.

While a great deal of talk regarding negotiations for the sale of the Federal telephone properties was occasioned by the visit of these men, nothing was done in that direction with the exception of talking the matter over. That a combination will be formed to take over these companies seems almost certain, but they will retain their local identity, and all the local stockholders will be kept in the companies. The idea is to secure new money and put the companies upon a better paying basis than they ever have been. Their showing has been excellent for the last year, but at the same time improvements and extensions will add much to their dividend-paying ability.

Friday at noon a luncheon was tendered the visitors at the Colonial Hotel by the local Independent telephone men. President F. S. Dickson, of the Cuyahoga Telephone Company, acted as toastmaster and as usual did his duties well. A number of impromptu addresses were made after the luncheon was concluded.

Among those present at the luncheon were: F. S. Dickson, Col. J. J. Sullivan, J. F. Harper, B. Mahler, E. G. Tillottson, H. R. Newcomb, H. A. Everett, F. H. Goff, O. F. French, H. P. McIntosh, L. W. Prior, John Gundry, E. H. Bourne, R. G. Enwright, E Weibenson, Will Hayes, F. H. Townsend, T. W. Hill, W. B. Woodbury, M. B. Overly, R. W. Judd, W. L. Cary, Jr., James B. Hoge, Dr. Kitchen, B. H. Lang, J. F. Boylan, Addison Hough, F. B. Schraeder, Newton D. Baker, Charles W. Lapp, John A. Harney, James J. Shipley, Adolphus Busch, Breckenridge Jones, J. D. Powers, Theodore Gary, Rollo Wells, George W. Beers, Edward E. Clement, Ed. L. Barber, J. W. Marsh, Frank L. Beam, Charles C. Deering, O. C. Snider, F. W. Roebling, J. B. Ware, Dwight E. Sapp, Mr. Gaynor, H. R. Ashbrook, W. D. Orthwein, Henry Nicolaus, C. H. Huttig, Edward A. Faust, Jr., H. D. Critchfield, Harry M. Daugherty, E. L. Coen, W. G. Thompson, Mr. Bantley and James S. Brailey, Jr.

Many of these gentlemen proceeded on their trip late Friday night to Toledo, where another stop was made. It was said that some of them would also visit Columbus.

It is stated on good authority that the United States Independent Telephone Company will have nothing to do with the properties in Ohio. It was organized to take care of business in the East. The Federal properties will be held in a group, according to best information obtainable, and some other properties may be grouped in the same way. It is not the policy of the telephone men to organize one large company to take in all the properties at this time, but to secure uniformity in operation and in the manner of transacting business and the equipment of plants the group plan is considered the best.

Indianapolis Telephone Reorganization.

Those who have been watching the building of large and efficient systems of Independent telephone lines throughout the country have been not a little interested in the change recently made in the ownership of the two large Indiana companies, the Indianapolis Telephone Company and the New Long-distance Telephone Company. At first, rumors were circulated that the men who negotiated the deal were not friendly to the Independent cause and much harm would follow, but now that the transfer of the properties has been made it is pointed out that the new owners are among the most ardent, able and successful Independent telephone men in the country. An aggressive campaign for still further improvement of the lines and equipment and the betterment of the service generally is promised. In the words of one of the new owners, "the New Long-distance Telephone Company has been reorganized as the backbone of a big Independent telephone system."

H. C. Stifel, the new president of the Long-distance company, is treasurer of the Altheimer and Ralings Investment Company, St. Louis. He is a director and large stockholder in the Kinloch Long-distance Telephone Company and a director in the Home Telephone Company of Toledo, Ohio. C. Marquard Forster, the vice-president, is president of the Kinloch company. Breckenridge Jones, one of the directors, is treasurer of the Kinloch company and treasurer of the Mississippi Valley Trust Company of St. Louis. He is one of the chief moving spirits in the United States Independent Long-distance Telephone Company, recently organized to establish long-distance service in the principal cities of the country.

Another director, James S. Brailey, Jr., is president of the Toledo Home Telephone Company and a director in the Cuyahoga Telephone Company of Cleveland. Other directors are A. F. Ramsey, a banker, and president of the Home Telephone Company of Crawfordsville; M. B. Wilson, president of the Columbus National Bank of Indianapolis, and Louis Hollweg, wholesale merchant of Indianapolis.

C. E. Stinson, acting as general manager of both the Indianapolis company and the Long-distance company, is a practical electrician, who has been active in telephone work for several years. He is the chief engineer of the Brailey interests, which include Toledo, Cleveland, Kansas City, Utica, N. Y., and other cities.

Indiana Telephone Items.

The Indianapolis Board of Public Works has approved the plans of the Indianapolis Telephone Company for putting its wires underground on the north side of the city.

The Central Union Telephone Company has completed arrangements for establishing an exchange at Waldron. The local system will be constructed by Elmer E. Moore and will be known as the Moore Telephone Company. The Bell company will give it toll-line service.

Fay Masten of Clayton, Ind., has been running a hay and straw-baling outfit, consisting of an engine, baler and a dining and sleeping car for 10 persons. The car is equipped with a telephone to connect on any telephone line, by means of which Mr. Masten notifies his farmer patrons what time he will be on hand with his baling outfit.

The Eastern Indiana Telephone Company of Winchester has been incorporated with a capital stock of $150,000, to operate in Eastern Indiana and Western Ohio. The directors include B. S. Hunt, J. S. Engle and others. The Parker City plant will toll lines to Albany and Losantville, and other plants in this locality will be merged into the one system.

The St. Joseph Valley Telephone Company has been incorporated to build Independent lines in Northern Indiana. Theodore Thorward, president of the South Bend Telephone Company, heads the movement.

Fires during the week destroyed the local telephone exchange at Petersburg and also occasioned the loss of 100 telephones and much cable at Washington.

One hundred "New Maniests" near Bluffton have asked for telephone connections. This is an innovation for this peculiar religious sect, since its adherents originally denounced the telephone.

The first called meeting of the executive committee of the Independent Telephone Association formed at Winona in July was held in Indianapolis on November 23d. The recent acquisition of the Indianapolis Telephone Company and the New Long-distance Telephone Company by strong financial interests is said to have given a decided impetus to the Independent telephone business in Indiana, and the association of Independent companies is confronted with a number of new situations calling for co-operative action. George W. Beers, president of the association, in an address spoke encouragingly of the Independent outlook. Those composing the executive committee and in attendance at the meeting were: George W. Beers of Fort Wayne, C. S. Norton of Indianapolis, A. Z. Foster of Terre Haute, A. C. Lindermuth of Richmond, Theodore Thorward of South Bend, O. P. Frieberg of Lafayette and J. W. Week of Greencastle.

C. L. Barger is at the head of a new telephone company which proposes to use automatic telephones and has applied to the City Council of Marion for a franchise. The members of the City Council have examined the workings of the new automatic system and are highly pleased with it.

S.

Telephone News from the Northwest.

The Deerfield (Wis.) Telephone Company has been incorporated with $10,000 capital stock.

The question has been raised before the Supreme Court of Minnesota whether the telephone companies may be taxed upon their real estate in addition to the gross earnings tax.

The Madelia Telephone Company of Madelia, Minn., has declared a semi-annual dividend of six per cent.

The council of Aberdeen, S. D., has refused a franchise to the Groton-Ferney Telephone Company.

The Northwestern Telephone Exchange Company and the Tri-state Telephone Company have been bidding for the purchase of the local telephone exchange at New Richmond, Wis. It is owned by Dr. F. W. Epley and the franchise is exclusive and runs for a number of years. The sale was finally made to the Northwestern.

Fox & Jewett have completed their long-distance telephone line from Roseau, Minn., to Warroad.

The Brooten (Minn.) Telephone Company has completed its exchange and has begun operations.

The Northwestern Telephone Exchange Company at Cass Lake, Minn., had its central office wrecked by fire which started in the room below. The switchboard was replaced and the office refitted within a few days.

The Interstate Telephone and Electric Company will extend its lines west from Jamestown and Linton, N. D., to Miles City, Mont.

Edward Ilton of Cedar Rapids, Iowa, has bought out his partner's interests in the Eldon (Iowa) Home Telephone Company.

The Corn Belt Telephone Company of Waterloo, Iowa, has purchased the Independent telephone system in Buchanan County, including exchanges at Aurora and Lamont.

W. C. Fidler has purchased the Tama (Iowa) telephone exchange for $11,000.

The Prole (Iowa) Farmers' Mutual Telephone Company has filed articles of incorporation.

R.

Ohio Telephone Notes.

A meeting of the Executive Council and Committee on Litigation and Legislation of the National-Interstate Telephone Association was held in Cleveland on November 24th. Members of the Executive Council present were as follows: E. L. Barber, Wauseon; C. E. Wilson, Philadelphia, Pa.; George W. Beers, Fort Wayne, Ind.; Charles C. Deering, Boone, Iowa; Theodore Gary, Macon, Mo.; J. D. Powers, Louisville, Ky.; Richard Valentine, Janesville, Wis., and John Van Liew, Los Angeles, Cal. Members of the Committee on Litigation and Legislation were Dwight E. Sapp, Mt. Vernon; Breckenridge Jones, St. Louis, Mo.; E. E. Clement, Washington, D. C.; J. B. Ware, Grand Rapids, Mich., and O. F. Berry, Carthage, Ill. The members of the committee discussed the development of the Independent telephone movement in the different sections of the country and the subjects that come under the notice for special consideration.

The directors of the new Frazeysburg Telephone Company have elected Max Frazier president and J. B. Rhodes general manager. The company has purchased the property of the Farmers and Merchants' Telephone Company, with an exchange at Frazeysburg and 28 miles of farmers' lines, and will connect with the lines of the Zanesville Telephone and Telegraph Company. J. B. Rhodes is the manager of the latter company also. The new company will extend the lines and make many improvements.

Reports from the officers show that the Cuyahoga Telephone Company now has 20,000 telephones in service in Cleveland and the suburban towns. Several main-line contracts have also been closed within the last month or two. President Dickson says that the condition of the plant is such that he will probably be able to reduce the operating expenses quite materially for 1906 without in the least impairing the service.

The Geauga County Telephone Company has been incorporated with a capital stock of $10,000 by R. C. Carver, W. R. Nutt and others. The headquarters will be at Chardon.

Judge E. E. Roberts at Lisbon heard a suit by telephone a few days ago. The attorneys were not able to go to Lisbon, both of them being at Alliance. They arranged with the court and each presented his side of the case over the telephone.

C.

Comparative Expense of Manual and Automatic Operation in Grand Rapids.

C. E. Tarte, general manager of the Citizens' Telephone Company of Grand Rapids, Mich., has prepared from his records a comparative statement of operating and maintenance expenses of the Citizens' company under manual and automatic operation. The statement supplements a recent letter from Secretary E. B. Fisher of the Grand Rapids company to the Automatic Electric Company in which he sets forth the increase since changing to automatic operation. Under manual operation Mr. Tarte gives the total operating expenses for the year ended December 31, 1903, as $46,808.23. An average of 4,977 telephones were in service during the year, which figures out $9.40 per telephone a year. Operating expenses with the automatic system are for the year ended June 30, 1905, and were $28,182.42. As there was an average of 6,119 instruments in service during the year the cost per telephone figures out $4.60.

Condensing the statement of Mr. Tarte somewhat, the following figures give an idea of his comparisons:

	Manual.	Automatic.
Exchange labor	$32,120.28	$ 9,582.42
Inspection department	8,039.38	10,720.00
Maintenance wagon, reconstruction wagon and labor	6,648.57	7,880.00
Total	$46,808.23	$28,182.42

The figures given, it will be noted, are for operating expenses solely, and do not take into account interest on investment, depreciation, office expenses, taxes, etc.

GENERAL TELEPHONE NEWS.

Linney Bros. & Head have purchased the telephone business of Stone & Gwin at Edgerton, Mo.

The plant of the Ottawa (Kan.) Telephone Company has been sold to the Home Telephone Company of Kansas City, Mo.

W. T. Turbeville, manager of the Home Telephone Company of Georgetown, S. C., wants prices on cable, wire, insulators and pins.

The Missouri and Kansas Telephone Company is said to have bought a controlling interest in the Wellington (Kan.) Independent Telephone Company.

The Farmers' Home Telephone Company of Canby, Ore., has been incorporated and capitalized at $10,000 by G. W. Scramlin, O. I. Miller and A. J. Strubhar.

The Lewiston-Clarkston Home Telephone Company has retired from the field, on recommendation of the Lewiston Commercial Club, in spite of the fact that 100 subscribers in Lewiston, Idaho, had been pledged.

The Cumberland Telephone and Telegraph Company of Nashville, Tenn., is said to have been given the contract to equip the Illinois Central railroad with telephone wires from Louisville to New Orleans, La. When completed the line will represent 1,000 pounds of copper to the mile.

Twenty-two country telephone lines centering in Bushnell, Ill., constitute what is known as the Farmers' Telephone Association. This association held its annual meeting recently and elected the following-named officers: President, I. H. Cheek; vice-president, George Solomon; secretary-treasurer, A. M. Sperry; executive committee, Messrs. Cheek and Sperry, Dr. Haines, George Solomon and W. E. Spicer.

The National-Interstate Telephone Association makes an urgent request that Independent companies be more prompt in responding to its request for map data. Maps of Indiana, Michigan, Missouri and Pennsylvania are nearly complete and a complete map of Ohio will be ready for distribution by December 20th. The association hopes to compile maps showing accurately Independent telephone lines in every state in the Union.

Incorporation papers have been granted recently to the following-named telephone companies: Vandalia and Southwestern Telephone Company, Pittsburg, Ill.; Crawford Independent Telephone Company, Crawford, Neb.; United Telephone and Telegraph Company, Elk City, Okla.; Dixie Telephone Company, Bronte, Texas; Indian Creek Telephone Company, Cortland, Neb.; Billings and Red Rock Telephone Company, Billings, Okla.; Cascade Telephone Company, Cascade, Mont.

The Northville Telephone Company has sold its plant at Northville, Mich., to R. B. McPherson of Howell, Mich., and J. B. Ware of Detroit, the consideration being $8,500. The purchase was made for the Peninsular company of Detroit. M. A. Porter will continue as manager for the new company. The company was organized six years ago in a small way, the original investment being but $500. It has grown to a model exchange of 260 subscribers. The Michigan State Telephone Company is putting in a new exchange in Northville and making other improvements.

The premier of the Manitoba (Canada) government, Mr. Roblin, has announced that his government will establish a system of telephones in Manitoba. The government is now prepared to recommend to the Legislature the establishment of a telephone system in that province, to be owned and controlled by municipalities and government jointly, as may be found most advantageous to both. Mr. Roblin says that the prices of telephones should be made so low that laboring men and artisans can have the benefit, as well as merchants, professional men and others. The intention is to give a service to all classes at cost, it is said.

The meeting of the Pennsylvania Independent Telephone Association in Pittsburg last month was attended by representatives of 50 Independent companies of the state. The association is now one year old, and this was the second meeting. Besides hearing a number of good papers, the meeting was productive in bringing into closer relationship the companies throughout the state. One of the features was an elaborate banquet at the Monongahela House. The officers elected for the ensuing year are: President, C. W. Kline, Consolidated Telephone Company of Pennsylvania, Hazelton; first vice-president, Charles Griffith, Johnstown Telephone Company, Johnstown; second vice-president, James Collins Jones, Keystone Telephone Company, Philadelphia; secretary, H. E. Bradley of Philadelphia; treasurer, C. E. Wilson, Keystone Telephone Company, Philadelphia; executive committee, Edward Davis, Philadelphia; Judge R. E. Umbel, Uniontown; William B. Trask, Erie; F. D. Houck, Harrisburg; Charles West, Allentown; E. D. Schade, Johnstown; G. B. Rudy, York; J. G. Splane, Pittsburg.

CORRESPONDENCE.

New York.

New York city, November 25.—The Municipal Ownership League has prepared a programme of legislative reforms which are to be sought for at the earliest possible date. The reforms include complete home rule for the city in respect to public utilities, public operation of new subways, a new organization for the Rapid Transit Commission, direct nominations, ballot reform and a bill to prohibit corporations contributing to party funds.

A locomotive invented by Lars Nelson and built by the Strang Gas Electric Company of this city at the Brill Car Works, Philadelphia, was tested on Wednesday on the Baltimore and Ohio railroad near Philadelphia, and is said to have proved satisfactory. This locomotive has an 80-horsepower gasoline engine connected to a 50-kilowatt Westinghouse generator, and a storage battery of 103 cells, each of 2½ volts.

Engineers and railroad men inspected the twin tunnels built by the McAdoo company between New York and Jersey City on Tuesday morning, the party walking through the whole length of the tunnel. When completed trolley cars will run through these tunnels and connect New York's shopping center with Jersey City by a two-minute run. The promoters of this enterprise are now seeking a franchise to extend their lines uptown as far as Herald Square, so as to secure a physical junction with the New York terminal of the Pennsylvania Railroad.

A coroner's jury investigating the cause of the death of a motorman has censured the Interborough Rapid Transit Company for "employing incompetent help," the men to whom the responsibility of the accident was brought home having been hired by the company during the strike of last spring.

Extensive publicity is being given to facts connected with the purchase of trolley lines by steam railroad companies in this state, and it is asserted that those lines which have already been acquired have proved profitable investments not only on account of their own traffic but also as feeders to the steam connections.

Flatbush, a suburb of Brooklyn, has a transit grievance and this week has held mass meetings to protest against the delays in proceeding with subway extension, the franchise for which was granted two years ago. The facts seem to be that the affair is not a local matter, but that the rapid-transit commissioners are holding up the work pending the completion of a larger subway plan scheme and the possibility of obtaining competing bids for the operating privileges.

The Brooklyn Rapid Transit Company is reported to have acquired at a cost of $74,500 the old Carnarsie railroad and will convert it, as previously announced, into an electric line for pleasure traffic.

The Brooklyn grade-crossing commission will shortly advertise for bids for excavating 1,000,000 cubic yards of earth in order to lower the tracks of the Long Island railroad for a length of four miles between Eighth Avenue and Avenue G. Progress is reported on pending excavation work as well as on bridge building.

Mayor McClellan has displayed a deep interest in the future of Queens Borough in view of the coming electrification of the Long Island railroad tracks, and he is taking steps to introduce legislation to compel the railroad to elevate over 60 miles of track from grade. These plans chiefly affect Long Island City, Jamaica and Flushing.

The Geneva, Phelps and Newark Railroad Company has been formed, with headquarteres at Geneva, N. Y., to operate an electric line 15 miles long in Wayne County. The directors are local men and the capital is $400,000.

Frederick R. Coffin and associates have incorporated the Electrolian Organ Company of Hoboken, N. J., with a capital of $2,000,000.

The Rochester Prism Electric Light Company has been incorporated under the laws of New York state with a capital of $100,000. The directors are M. M. Buyck, H. R. Glynn and S. W. Long of Rochester.

F. A. Babcock and others of Buffalo have incorporated the Babcock Electric Carriage Company with a capital of $100,000

The Greenwich (N. Y.) Electric Company has been organized this week with a capital of $5,000.

An electric equipment is to be put in at Public School No. 149, Brooklyn, and fire-alarm installations are called for in 16 other Brooklyn schools.

As recommended in the report of Assistant Chief Engineer Nichols of the Finance Department, the Board of Estimate appropriated yesterday $175,000 to be used in putting underground electrical wires and conduits in the boroughs of Brooklyn and Queens. The Municipal Commission on Electric Lighting, consisting of Cary T. Hutchinson, George F. Sever and Nelson P. Lewis, was directed to prepare plans for a system of subways in both boroughs to carry all underground electrical conductors, including the distributing wires of proposed municipal electric-lighting plants for those boroughs. The plans also will cover necessary extensions of existing subways in Manhattan and the Bronx.

D. W. W.

Dominion of Canada.

Ottawa, Ont., November 25.—Owing to the considerable efforts made in Canada to work large peat fields, P. B. Ball, the Canadian commercial agent in Birmingham, England, has sent the Dominion government some information about the peat industry in Great Britain. Within a few weeks a new company has started manufacturing electro-peat coal in Ireland by the Bessey process. By this method the peat is taken direct from the bog by a huge excavator and pressed into a substance like coal by an electric process. By the application of alternating current the calorific properties of the peat are preserved intact.

Municipal ownership of the lighting plant is said to be working well in Brockville, Ont. The town owns and operates its own gas and electric system and the statement of account for the year ended September 30th, as given out, shows that after deducting $2,440 for depreciation on plant, paying interest on debentures and all other expenses, the profits were $6,508, making a total of $26,285 to the credit of the profit and loss account. Of this the sum of $23,594 has been applied to reducing the debenture debt.

The influence of snow and ice upon street-railway earnings in a city like Montreal is shown clearly by a table which has been compiled by the Montreal Street Railway Company, giving the details from month to month for the year ended October 1st. The heaviest month for the net earnings on the system was August, when they reached $121,000, and the smallest was February, the month of deep snows and heavy storms, when the net earnings were only $36,000. In the months of January, February and March, when the Canadian winter is at its worst, in no month did the street railway earn $50,000 over and above operating expenses. Beginning with April the net earnings at no time ran below $75,000, until December is again reached, when there is a perceptible drop.

On November 15th the Great Northwestern Telegraph Company finished stringing a large number of new heavy copper wires on its system from Windsor, N. S., in the west to Halifax, N. S., and St. John, N. B., in the east. The company has been gradually working out a policy of connecting the larger commercial centers in Canada by direct wires. Also through its exclusive connection with the Western Union Telegraph Company this policy has been extended to include direct service between the large Canadian cities and some of the important and nearby points across the boundary. The Great Northwestern now operates direct circuits between Toronto, Winnipeg, Ottawa, Montreal, Detroit, Chicago, Buffalo and New York, as well as a number of smaller cities in Ontario and Quebec and the principal cities of the maratime provinces.

A general reorganization of the finances of the Montreal street railway is expected to take place before the winter is over. At the coming session of the Quebec Legislature the company will ask power to increase its capital and issue additional stocks and bonds. The company also wishes authority to guarantee the capital and interest or dividends on bonds or stocks of other companies which it may lease or operate, and power to change the denomination of its shares from $50 to $100.

In view of the troubles ahead of the city of Montreal regarding its fire-alarm system, it has been suggested that the adoption of a wirelesstelegraph system of fire alarm for the city would prove a satisfactory solution of the difficulty. Mr. Ferns, superintendent of fire alarms for Montreal, says that no doubt the tests which have been made so far have been successful, but they were made on a very limited scale, and it was highly improbable that the system in its present uncertain stage would receive consideration from interested authorities.

W.

Winnipeg, Man., November 25.—The City Council of Winnipeg has decided to submit to a vote of the people at the next election a proposition that the Winnipeg Street Railway Company shall not require its motormen or conductors to work more than six days in the week, and this stipulation to be in any agreement made with the company for the running of the cars on Sunday. The company has intimated it will not agree to such an arrangement. Preparatory to using its new power supply for running cars and supplying light and power to the city, the company is now installing a 1,500-horsepower Goldie & McCulloch engine with an 800-kilowatt Canadian General Electric generator attached; also an 850-kilowatt motor-generator. This will help out until the power from Lac du Bonnet Falls is available, about January 1st. The company is now preparing to connect its transmission cables with the central power station on Mill Street. The City Council is about to demand many improvements in the power and light-distribution system and in the service and equipment of the street railway. These demands, added to the dispute as to the company's rights under its charter and franchises, may result in a fight between the company and the city.

The dam at Hazlewood Lake, near Port Arthur, is completed. It is between 850 and 900 feet in length, the top being about seven feet above the normal level of the lake. It has a solid rock bottom the entire length and makes a fine waterpower.

At a meeting of the shareholders of the Toronto and Niagara Power Company in Toronto the agreement between the power company and the Toronto and Hamilton Electric Railway Company was confirmed, granting the railway company power to build and operate its railway between Toronto and Niagara Falls on the power company's right-of-way. The railway company by its agreement undertakes to construct the line and pay the interest on half of the cost of the right-of-way of the power company. H.

Ohio.

Cleveland, November 25.—Arrangements have been completed between the Western Ohio and the Toledo, Bowling Green and Southern, whereby through cars will be operated over the two lines between Toledo and Dayton. Special cars will be put on that will make the trip in four hours and a half, it is said.

The securities of the Columbus, Delaware and Marion will shortly be listed on the Columbus stock exchange.

The City Council at Delaware has passed a resolution declaring it necessary to rescind and vacate the franchise of the Columbus, Delaware and Marion road in that city. Trouble has arisen over charges that the company has failed to live up to the agreement in the franchise.

An attempt will be made to modify the city ordinance at Cleveland which requires that interurban cars stop at all crossings. The limited cars have been running through at a good speed in order not to loose time and complaint has been filed with the board of public service.

Surveys have been completed for a new line from Youngstown to Akron and Canton. Former Attorney-General Frank S. Monnett is interested in the road.

Reports from Zanesville are to the effect that the Zanesville Railway, Light and Power Company and the Mansfield Railway and Light Company have disposed of their properties to H. M. Byllesby & Co. of Chicago.

The Massillon Light, Heat and Power Company of Massillon has asked the canal commissioners to grant the right to build a pole line along the Ohio canal bank to Canal Fulton in order to carry a wire to supply the latter place with light.

The capital stock of the Avon Beach and Southern has been increased from $10,000 to $75,000. This road is owned by the same people who own the Lake Shore Electric.

The Cleveland Electric Railway Company has asked for a franchise for the extension of its Union Street line through Newburg, a distance of two miles.

Fifty new cars will be ready for use on the Cincinnati Traction Company's line early in January.

It is stated that the Widener-Elkins people are negotiating for the Dayton and Piqua road, with the intention of extending their system north toward their terminal that is being built out of Toledo.

Health Officer Freidrich of Cleveland has made complaint against the plan of heating cars with stoves, as is done in that city. On account of the dirt and filth that gathers about them, he says they are conducive to disease. O. M. C.

Indiana.

Indianapolis, November 25.—The Kokomo, Marion and Western Traction Company may extend its line from Kokomo to Burlington and thence to Delphi. The Burlington people offer $35,000 subsidy in aid of the road.

The Louisville and Southern Indiana Traction Company, of which Samuel Insull of Chicago is president, made arrangements during the week to extend the company's line from Louisville to Sellersburg, where large cement mills are in operation. It is the purpose of the mill operators to give the traction line valuable freight contracts.

Engineer Joliff of the Indianapolis, Columbus and Southern Traction Company has completed the survey of the new line from Columbus to Seymour and has opened an office in Columbus.

Owing to interurban competition between Ft. Wayne and Logansport, the Wabash railroad has reduced the number of trains by two.

Eleazor Darrow has been made general manager of the Toledo and Chicago Traction Company, now building a line between Fort Wayne and South Bend. Mr. Darrow was formerly connected with the Indiana Union Traction Company at Anderson, but more recently with the Toledo, Bowling Green and Southern Traction Company of Ohio.

Regular service was begun on the Terre Haute and Sullivan traction line between Terre Haute and Farmersburg this week. This makes the thirty-sixth interurban line for Indiana.

Ground has been broken at Warsaw for the power house which will operate the Winona and Goshen and the Winona Lake and Peru interurban lines. The power station will be one of the largest in the state. It is understood that the Winona interurban company and the Indianapolis and Northern, the latter a part of the Indiana Union Traction Company, will co-operate. It is said to be the intention of these two lines to build an electric road from Winona Lake to Chicago, paralleling the Pennsylvania railroad.

Traction lines in Indiana recently acquired by to Dolan-Morgan-McGowan syndicate of Philadelphia and Indianapolis were inspected by Mr. Morgan and associates during the last week. The party came to Indianapolis in a private car and was joined by Mr. McGowan and Mr. P. H. White. During these trips and in a subsequent meeting held in Indianapolis the details of the merger company were under discussion. In the inspection party were Randall Morgan, Marshall Morgan, M. R. York, Hugh J. McGowan, E. B. Peck, W. Kelsey Schoepf, W. B. Reynolds and others.

The Postoffice Department is preparing to utilize many more of the interurban roads in Indiana for the carrying of mail. A contract has just been entered into with the Kokomo, Marion and Western traction line to carry the mail between Kokomo, Greentown and Marion. Several additional contracts are to be made soon.

A new electric-light plant has been completed at Jasonville. The company is composed entirely of Jasonville people. James K. Person is president and H. S. Hyatt secretary.

The question whether or not the 1,000-mile books issued by the Central Passenger Association and the interurban companies at a reduced cost may be considered a discrimination in railroad rates within the inhibition of the Indiana law is likely to come before the Indiana railroad commission. The railroad commission law expressly prohibits discrimination as regards freight traffic in favor of the larger dealer, and the point is made that the prohibition will obtain as regards passenger traffic as well.

The Indianapolis and Cincinnati Traction Company has ordered 10 passenger and four express and freight cars from Barney & Smith for February delivery.

The Fort Wayne Electric Works has shipped a motor to the Kalispell Water and Light Company at Kalispell, Mont.; a 70-light generator to O. S. Bryant of Scottsville, Ky.; a carload consisting in part of a 1,000-light generator, a 15-horsepower motor, a 25-horsepower motor, one four and one three-horsepower motor to the Bosch Brewing Company at Kale Linden, Mich.

The council of Bloomington has granted a franchise to the Indianapolis, Vincennes and Evansville Traction Company. The line is being financed and built by Indianapolis and foreign capitalists.

The Evansville and Mt. Vernon Traction Company has finished the grade and is now laying iron rapidly. The company will not build a power house at present, but will get its power from the Evansville Gas and Electric Light Company. A sub-station, however, will be built at Lippe. S. S.

Michigan.

Grand Rapids, November 25.—The International Construction Company of New York will do the construction work for the Grand Rapids and Ionia, the Grand Rapids, Belding and Greenville, the Ionia and Owosso and the Owosso and Pontiac electric lines and will finance the roads. Cars will be running on the first two roads, it is said, by next midsummer and on the entire system within 18 months. Work has begun at Saranac. Major I. H. Radford of New York will be chief of construction. E. M. Hopkins of Detroit has been elected president of the system.

Work will soon be begun on the local sub-station of the Grand Rapids-Muskegon Electric Power Company. The building will be of brick and concrete construction, 100 by 60 feet, thoroughly fireproof.

The waterworks system at Albion is now being operated by electricity, the power being furnished by the Commonwealth Power Company of Jackson. It will mean a saving to the city of $1,400 a year, which will be applied on the purchase of the 1,000,000-gallon electric pump, the motor and electrical connections.

The M. B. Wheeler Electric Company of Grand Rapids has secured contracts for wiring the new Crawford chair factory at Grand Ledge, Mich., and furnishing a generator with a capacity of 350 lights; also for installing a 75-light generator and switchboard for the R. F. French mill at Middleville, Mich., and for furnishing engine, generator and supplies for 75 lights in the plant of the Blue Lake Lumber Company at Mancelona, Mich.

The committee appointed by the council of Muskegon Heights to consider the advisability of installing a light and water plant will report favorably on the project. Plans will be drawn and specifications prepared for a $50,000 plant.

The Village Council of Shelby has created the office of superintendent of light and water, and the incumbent of that office will have supervision of the municipal plant.

The Kalamazoo, Lake Shore and Chicago Traction Company has placed an order for 1,000 tons of steel rails and several thousand ties, to be used on the line of the road west of Paw Paw, and it is expected cars will be running on that section of the line within two months. Cars will run through from Kalamazoo to South Haven early next summer.

Engineers have been at work for two months making surveys for a proposed electric railway to connect Kalamazoo with Elkhart, Ind. Rights-of-way have been secured a good deal of the distance. The road is being promoted by B. C. Carr of Battle Creek, and Chicago men. B.

Northwestern States.

Minneapolis, November 25.—The first large modern turbo-generator to be installed in the Northwest has been placed in the main power station of the Minneapolis General Electric Company. The machine is of the Curtis type.

A new dynamo has been installed in the electric-light plant at Willmar, Minn., by W. I. Gray & Co. of Minneapolis.

The Mitchell (S. D.) Gas Company has purchased and taken over the electric-light system in Mitchell.

It is thought that the fight for a franchise for a trolley line from Des Moines to Indianola, Iowa, will be settled amicably by the consolidation of the two companies. In that case a franchise would be readily granted.

The electric-light system has been completed at Mahnomen, Minn., and the plant has been started.

Sutton & Decker of Austin, Minn., have sold their electrical supply house to T. J. Gates of Winona, Minn., and W. Gregson of Austin.

The council at Appleton, Minn., has voted to purchase a storage battery for the electric-light plant and will give patrons a 24-hour service. Bids will be taken until December 5th.

O. F. Doyle of St. Cloud, Minn., has prepared plans and estimates for the proposed electric-light system at Foley, Minn.

Charles Ebling proposes to put in an electric-light and waterworks system at Hope, N. D.

At a special election held at Aberdeen, S. D., $50,000 worth of city bonds were voted for a new electric-light plant. R.

Pacific Slope.

San Francisco, November 24.—The Pacific Coast Company, owner of the Black Diamond and Coal Creek coal mines, near Seattle, Wash., is planning to substitute electric locomotives for mule power in the mines. Forty-seven mules will be displaced, many of which have been underground for 10 or 15 years.

The Town Council of Gilroy, Cal., has opened bids for the construction of the proposed municipal electric-light plant and for poles, wires, transformers, etc. The bids were referred to City Engineer Thurber for examination and will be again considered by the council at the next meeting. The bidders were: California Engineer Construction Company, $6,436; Compressed Air Machinery Company, $6,500 and $6,200; California Hydraulic Engineering and Supply Company, $6,866 and $6,847; Henshaw-Buckley Company, $7,486; Tracy Engine Company, $7,943, and C. C. Moore & Co., $9,550, $9,676, $9,959 and $10,076. The bids for furnishing poles, wires, transformers and other supplies outside of the power house were numerous.

Consulting Engineer J. H. C. Stut has completed plans and specifications for the reconstructing of the Geary Street cable road into an electric road and will render his report at the next meeting of the Board of Supervisors of San Francisco.

At the last meeting of the City Council of Fresno, Cal., a report was received from a committee appointed to look into the matter of the cost of a municipal electric-light plant. The estimate called for a plant capable of furnishing 150 arc lights, which, including the machinery, will cost complete $18,851. The cost of poles, transmission lines, etc., is placed at $8,750 additional. Another estimate submitted called for the construction of a handsome stone building, a lighting plant capable of furnishing 82 arc lights and of furnishing power to operate pumps for a municipal water plant, the whole to cost $37,000. No definite action was taken on either of the propositions. The municipality has on hand about $28,000 to be expended for improvements.

The Vallejo and Napa Valley Electric Railway Company, with headquarters at Vallejo, Cal., has been reorganized and new officers have been chosen. L. J. Perry will hereafter act as general manager and Charles W. Wilkinson will act as auditor.

The Edison Electric Company of Los Angeles has closed a contract with the Risdon Iron and Locomotive Works of San Francisco for steel lining for the Edison company's tunnel on Kern River. This tunnel is 1,800 feet long and 7½ feet in diameter. The contract will call for about 800 tons of steel plates ranging in thickness from one-half to 1½ inches. The tunnel will carry water sufficient, it is said, to generate 25,000 horsepower at the lower end.

Last week J. P. Magney of Los Angeles gave a test of his newly patented trolley pole and wheel device before a number of electrical engineers of Southern California. The new trolley is without springs and is held in position by means of an air chamber. The connection extends from the trolley pole to a valve regulated by a shoe. Mr. Magney claims a number of advantages for his patent.

The Northern Electric Company of San Francisco, which is constructing electric railways in

the Sacramento Valley, has purchased a site in Chico, Cal., for depot and freight warehouses. The company has completed its roadbed north of Marysville, Cal., and will begin laying rails next month. A.

PERSONAL.

Joseph Sachs is now the president of the Arknot Company of Hartford, Conn., and is no longer connected with the Johns-Pratt Company.

C. E. Wilson, general manager of the Keystone Telephone Company of Philadelphia, Pa., has been appointed a member of the executive council of the National Interstate Telephone Association, to succeed the late W. D. Barnard.

C. I. Wagner has been appointed general freight agent of the Fort Wayne, Van Wert and Lima Traction Company, with headquarters at Lima, Ohio. He has for a number of years represented the Dayton, Covington and Piqua Traction Company.

Henry L. Doherty has been elected a director of the New York and Queens Electric Light and Power Company. He is connected with many lighting companies, and has been general manager of the American Light and Traction Company properties.

William Parkinson, one of the leading citizens and business men of Orange, N. J., died on November 20th. He was born in England and came to this country in 1869, later becoming a mechanical engineer in the employment of Thomas A. Edison. He retired in 1884 and devoted his time to buying and selling real estate.

While standing in front of a newspaper bulletin board in Boston on November 25th reading the bulletins from the Yale-Harvard football game, William E. Decrow, New England manager of the Gamewell Fire Alarm and Telegraph Company, dropped dead from heart disease. Mr. Decrow was 52 years of age. In 1876 he entered Yale and became interested in athletics.

President Horace E. Andrews of the Cleveland Electric Railway Company has been offered the presidency and general management of the Yerkes tube-railway company in London, but as yet he has not decided whether to accept. The proposition is attractive because of the magnitude of the Yerkes surface and underground systems. Mr. Andrews' work as head of the Cleveland system and the Andrews-Vanderbilt-New York Central traction system has brought him to the attention of the railroad world as a man of great ability. Though but little more than 40 years of age, he has accomplished much in his chosen work, and the acceptance of the place offered would put him perhaps in the most prominent position among the street-railway men of the world.

To welcome Gisbert Kapp, the newly appointed professor of electrical engineering at the Birmingham University, from Germany, to which country he went in 1894, a dinner was recently given at the Imperial Restaurant in London. The welcome was an enthusiastic one, many congratulatory speeches being made. Among the prominent men present were Professor W. E. Ayrton, Colonel R. E. B. Crompton, R. S. Erskine, A. H. Preece, J. Swinburne, Professor W. C. Unwin and S. P. Thompson. Professor Thompson said that he was glad to think that the University of Birmingham did not advertise for the cheapest man to fill the professorship of electrical engineering, but communicated privately with Mr. Kapp, recognizing that he was the man to fill the post, just as they had done when Sir Oliver Lodge was appointed principal of the university.

J. S. Lehman has been engaged by the Sawyer-Man Electric Company as one of its general lamp salesmen and has been assigned to the St. Louis office. Mr. Lehman is well known in the incandescent-lamp business. He entered the incandescent-lamp field in 1893, being cashier and bookkeeper for the Columbia Incandescent Lamp Company of St. Louis. Four years later he was put in charge of all its city business, which he handled successfully until 1899, when he was transferred to Texas, and spent the following three years in that state, Louisiana and Mexico. In 1902 he was recalled to St. Louis and assigned to the western territory, including the Pacific Coast. He continued in that territory until the first of November, 1905, when he entered the employment of the Westinghouse Electric and Manufacturing Company as general lamp salesman for the Sawyer-Man Electric Company. Irwin Lehman, a brother, who for a number of years represented the Columbia Incandescent Lamp Company in the Texas territory, has also entered the employment of the Westinghouse company as lamp salesman for the Sawyer-Man Electric Company in Texas.

J. S. LEHMAN.

ELECTRIC LIGHTING.

The Denver and Rio Grande railroad will install an electric-light system for its own use at Denver, Colo.

The City Council of Aurora, Ill., has under consideration the creating of a department of electricity.

The contract for lighting the city of Lawrence, Kan., has been awarded to the Lawrence Electric Light Company.

A franchise is said to have been granted to spencer Owen to construct and operate an electric-light plant in Springdale, Ark.

R. M. Adams is interested with local persons at Ozark, Ark., in a project to install an electric-light plant and system of waterworks in Ozark.

Arrangements are being made by the city of Bamberg, S. C., for installing an electric-light plant of 40 arcs and 1,000 incandescents, for which a bond issue of $15,000 was recently authorized.

The Camptown (Ky.) Fuel and Light Company has been incorporated with a capital stock of $8,000, by J. S. Botts and Charles Kerr of Lexington, Ky., and A. F. Byrd of Winchester, Ky.

M. J. Hart, H. T. Gurley and R. O. Randle are at the head of the New York-New Orleans Electric Company of New Orleans, which has been incorporated with a capital stock of $1,000,000 to erect and maintain electric plants, etc.

Sealed proposals will be received by the city of Sparta, Ga., until December 7th for machinery and material and installing complete an electric-light plant. For specifications, form of proposal, etc., address R. W. Moore, mayor.

The Consumers' Ice and Cold Storage Company of Key West, Fla., will install an electric-light plant and has applied to the City Council for a franchise to do a lighting business in the city. F. R. Ladd is president of the company.

The Western Heat, Light and Power Company of Cicero, Ill., has been incorporated with a capital stock of $2,500 to operate a heat, light and power plant. The incorporators are Walter D. Herrick, Iver Jeffreys and Donald S. MacWilliams.

A remonstrance signed by heavy taxpayers of the city of Terre Haute, Ind., was presented by a committee of business men to the council on November 27th against proceeding with the municipal lighting plant for which the people voted two to one recently. However, the administration will go ahead, it is said, unless enjoined by the court.

The Illinois Athletic Club of Chicago will install an isolated electric-light and power plant of considerable size on its property and is about to ask permission from the City Council to sell the surplus current not needed for its own use to buildings in the vicinity of its clubhouse. To conduct this business the Illinois Athletic Club Electric Company has been organized and incorporated with a capital of $2,500. The incorporators are R. A. Folsom, Dwight Lawrence and William Hale Thompson.

The Steelton Light, Heat and Power Company's power plant at Steelton, Pa., was destroyed by fire on November 20th. The loss to the company is placed at $60,000 by Fred E. Keeney, the general superintendent. The plant was ruined within a few moments from the start. Ten dynamos, supplying 12,000 incandescent lamps, and three engines of a total horsepower of 550 were destroyed. The plant is to be rebuilt at once. In the meantime the company will make use of the old plant of the Pennsylvania Steel Company for incandescent service and the Central Pennsylvania Traction Company plant for power service.

ELECTRIC RAILWAYS

The Manila (P. I.) Electric Railway and Light Company shows gross earnings of $74,225 and net of $36,248 for the month of October.

It is reported that the property of the Kankakee (Ill.) Electric Railway Company, of which Emory Cobb is president, has been sold to Chicago and New York men.

The Wichita Mountains Traction Company has been incorporated, with headquarters at Hobart, Okla., and proposes to build an electric line from Roosevelt to Apache, Okla.

The electric railway connecting Anna and Jonesboro, Ill., and extending one mile north of Anna to the state hospital for insane has been placed in operation. It is owned by Francis S. Peabody and associates of Chicago and is bonded for $100,000. The road is well built and has the best equipment. Freight and coal will be hauled.

Negotiations are about to be consummated for the sale to the Washington, Baltimore and Annapolis Electric Railway Company of the property in Baltimore on which formerly stood the wholesale warehouse of John E. Hurst & Co., in which the great fire of February a year ago started. Upon this lot the railway company will erect its terminal station, waiting rooms and general office building. Work on the new structure will begin immediately after the company secures the franchises, for which it has petitioned the City Council.

The net earnings of the Twin City Rapid Transit Company of Minneapolis for 10 months of the current fiscal year are only about $12,000 below those for the whole of 1904. The road will this year make the best showing of net earnings in its history.

The Pennsylvania Railroad Company has decided to go ahead with the plan to equip with electric power the old West Jersey and Seashore railroad to Atlantic City, and some of the suburban lines out of Camden. Samuel Rea, third vice-president of the company, and chairman of the special committee having the matter in charge, says it will take a year to complete the work.

The United Railroads of San Francisco, controlled since the consolidation four years ago by Brown Bros. & Co. of New York, have passed into the hand of interests represented by the banking house of Ladenburg, Thalmann & Co. of New York. Arthur Howland, who has been president of the United Railroads, will retire from the management of the properties at the end of December, it is said.

PUBLICATIONS.

A handsome new catalogue issued by the Otis Elevator Company of New York illustrates and describes in a general way elevating machinery and apparatus manufactured by that company.

Private branch exchange switchboards and portable desk telephones are brought to the attention of the busy man by a neat little booklet issued by the Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y.

The generating and distributing system of the Portland (Ore.) General Electric Company is thoroughly described in a pleasing brochure, which is sent around with the compliments of that company. The description contained is a reprint of a paper by Mr. F. G. Sykes read before the Electrical Transmission Section of the Pacific Coast Engineering Congress.

National stationary and portable motor-driven air compressors for continuous and intermittent service as manufactured by the National Electric Company of Milwaukee are described and illustrated in a recent bulletin. It is stated in the bulletin that at the present time more than 15,000 of these compressors are in daily use. Polyphase induction motors are made the subject of another bulletin issued by the same company.

Northern motors in hoisting service are described in a leaflet which is distributed by the Northern Electrical Manufacturing Company of Madison, Wis. The leaflet reveals the special adaptability of the various types of motors for hoisting service. Illustrations show some motor-driven hoists embodying the box-type machines, which are especially designed for practically any kind of service. These motors are easily fixed to the machine and are dust proof.

A clever advertising idea is to be credited to the Western Display Company of St. Paul. It is sending out a number of sheets of ordinary scratch paper pinned together, and upon these is written in a large, bold hand a number of reasons why electric signs are paying propositions to the general business man who has something to sell. The idea is original and will catch and hold attention. On the wrapper in which these sheets are done up one is informed that "The world does not go to bed at sundown"

MISCELLANEOUS.

At the regular meeting of the Lynn General Electric Engineering Society, on December 13th, H. G. Riest of the Schenectady Works will give a lecture on "Armature Winding." Mr. Riest was formerly a foreman of the winding department in Lynn.

President Roosevelt is reported to be keenly interested in the preservation of Niagara Falls, and it is supposed that he will recommend speedy action on this matter in his forthcoming message to Congress. A little while ago an influential delegation visited the president and told him that 10 companies now operating at Niagara have authority to utilize 1,339,500 horsepower of the effective energy of the falls.

The engineering assemblies which were inaugurated at Purdue University, Lafayette, Ind., last year, and which were well received by the students, are to be continued during the present school year. Beginning November 27th, the assembly will convene each Monday until April 1st. Members of the faculty, practical engineers, and professors from neighboring institutions will deliver addresses and read papers. The meetings will be open to students, members of the instructional corps of the university, members of electric or engineering associations and to the press.

TRADE NEWS.

The Lane & Bodley Company of Cincinnati, Ohio, calls attention to its four-valve shaft governor engine. Bulletin No. 100, describing the engine, will be sent on application.

Dr. F. A. C. Perine, consulting electrical engineer, now has his office in the suite of Henry L. Doherty at 60 Wall Street, New York. The change took place on November 25th.

The Scott-Rankin Company, recently incorporated with a capital of $5,000, will deal in electrical supplies at El Paso, Texas. H. P. Scott is president, T. G. Rankin, secretary, and E. S. Penn, manager.

The Baldwin Locomotive Works has completed plans for the erection of another large building in Philadelphia, which will be devoted solely to the manufacture of electric trucks. It has been within the last four years that the Baldwin works have engaged in the manufacture of electric trucks.

C. S. Powell, general agent of the Westinghouse Electric and Manufacturing Company, who has for some time occupied offices at 11 Pine Street, New York, has removed to the offices of the company on the nineteenth floor of the Trinity Building, 111 Broadway. The company, in addition to its offices in the Hanover Building at 11 Pine Street, occupies the entire nineteenth floor of the Trinity Building.

Charles F. Chandler, Russel H. Osgoodby and Sybil Chandler of Muncie, Ind., have incorporated as the United States Electric Sign Company. They have leased the plant of the Crozier Manufacturing Company and will manufacture electric signs and advertising emblems of all kinds. The business streets of Muncie are very brilliant at night as a result of many signs installed for merchants by the men in the new company. The business of the sign company is not to be confined to Muncie, as representatives have been placed on the road and orders have already been secured from Ohio and Indiana cities.

The National Electrical Manufacturing Company, which was recently organized by P. A. Williams, has opened offices and shops in the new building at 512-514 Grand avenue, Des Moines, Iowa. The company does a general electrical contracting business, making a specialty of farm-lighting systems. Officers of the company are: P. A. Williams, president; F. A. Spry, vice-president; John McLennan, treasurer; T. E. Heifner, secretary.

President Coffin of the General Electric Company in asking for proxies for use at the special meeting of stockholders to be held December 5th to increase the capital stock by $11,674,500, says: "The orders received by your company since February 1, 1905, have exceeded the orders for a like period in the previous year by 40 per cent. It is obvious that a largely increased business will require additional capital, and your directors therefore recommend to the stockholders the increase of the share capital of the company. Should the increase be authorized by vote of the stockholders it is the intention of the directors to issue part of the new stock at the present time and the remainder as the needs of the company may require it."

The Crocker-Wheeler Company of Ampere, N. J., manufacturer and electrical engineer, announces the establishment of an industrial engineering department in which is concentrated all its work in the line of industrial engineering as applied to railway shops, machine shops, and industrial plants. The company was among the first to recognize that even high-class electric motors and generators should be accompanied in every case with sound engineering advice to the purchaser. Each sale of a motor has meant that a motor-drive problem has been successfully solved by a group of engineering experts. J. K. Warner Davenport, E. E., formerly a consulting engineer making a specialty of industrial work, has become associated with the company in order that its growing activities along these lines may be handled in as thorough and satisfactory manner as heretofore. Mr. Davenport and his staff of assistants are at the present time giving personal attention to several important industrial propositions.

BUSINESS.

W. N. Matthews & Brother of St. Louis, manufacturers of Stombaugh guy anchors and Kearney cable clamps, report that the demand for the Kearney cable clamp has been far in excess of their expectations. This is one of those useful inventions which everyone looks at and says, "Why didn't somebody think of this before?"

The Southwestern Electric Company of St. Louis, repairer of electrical machinery of all descriptions and dealer in second-hand electrical machinery, reports a good season's business. This company is particularly well equipped to handle business in the West and Southwest, and by its careful and prompt services has made an excellent reputation.

The Stanley-G. I. Company of Pittsfield, Mass., has just closed a contract with Kurz & Root, consulting engineers and contractors of Appleton, Wis., covering 80 series alternating arc lamps, transformers, regulators, arc-lamp panels, generator switchboard and other accessories in connection with a lighting installation at Menasha, Wis.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) November 21, 1905.

804,819. Signaling System. James E. Allison, St. Louis, Mo., assignor to George M. Seeley, New York, N. Y. Application filed August 14, 1902.

An electric signaling system is described in which there are a number of signals and a separate operating mechanism for each signal. There is a source of energy local to each operating mechanism. (See cut.)

804,820. Signaling System. James E. Allison, St. Louis, Mo., assignor to George M. Seeley, New York, N. Y. Application filed May 4, 1904.

This patent describes a single sending instrument by means of which any one or all of the signals mentioned in the preceding patent can be separately or collectively operated and restored to normal.

804,843. Leading-in Conductor for Electric Vapor Apparatus. Peter C. Hewitt, New York, N. Y., assignor to the Cooper Hewitt Electric Company, New York, N. Y. Application filed March 26, 1904.

In combination with the glass container of a vapor apparatus is a platinum disk sealed into the glass and one or more reinforcing pieces of copper attached to the disk.

804,848. Telephone Signal System. Amiel R. Hoover, Pleasanthill, Ill., assignor of one-half to C. J. Craigmiles, Pleasanthill, Ill. Application filed April 20, 1905.

The claim of the patent describes a box having a hinged cover as follows: A relay and local battery in the box, a receiver switch-hook and a circuit closer in opposite sides of the box, a transmitter and local bell on the hinged cover of the box, binding posts for a normally charged bell line-circuit, conductors connecting the binding posts with the circuit closer and the coils of the relay, binding posts for a telephone line circuit, conductors connecting the binding posts to the receiver switch hook, the receiver, the armature switch of the relay, the local bell and the transmitter, and a conductor connecting the local battery with the conductor leading from the receiver to the armature switch, and the conductor between the transmitter and the local bell.

804,849. Electric Switch. Frederick Huffer, New York, N. Y. Application filed April 9, 1904.

An electric switch combined with a movable and a fixed contact element has a casing surrounding the elements and means connecting the two for imparting motion in one direction to the movable elements, the means being inoperative in the other direction. A coiled-spring contact between the two elements forms an electric connection.

804,861. Multiple Switchboard for Telephone Exchanges. Milo G. Kellogg, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed February 13, 1892. Renewed February 9, 1893.

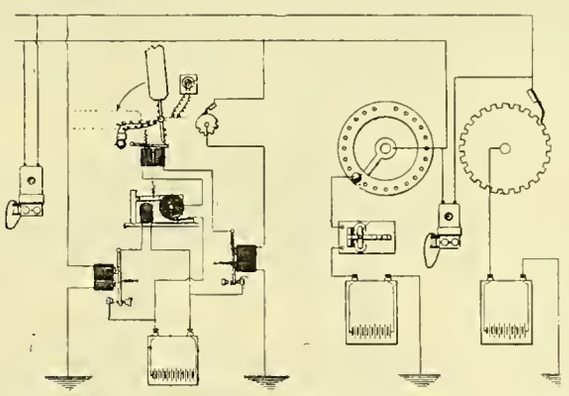
In a telephone exchange system having two metallic-circuit lines and two line annunciators, one for each line, through which the line is closed at the central office, the lines are temporarily switched together for conversation into a single metallic circuit. Included is a clearing-out annunciator and a battery in a circuit connection from the metallic circuit to the ground, a calling generater at each subscriber's station in the metallic circuit of his line whenever the generator is being operated to send either a calling or a clearing-out signal and a normally closed ground connection at each subscriber's station to the metallic circuit of his line.

804,862. Telephone-exchange System. Milo G. Kellogg, Chicago, Ill. Application filed December 20, 1894.

Claim 1 reads: In a telephone exchange system, the metallic-circuit lines divided into two divisions, the multiple switchboards divided into two divisions, one division of boards for each division of lines; switches for each of the lines, one switch for each line on each of the several boards of its division, and on one board of the other division; two annunciators at the central office for each line, through one side of which one side or branch of the line is permanently grounded and through the other of which the other side or branch of the line is permanently grounded; in combination with a calling generator at each subscriber's station permanently or whenever operated to send a call in the through or closed circuit of the line at the station, and contacts to at will ground his line on either side of the generator.

804,880. Automatic Weighing Apparatus. John L. Peppard, Kansas City, Mo. Application filed June 28, 1905.

The apparatus employs in its operation an electric circuit and an electromagnet having a yieldingly retracted armature.



NO. 804,819.—ELECTRIC SIGNALING SYSTEM.

804,931. Apparatus for Electrolytical Decomposition. Gunnar E. Cassel, Stockholm, Sweden. Application filed May 4, 1905.

Two end plates of conducting material forming an electrode and an eduction pipe extending from one plate to the other are the principal parts of the apparatus.

804,940. Electric Switch or Disconnecting Device for Telephones. Leonard J. Fletchall, Hatfield, Mo., assignor of one-half to Mark L. Belden, Hatfield, Mo. Application filed August 11, 1904.

A support carries house and line terminals which are provided with a switch for normally connecting them. A ground wire is secured to the support and has one end thereof bent laterally to form a terminal contact arm. A flexible medium is connected to the switch blade for moving the latter in contact with the terminal of the ground wire.

805,026. Staff System for Controlling the Traffic Along Single-track Railroads. Thomas H. Patenall, Wilkinsburg, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed February 6, 1905.

This system has staff instruments located at each end of a track to be protected, and electric circuits between the staff instruments and an independent staff do the main part of the work.

805,057. Ringing Key. Edward B. Craft, Chicago, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed April 8, 1905.

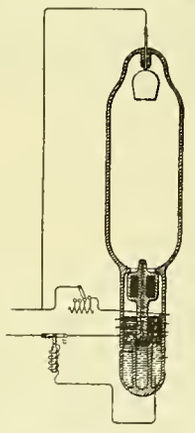
Mechanical features of a telephone ringing key are described.

805,062. Guard for Third Rails. Augustus A. Hickerson, Reynoldsburg, and William H. Phalor, Shepard, Ohio. Application filed February 6, 1905.

A guard for an electric third rail having a removable roof portion is described.

805,092. Electric Transmitter. Jerome Prince, Milford, Mass., assignor of parts to Charles E. Aldrich and John H. Macdonald, Beverly, Mass. Application filed February 2, 1905.

A telephone transmitter is included in a casing having a vibratory diaphragm. A flexible disk having copper, zinc and carbon plates co-operates with and is secured to the diaphragm. A carbon cup has carbon, zinc and copper plates connected to the interior of the case and arranged opposite the flexible disk. Granules are interposed between the plates in the respective disk and cup, and circuit wires are connected to the electrode of the transmitter.



NO. 805,292.—METHOD OF STARTING ELECTRIC GAS AND VAPOR DEVICES.

805,093. Coupling for Electrical Conduits. Alexander C. Proudfit, New York, N. Y. Application filed October 14, 1903.

A coupling member for electrical conduits and the like comprises a metal body having a number of mouths to receive pipe, and an inner integral medial flange presenting convex rounded surfaces toward each mouth of the coupling.

805,096. Trolley Wheel and Mounting Therefor. Frank N. Russell, Elmira, N. Y., assignor of one-half to Albert D. Lane, Shoshone Agency, Wyo. Application filed April 15, 1905.

A trolley wheel having semispherical journals or enlargements with fixed relation to each other and to the wheel and mounted in bearing blocks or cups is described.

805,108. Signaling System. Paul Winsor, Weston, Mass. Application filed August 11, 1905.

In combination with a train-line circuit provided with a ground connection at its opposite ends are a number of circuit controllers, a signal included in the train-line circuit at one end thereof, a switch controlling the signal and a battery included in the train line at the opposite end thereof.

805,124. Sleet Cutter for Third Rails. Ervin A. Dunbar, Wheaton, and Walter H. Rogers, Warrenville, Ill. Application filed March 18, 1905.

The device is composed of a number of cutting disks arranged side by side and separately rotatable on one axle.

805,126. Multiple-station Telephone System. Arthur J. Farmer, Detroit, Mich. Application filed December 26, 1903.

A party-line switching appliance has means in the cord circuit at the exchange for sending actuating current over both line conductors in parallel to the switching appliance. Relay apparatus is provided for sending current over one side of the line thereto, and means controlled by the removal of the connecting plug restores the relay apparatus to normal condition.

805,131. Incandescent Electric Lamp. Royal Gerow and George H. Gerow, Northport, Canada. Application filed December 31, 1904.

A type of incandescent electric lamp is described.

805,154. Fuse Terminal. Henry E. Procunier, Oak Park, Ill. Application filed April 3, 1903.

Combined with a base or supporting plate is a conducting post penetrating the plate and having at one side of the latter a fuse connection. Insulating sleeves on the post are stopped longitudinally in opposite directions by the post and plate respectively; a conducting plate is penetrated by the post without contact therewith and is bound between the sleeves.

805,166. Electric Rail. Louis Steinberger, New York, N. Y. Application filed January 3, 1905.

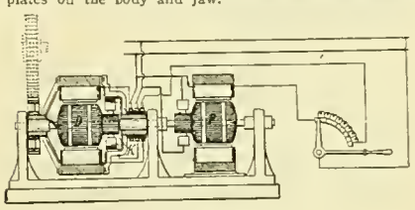
An electric rail comprises a supporting member provided with upwardly projecting flanges and a rail member provided with downwardly projecting flanges and disposed adjacent to the supporting member. Means are provided for insulating the rail member, and a heating coil is disposed intermediate of the rail member and the supporting member.

805,167. Insulator Pin. Louis Steinberger, New York, N. Y. Application filed January 3, 1905.

Details are described.

805,169. Insulator and Wire Clamp. John F. Tanbold, Scranton, Pa. Application filed February 26, 1904.

An insulator for telegraph wires consists essentially of a fixed body, a movable jaw having a rack-bar extending alongside the body, a pinion lever pivotally supported by the body and engaging the rack-bar and insulating jaw plates on the body and jaw.



NO. 805,188.—ELECTRIC MOTOR CONTROL.

805,188. Apparatus for Controlling Electric Motors. Harry E. Dey, Brooklyn, N. Y., assignor to Ernest R. Esmond, New York, N. Y. Application filed May 5, 1899.

A dynamo-electric machine of the shunt type has both its members rotatable. Driven mechanism is connected to one member of the machine. A second dynamo-electric machine is connected to the other member. The second machine is also of the shunt type and connected to the same constant potential circuit with the first machine but in multiple therewith and a regulating resistance in the field-magnet circuit of the second machine. (See cut.)

805,195. Electropneumatic Channeler. Arthur H. Gibson, Easton, Pa., assignor to the Ingersoll-Sergeant Drill Company, New York, N. Y. Application filed April 27, 1905.

In combination, a truck, a channeler adjustably mounted thereon and a presser and motor adjustably mounted on the truck whereby the channeler and presser cylinders may be kept in close proximity to each other as the channeler is adjusted to different positions along the truck.

805,225. Electric Trolley Switch. George H. Negley and Isaac L. Brown, Indianapolis, Ind. Application filed September 11, 1903.

A switch at the juncture of a main and side-track trolley wire for guiding the trolley wheel is the feature.

805,248. Electric Lamp. Elihu Thomson, Swampscott, Mass., assignor to the General Electric Company. Application filed May 8, 1899.

The combination in an electric lamp consists essentially of a pyro-electrolytic conductor in an electric circuit, arcing points in proximity hereto, means for establishing an arc for giving initial heat to the conductor, and means for breaking the arc when the conductor attains the proper temperature.

805,249. Electric Conductor. Louis E. Underwood, Lynn, Mass., assignor to the General Electric Company. Application filed April 1, 1905.

A carbon block has a recess and a restricted passage leading away from the recess formed in it, and a flexible conductor has a portion in the form of a bight or loop located in the recess and an adjacent portion located in the restricted portion, the bight or loop being soldered to the carbon block.

805,253. Voltage Regulator. Ernst F. W. Alexanderson, Schenectady, N. Y., assignor to the General Electric Company. Application filed March 10, 1905.

In combination are an electric circuit, a source of current therefor, a transformer arranged with an open magnetic circuit and having its secondary windings in series with the electric circuit, and means for supplying to the primary of the transformer a current substantially in quadrature with the voltage impressed on the electric circuit and varying in magnitude with the drop in voltage of the source due to variation in amount of current flow.

805,260. Insulating Bushing. John G. Callan, Lynn, Mass., assignor to the General Electric Company. Application filed August 28, 1902.

This method of making an insulating bushing consists in coating a wire with a suitable insulating compound, stretching the wire to reduce its diameter and then removing the coating of insulating compound.

805,263. Time-limit Device for Controllers. Alexander Churchward, New York, N. Y., assignor to the General Electric Company. Application filed October 10, 1903.

The combination with a controller handle, of a dashpot set for a minimum time limit, and means for automatically increasing the time limit if the handle is moved too quickly.

805,282. Incandescent Lamp. Gustavo Germani, Pittsburg, Pa. Application filed October 13, 1904.

The features of a new incandescent electric lamp are set forth.

805,288. Enclosed Fuse. Caryl D. Haskins, Schenectady, N. Y., assignor to the General Electric Company. Application filed June 24, 1904.

The combination with a fusible conductor consists of an absorbent insulating material and means to force the insulating material into intimate contact with the ends of the conductor upon disruption thereof.

805,289. Magnetic Separator. Harry E. Heath, Windsor, Conn., assignor to the General Electric Company. Application filed September 17, 1903.

A number of pole pieces traveling longitudinally of a stationary conductor in a magnetic separator are provided with means for carrying the material to be treated beneath the pole pieces.

805,291. Semaphore Signal. Reinhold Herman, Crafton, Pa., assignor to the General Electric Company. Application filed April 26, 1905.

Mechanical features of an electrically operated semaphore signal are described.

805,292. Method of Starting Electric Gas or Vapor Devices. Peter C. Hewitt, New York, N. Y., assignor to the Cooper Hewitt Electric Company. Application filed November 24, 1903.

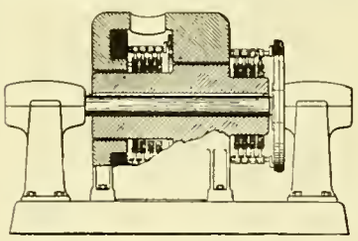
This method of starting a gas or vapor electric device having electrodes consists in electromagnetically projecting a stream of fluid from one electrode into contact with another electrode and causing the stream to separate whereby conduction is established first through the stream of fluid and afterward through a vapor path. (See cut on preceding page.)

805,293. Starting Device for Mercury-vapor Apparatus. Peter C. Hewitt, New York, N. Y., assignor to the Cooper Hewitt Electric Company, New York, N. Y. Original application filed November 24, 1903. Divided and this application filed October 19, 1904.

In a gas or vapor electric apparatus are two electrodes, one of which is a fluid and the other a solid, and means for projecting a stream of the fluid into contact with another electrode, thereby causing the electric current to traverse the intervening vapor or gas.

805,315. Unipolar Machine. Jakob E. Noeggerath, Schenectady, N. Y., assignor to the General Electric Company. Application filed April 1, 1905.

In a dynamo-electric machine are combined a unipolar field structure, a conducting armature body rotatably mounted in the field, collector rings having portions only in contact with the armature body, the points of contact of the rings being distributed substantially uniformly around the armature, and groups of collecting brushes bearing on the rings. (See cut.)



NO. 805,315.—UNIPOLAR DYNAMO.

805,322. Electric Arc Lamp. William R. Ridings, Stretford, England, assignor to the Westinghouse Electric and Manufacturing Company. Application filed March 1, 1904.

An electric arc lamp is described having electrodes feeding by gravity upon the release of a clutch operated by electromagnetic means, the coils for operating the feeding mechanism being cut out by a shunt-wound electromagnet when the arc is struck or when the arc does not exceed the normal length, the shunt-wound magnet having an armature by means of which the circuit of the electrode-feeding coils is both opened and closed.

805,327. Electric Self-winding Clock. Charles F. A. Sturts, San Francisco, Cal. Application filed June 3, 1904.

Mechanical and electrical mechanism as applied to a timepiece for winding are described.

805,346. Alternating-current Motor System. Albert G. Davis, Schenectady, N. Y., assignor to the General Electric Company. Application filed April 4, 1898.

Briefly, the combination with a source of single-phase current consists of a motor driven by electric energy from the source, a multiphase winding on the secondary of the motor leading from the secondary to the primary of a second motor, and a secondary for the second motor, the two motors being coupled to perform mechanical work.

805,353. Illuminated Sign. Elias L. Elliott, Lakewood, Ohio, and Eugéne Lucien, Paris, France. Application filed September 16, 1904.

In an illuminated sign a support carries the letters forming the sign, the surfaces of the letters being approximately parabolic. A light for illuminating the letters is disposed at the focus of the parabolic surfaces in such manner as to illuminate the letters and cause the rays of light reflected therefrom to be thrown forward.

805,370. Electric-light Shade or Hood. Albert S. Marten, East Orange, N. J. Application filed March 23, 1904.

Details are described.

805,400. Ice Remover for Trolley Wires. Montraville M. Wood, Chicago, Ill., assignor to the General Electric Company. Application filed March 24, 1905.

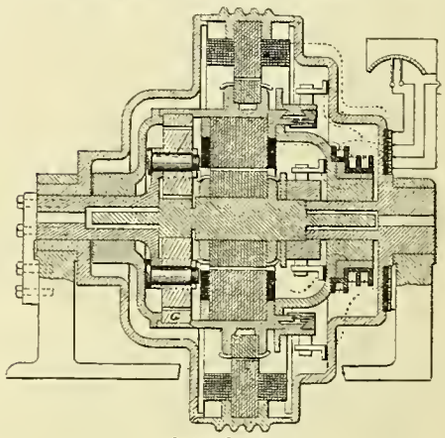
An ice remover for suspended electric conductors comprises a number of impact devices adapted to be removably connected to the periphery of a trolley wheel.

805,408. Trolley Wheel. Thomas Broadbent and Israel Hey, Wollaston, Mass. Application filed June 17, 1904.

A hollow transversely divided axle having lubricating openings, a cylindrical bushing provided with openings and surrounding the axle, and a trolley wheel mounted on the bushing describes the patent.

805,412. System for Wireless Telegraphy. Thomas E. Clark, Detroit, Mich., assignor to the Thos. E. Clark Wireless Telegraph-telephone Company, Detroit, Mich. Application filed February 17, 1902.

In a system of wireless telegraphy and signaling, the combination with an aerial conductor consists of an induction coil having each terminal of its secondary connected with the conductor through an external circuit, copper spheres included in the circuit and a conical body adjacent to but spaced from the spheres, which latter are adjustable so that the space between them and the conical body may be increased or decreased.



NO. 805,416.—MOTOR.

805,415. Alternating-current Motor System. Albert G. Davis, Schenectady, N. Y., assignor to the General Electric Company. Original application filed April 4, 1898. Divided and this application filed April 9, 1902.

The method of obtaining mechanical work from the energy of a single-phase alternating current consists in causing, by single-phase alternating current, the rotation of an armature at a speed lower than synchronous rotation, converting thereby a portion of the energy of the current into mechanical work, and another portion into low-frequency multiphase currents; transmitting the low-frequency multiphase currents to a multiphase motor, producing a rotary field in the motor by the multiphase currents, and causing by the rotary field a rotation of the second motor.

805,416. Electric Motor. Ernest R. Esmond, New York, N. Y. Continuation of application filed August 23, 1901. This application filed October 25, 1904.

The combination, with two motors having three of the four motor members mechanically connected together, consists of means for regulating the speed of one or both of the motors. (See cut.)

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on November 27, 1905:

393,353. Porous Cup for Galvanic Batteries. H. J. Brewer, New York, N. Y.
393,365. Switch or Circuit-changer. W. W. Griscom, Haverford College, Pa.
393,373. Electric Motor. F. J. Keller and J. W. Carnes, Massillon, Ohio.
393,389. Controller for Electric Circuits. W. J. Paine, Boston, Mass.
393,391. Filament for Incandescent Lamps. G. S. Ram, Montclair, N. J.
393,395. Galvanic Battery. H. L. Roosevelt, New York, N. Y.
393,447. Electric Arc Lamp. G. Pfannkuche, Exeter, N. H.
393,469. Dynamo-electric Machine. W. W. Griscom, Haverford College, Pa.
393,470. Distribution of Electricity by Secondary Batteries. W. W. Griscom, Haverford College, Pa.
393,473. Incandescing Electric Lamp. E. H. Johnson, New York, N. Y.
393,508. Multiple Switchboard. M. G. Kellogg, Hyde Park, Ill.
393,509. Multiple Switchboard. M. G. Kellogg, Chicago, Ill.
393,526. Electric Depositing Cell. E. L. Smith, Ansonia, Conn.
393,529. Telephone Exchange. W. R. Vansize, Plainfield, N. J.
393,558. Electric Letter Box. C. F. Harms, Hoboken, N. J.
393,573. Storage Battery. L. Paget, Trenton, N. J.
393,574. Electric Light Regulator. L. Paget, Trenton, N. J.
393,575, 393,576, 393,577. Secondary Battery. L. Paget, New York, N. Y.
393,596. Electric Fluid-pressure Engine. G. Westinghouse, Jr., Pittsburg, Pa.
393,622. Conduit for Electric Railways. M. Dallas, New Orleans, La.
393,636. Dynamo-electric Machine and Electric Motor. W. F. Freeman, New York, N. Y.
393,637. Electric Striking Attachment for Clocks. J. H. Gerry, Brooklyn, N. Y.
393,639. Galvanic Battery. J. L. Gethins, Boston, Mass.
393,657. Electric-light Burglar-alarm Indicator. R. Packer and I. E. Cochran, Jr., Chester, Pa.
393,704. Globe for Electric Lamps. S. Heimann, New York, N. Y.
393,733. Incandescent Electric-lamp Socket. W. F. Wollin, Lancaster, and Elmer H. Werline, Williamsport, Pa.

WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XXXVII. CHICAGO, DECEMBER 9, 1905 No. 24

LIBRARY OF ELECTRICAL

Electricity and Electric Power for Therapeutic and Hygienic Purposes.

Well-appointed hospitals of the present day are fitted with devices and appliances of various kinds which use electricity as a therapeutic agent. Electrically operated appliances are also frequently used for hygienic purposes, an application of this character being the well-known Zander system of physical exercise originated by Dr. Gustav Zander in Germany.

Complete equipment for the Zander system consists of about 65 machines, which are divided into two classes—those for active movement and those for passive movement. The passive exercises are taken with the aid of electrically propelled machines, some of which are shown in Fig. 4, which is a view in a hygienic institute in Chicago, where the Zander system is employed.

In the Chicago institution there are in operation 23 motor-driven pieces of apparatus for the passive movements, the motors ranging from one-quarter to one-half horsepower, and one being provided for each piece of apparatus. They are of the slow-speed type, and being provided with belts or rawhide gearing they are practically noiseless in their operation.

Inspection of Fig. 4 will show near the front of the picture a motor-operated piece of apparatus which is used to obtain the effect of horseback riding. In other parts of the room are devices for exercising or manipulating various parts of the body. The largest machine which is near the rear of the room, as shown in Fig. 4, is for the development of the chest and lungs by artificial dilation.

The whole purpose of the Zander system is to give direct exercise, distributed evenly over the whole body, and to build up undeveloped parts, by bringing to those parts the stimulus of increased blood circulation. Electric power is particularly well adapted for driving the mechanically operated exercising machines, owing to the cleanliness, comparative noiselessness and compactness of the motors. Current is taken from an external source of supply.

For therapeutic purposes great progress has been made during the last few years in England, and most of the large British hospitals have instituted departments for the treatment of diseases by electrical means. The latest of these is Guy's Hospital, St. Thomas Street, London. Here a complete installation of apparatus has been made for almost every description of electrical treatment now in vogue. This equipment consists of special hydro-electric baths, apparatus for vibratory massage, high-frequency and X-ray apparatus, Wimshurst machine, switchboards for various combinations, Finsen light apparatus, etc.

Special hydro-electric baths are provided with a switchboard specially designed for Guy's Hospital, which embodies many details which have not been hitherto applied in hydro-electric baths. With this apparatus it is possible to give direct or alternating currents at the same time in different parts of the bath, or to different patients. On a marble base are arranged resistance lamps, galvanometer with shunt for increasing the reading, a voltage regulator, circular rheostat, induction coil, current reversers, a specially arranged key commutator to transmit currents to seven points at once, and a rotary sinusoidal current generator, all being worked by the current from the main circuit.

The apparatus for vibratory massage consists principally of an ingenious motor-transformer, wound to run from 100-volt direct-current mains. Attached to one end of the shaft is a flexible cable with a ball attachment at its extremity; this ball vibrates with various degrees of speed, regulated by a collar arrangement, which may be moved around while the ball is in action on the patient. The top of the ball is drilled with three screw holes to take various shaped electrodes for local treatment of the smaller muscles, etc., where the ball itself would be too

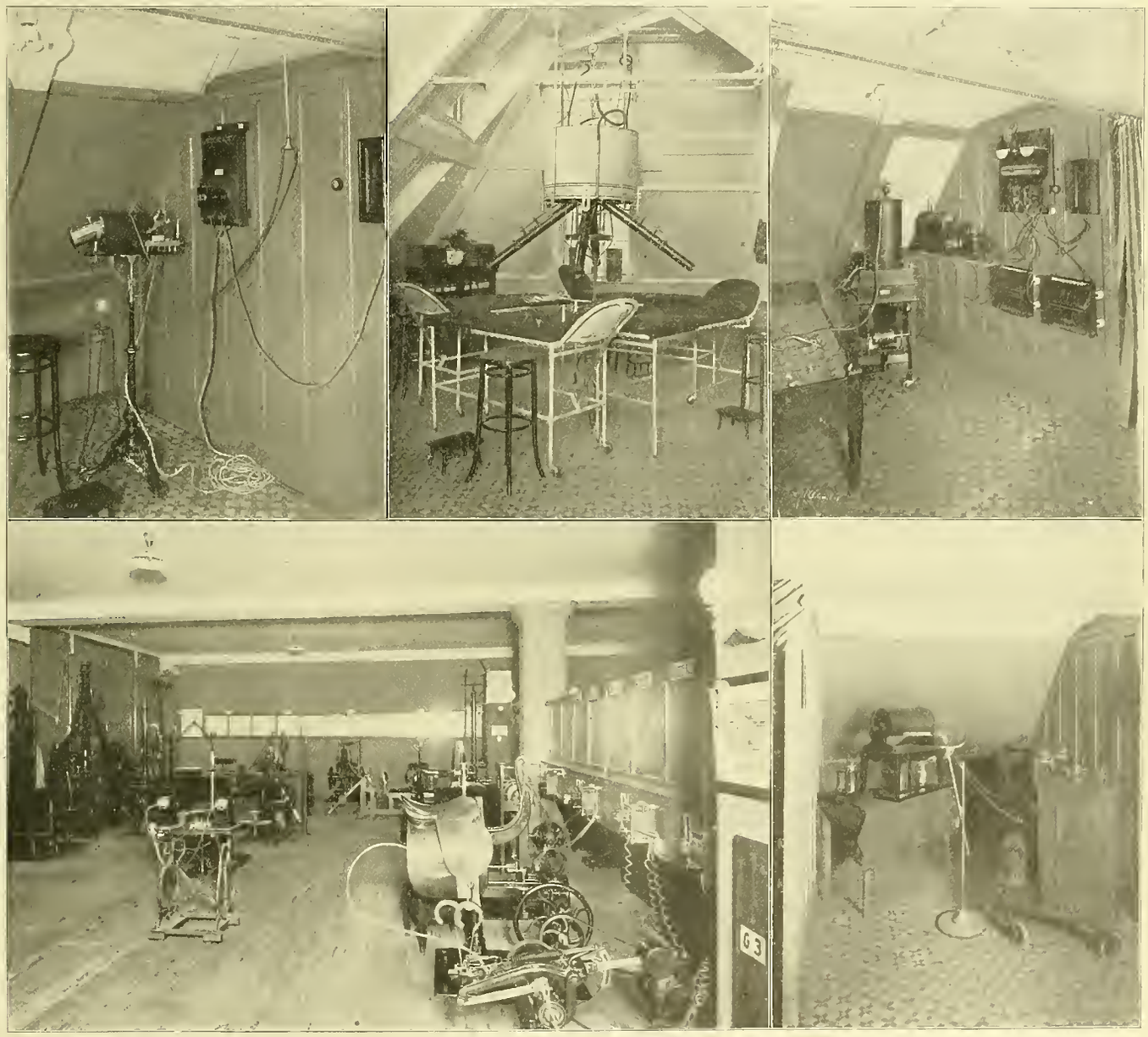


Fig. 1. Finsen Light for Individual Cases. Fig. 2. Improved Finsen-light Apparatus in London Hospital. Fig. 3. Apparatus for Applying High Potential and High Frequency.
Fig. 4. Interior of a Hygienic Institute in Chicago, Showing Electrically Operated Exercising Machines. Fig. 5. Induction Coil for X-ray Work.

large. The motor-transformer can be used also to give a carefully regulated sinusoidal current, light small lamps, such as headlamps, cystoscopes, etc., and also render a cautery point incandescent.

A special cubicle is fitted for the application of high potential and high frequency current (Fig. 3). In this installation the direct current is utilized from the main supply, both for the induction coil and to actuate the motor of the mercury jet interrupter, through variable resistances. A switchboard is used for switching in the current. It is provided with a voltmeter and ammeter for reading the pressure and amount of current going to the primary circuit of the coil. From the secondary circuit of the coil, which terminates at the discharging pillars, wires are led to a spark gap and Leyden jars, where extremely high alternations of current take place, and the potential of the secondary of the induction coil is raised and transformed to a static condition. This current passes to a solenoid composed of windings of thick copper wire, which allows, by means of an ingenious arrangement, the insertion of more or less turns of the winding, thereby affecting the current potential which is utilized in treatment. The current is applied through vacuum tubes, if local treatment be desired, and by the condensation method when the general electrification of the subject is considered necessary.

The induction coil utilized in the X-ray treatment (Fig. 5) is of 12-inch spark length, with a dipper-type mercury interrupter, using direct current from the mains, through regulating resistances for the coil and motor of the interrupter respectively. Volt and ammeters are in circuit to read the pressure and amount of current used. There is a special feature about the arrangement of the X-ray tube itself for therapeutic treatment. The tube is mounted on a stand and is enclosed in a transparent screen which entirely cuts out the rays from both patient and operator—an important desideratum. To permit the passage of the rays to the part of the patient to be treated, there is an orifice in the globular screen, to which can be fitted various size tubes of the same material. Down this the rays pass direct to the affected part, and thus obviate the use of lead-foil protection, which was formerly necessary to prevent burns. The tubes can be sterilized.

The Wimshurst machine used for static electricity is constructed of eight plates, each 36 inches in diameter, the rotary power for driving being derived from an electric motor connected to the main circuit. This method of treatment is not used to a very large extent, but is coming more into favor.

The switchboard for direct and alternating current, combined current and electrolytic action consists of a polished marble base, whereon are mounted two resistance lamps with switches, a galvanometer with a shunt to increase the readings of the instrument, switch to reverse the polarity of the direct current, switch to allow direct, alternating or combined current to flow from the terminals, induction coil with regulating primary and secondary and special circular rheostats of 10,000 ohms resistance, divided into 56 steps. This allows of very fine gradations of current to the patient. Much success has attended the application of these currents, in conjunction with the special arm bath for writer's cramp.

The Finsen light apparatus (Fig. 2) for the treatment of lupus embodies numerous improvements. By an ingenious arrangement the fullest use is made of the light from the lamp, so that the current consumption is about 50 amperes only, as against 70 or 80, or even more, in the older types, great economy in running being thereby effected. The principles of this treatment are now familiar to the majority of readers.

The smaller Finsen light apparatus (Fig. 1) is used for lupus treatment of a single patient at one time. The principles of construction are very similar, there being an arc lamp of high candlepower arranged to project its rays through a telescope for elimination of heat rays and concentration of the chemical rays to a point of convergence, where a compressor is used on the patient in a similar manner as with the large Finsen light-converging apparatus. A special type of self-feeding arc lamp is used with this apparatus, which has proved very good in its working capacities. The stand on which the apparatus is mounted is designed to give every possible movement and height required. Moreover, it is mounted on a wheeled base, which renders it particularly useful for small institutions.

The Lortet-Genoud London Hospital lamp, also designed for the light treatment of lupus, is a modification by the London Hospital staff, of the French lamp, Lortet-Genoud. The general construction consists of a stand having a heavily weighted base, on which is mounted a hand-feed arc lamp. The rays from this lamp are projected through a double shield having two rock crystal lenses set in its center. Between this shield water circulates, serving the same purpose as the Finsen and Finsen-Reyn apparatus. In the use of this lamp no compressor is required, as the patient is pressed against the front lens of the shield at the part required to be treated.

All the above light-converging apparatus, designed for lupus treatment, is also being employed in the treatment of rodent ulcer.

A "Magazine" Arc Lamp.

An arc lamp of the "magazine" or self-trimming type is described in a recent patent granted to William R. Ridings of Stretford, England.

One object of the invention is to provide means whereby a number of carbons or electrodes deposited in a lamp can be automatically fed one after the other into the carbon-holders by gravity, so as to maintain a continuous supply of carbons in the holders until the number of carbons deposited has been exhausted. For this purpose, according to the invention, each carbon-holder of a lamp is provided with a magazine into which the respective carbons can be conveniently dropped, say, from the top of the lamp. The magazines are arranged so as to be capable of rotation about an axis parallel with that of the respective carbon-holders, and are provided with a convenient number of annularly disposed longitudinal chambers or longitudinal series of supports capable of freely supporting each carbon practically parallel to the axis of the magazine, so that when a partial rotation is periodically given to the magazine the chambers in succession come into line with the holders.

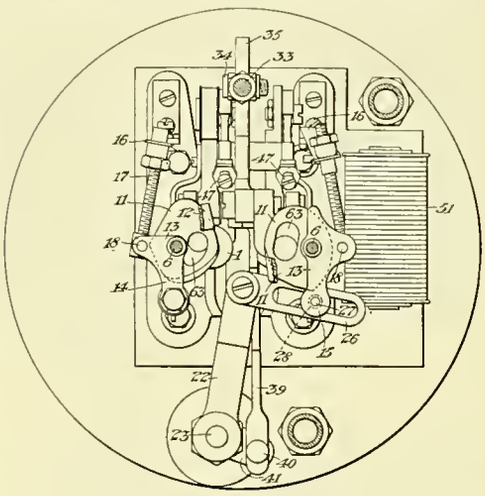


Fig. 1. Plan of Mechanism.

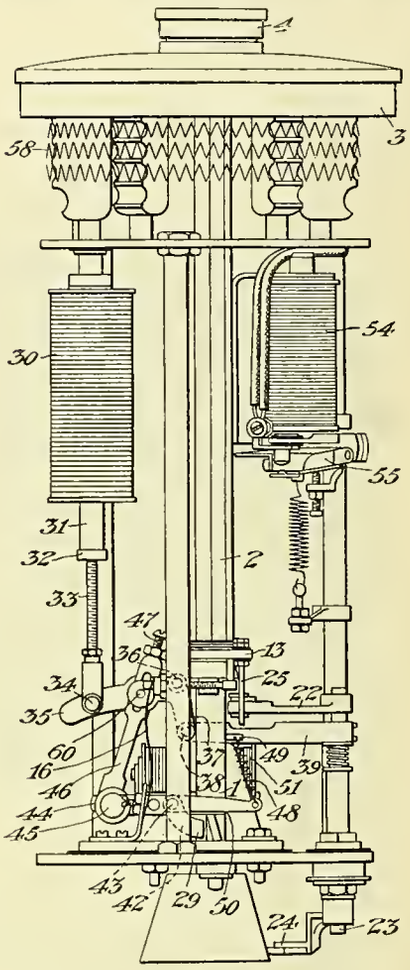


Fig. 2. Side View.

A "MAGAZINE" ARC LAMP.

Means are provided whereby the periodical partial rotation is automatically given to the magazine as soon as the top end of the carbon in use has been lowered by the feeding gear below the level of the bottom of the magazine, and is completed when the carbon in use has been further lowered to or below the level of the top of the carbon-holder, thus bringing a fresh carbon first into contact with and finally into line with the remainder of the carbon in the holder. As the carbon in the holder is further lowered the fresh carbon follows by gravity until it comes within the control of the feeding gear. This action is repeated until the supply in the magazine is exhausted.

One convenient manner of obtaining the above-mentioned periodical partial rotation of the magazine is to utilize the motion of the feeding or striking gears or that of the solenoid core which actuates them to revolve a slotted disk or retract a pawl, trigger, pivoted lever or the like against the resistance of a spring so as to bring pressure to bear in the direction of rotation of the magazine against a projecting end of each of the carbons in succession or against a series of projections on the magazine itself. The pressure thus placed on the magazine directly or indirectly tends to retain the carbon in use in contact with the carbon-holder, which provides a counter resistance to the above-mentioned spring. This counter resistance is removed as soon as the feed removes the upper end of the carbon in use from the magazine, allowing the magazine to be partially rotated by the spring bringing the next succeeding carbon first into contact with and then into line with the carbon in the holder. The above-mentioned slotted disk, pawl, trigger, pivoted lever or the like is thereupon again retracted by the motion of the actuating gear above mentioned with a like result. It is necessary to provide the gear connecting the actuating mechanism with the magazine rotating device with a lost motion so as not to interfere with the normal working of the feed or striking gear.

Referring to Figs. 1 and 2, a plan and side view of the lamp mechanism, respectively, the operation of the lamp may be noted. When the current is switched on, sufficient current traverses the coil of the magnet (54) to cause its armature (55) to be attracted, and thereby to complete the circuit of the series coils (30), which thus become energized and attract the cores (31), by which means the striker (24) is brought into its active position in which it projects under and connects the points of the electrodes which are not shown. The carbon clutches (29) are operated by the same means, but momentarily later, so as to release the carbons after the point of the striker has covered the position of the points of the carbons, and the pawls (13) are retracted and momentarily held to enable the carbons to feed by gravity. The carbons having descended into contact, the striker current through the electromagnet (54) will be reduced, whereby it becomes de-energized sufficiently to allow the armature (55) to break the circuit of the series coil (30), whereby the pawls (13) and feed clutches (29) will be released, the striker withdrawn and the arc struck. Owing to the relative positions of the pin (27) in the end (15) of the pawl and the slotted link (26), both the striking and feeding mechanism are free to act without materially altering the position of the pawls, except so far as to momentarily relieve the carbons from the pressure of the springs (16) when required to feed. When the carbon in the holder (1) has become consumed so far that the top has passed out of the magazine the spring (16) will be free to act and the pawls (13), revolving the magazine, will, when the carbon in the holder (1) has further passed below the level of the table (11), allow a fresh carbon to be introduced by gravity into the mouth of the carbon-holder (1). Finally,

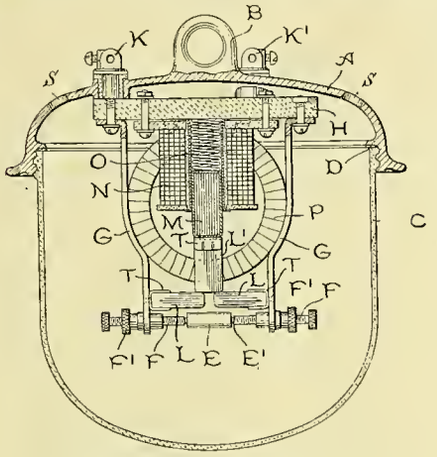
when the series coils (30) are again energized the pawls will be again retracted.

It will be observed that for the greater portion of the time during which the lamp is in operation the series coils and substitute resistance are cut out of circuit. The expenditure of energy in passing current through the series coils and resistance during this part of the time is thereby avoided.

Thomson's Improved Pyro-electrolytic Lamp.

A pyro-electrolytic lamp, of which class the Nernst lamp is an example, is one in which the light-giving conductor is pyro-electrolyte, or a substance which is of a low apparent or actual conductivity at ordinary temperatures, but which at higher temperatures, particularly the temperature of luminescence, is capable of carrying substantial currents. Elihu Thomson, in a recent patent, seeks to improve the mechanism of such lamps so that it will not be unduly complicated or shall not employ the application of an external flame to start the lamp.

Referring to the accompanying drawing, the action of the improved lamp may be followed. When current is first admitted the light-giving body (E) is cold, so that no substantial amount of current can flow, which results in causing substantially all of the current to pass through the



IMPROVED PYRO-ELECTROLYTIC LAMP.

blocks (L) (L') (L). At the same time the solenoid (N) is energized and the block (L') is gradually lifted against the action of the spring (O). The dashpot action prevents this lifting from taking place too suddenly. This tends to cause the arc to form between the points (L) (L) or from the block (L) to the block (L') and from the block (L') to the right-hand block (L). The field of force generated by the coil (P) is in such a direction as to tend to cause this arc to pass down and to play upon the block (E), substantially enveloping the latter in a mass of highly heated arc vapors. When the block (L') has reached its final position this arc will either break or be confined to the carbon blocks (L) (L). Soon after the current is admitted the light-giving body (E) will be heated to a point where it will take a considerable amount of current, which will still further increase the power of the coil (P), so that the arc between the points (L) (L) will be extinguished if it has not already been extinguished by the movement of the block (L'). The lamp will now continue to run without interruption unless for some reason the current supply is interrupted. If this occurs the block (L') will again assume the position shown in the diagram and the starting action will be repeated. It will be noticed that the arcing points are formed of carbon or some other suitable material and are placed in spring-clips (T) (T) (T) in such a way that the arcing points may be taken out and renewed when they are partially consumed.

Drainage Canal Power Development.

Unforeseen difficulties have been encountered in the power development of the Chicago Drainage Canal at Lockport, and the work is behind. About 61 per cent. of sections 1, 2 and 3 of the development has been completed. To this time the value of work done is $1,122,993. There have been 457,000 yards of excavations, 87,000 yards of concrete laid and 200,000 yards of clay placed in embankment. Section 4 was flooded by high water twice last year, but the contractor has finished the work. The power house is being erected. Completion of the work may be expected by January 1, 1907.

Proposed Central Heat, Light and Power Plants for Government Buildings in Washington, D. C.

Extensive improvements in the lighting, heating and power facilities for the government buildings in Washington are contemplated. In the Western Electrician of October 7th it was announced that a large central plant was to be erected to supply electric light, heat and power to the Capitol Building, Congressional Library and Senate and House of Representatives office buildings. Bids for these were opened September 30th and are now under consideration. Another undertaking which has not progressed so far but which is receiving attention is that of furnishing a similar plant for the government buildings on the Mall and in the vicinity of the White House. The buildings considered in this plan are the White House, Treasury Department, State, War and Navy Departments, Winder Building, Court of Claims, Washington Monument, Bureau of Engraving and Printing, Postoffice Department, Smithsonian Institution and National Museum, Army Medical Museum, and the following-named new buildings now under construction: Municipal Building, Department of Agriculture, National Museum—practically 13 buildings in all. The Smithsonian and old National Museum, being already connected mechanically, are treated as one. The Hall of Records, west of the State, War and Navy Building, has not been included in the estimates because not yet definitely authorized by law, but it may readily be connected to the central-station plant when constructed.

The buildings making up this group are at present lighted and heated by a large number of isolated plants in the various buildings, containing in all about 73 boilers aggregating about 4,500 nominal horsepower and burning annually about 20,000 tons of coal. From these boilers, engines and steam pumps, aggregating about 2,300 horsepower, are operated. The boiler, engine and cold-storage equipments occupy approximately 600,000 cubic feet, which would be available for other purposes if a central plant were installed. By act approved April 28, 1904, Congress directed the superintendent of the Library Building and grounds, Bernard R. Green, to submit plans and estimates for a complete central light, heat and power plant to take the place of the present inefficient systems. To help him in the work Mr. Green secured the services of Prof. Homer S. Woodbridge of Massachusetts Institute of Technology, who, in turn, was assisted in the electrical planning by Julian E. Woodwell and Proctor L. Dougherty, respectively inspector and assistant inspector of electric-light plants for the Treasury Department. The following extracts from the report to Mr. Green will be of interest.

The matter of first importance in the selection of a site for the proposed central station is that the location shall be most favorable to economy in matters of installation and especially of operation, or, in other words, which shall make the station central and reduce distances of service to a minimum. The records of coal consumption for heating and ventilating and also for power and lighting in the buildings of the executive group and of the purchased electrical service furnished to some of them have supplied the data necessary to determine the centers of balance for both thermal and electrical consumption. These two points being determined, the most economic locations for heat and electricity generation for distribution are approximately indicated.

By reference to the accompanying plan (Fig. 1) it will be seen that both of these centers lie close to square No. 230, bounded by streets B and C and Fourteenth and Fifteenth NW. It therefore has seemed advisable to make a careful study of the entire problem with first reference to a location of the station at that most central and consequently most favorable of all points. Should the economic results prove adverse when the central plant is so located, the impracticability of a central-plant scheme would be demonstrated and an adverse report would be made obviously necessary. If, on the other hand, the margin of economic advantage should be found to be large for a central station in that position, the question of alternative locations which might be preferred for reasons other than economic, and usable only at a relative economic loss, could then be reasonably entertained.

Square No. 230, the location of the highest economic value, will be designated in the following discussion as Station A.

The required maximum power and heating ca-

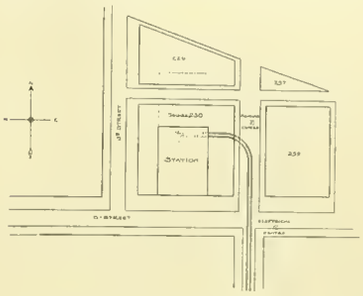


FIG. 1. HEATING AND ELECTRICAL CENTERS IN PROPOSED SYSTEM FOR GOVERNMENT BUILDINGS.

pacities of a central station for serving the group of executive buildings have been carefully computed from data furnished from records and logs obtained from the superintendents, custodians or engineers of those buildings. By means of those, season aggregates and the daily average, and also the daily and hourly maximums, have been obtainable in relation to coal consumption and to electrical quantities used. Upon such data, reduced to terms of the higher efficiency obtainable in a properly planned and operated central plant, is based the following table of maximum boiler power required for heating and ventilation and also for lighting and power. The distances given are those, first, of actual measurement in right line; and, second, the distances following the pipe line; and, third, the distances following the line of electric conduits as planned in the general scheme for initial study:

Building.	Boiler Horse-power.		Right Line in Feet.	Pipe Line in Feet.	Cable Line in Feet.
	Heating and Ventilating.	Light and Power.			
State, War and Navy	600	260	2,300	2,400	2,600
Treasury	420	265	1,800	2 200	1,100
Bureau of Engraving and Printing	360	375	2,000	2,500	2,920
Postoffice	340	194	1,560	1,740	2,090
Smithsonian group	270	86	2,640	3,320	[a]3,900
White House	90	[b]	2,060	2,480	2,860
Winder Building	80	45	2,680	2,740	2,950
Medical Museum	110	17	3,360	4,220	4,000
Monument		140	1,500		1,650
Municipal Building	450	244	920	980	1,300
National Museum	480	288	2,040	3,320	2,970
Agricultural Museum	470	274	1,920	2,360	2,420
Total	3,670	2,188			

[a] Subcenter of electric distribution.
[b] Supplied from State, War and Navy.

One or two anomalies appear in the quantities as scheduled, which are due to features of work in several of the buildings. The State, War and Navy Building is warmed by the indirect method of heating; the Treasury by a direct; the Municipal Building is to be freely ventilated, while the much larger building for the National Museum is to be warmed chiefly by the direct method and with only local ventilation. The Bureau of Engraving and Printing uses an amount of electric power quite out of proportion to its relative size.

The power of the proposed combined plant for

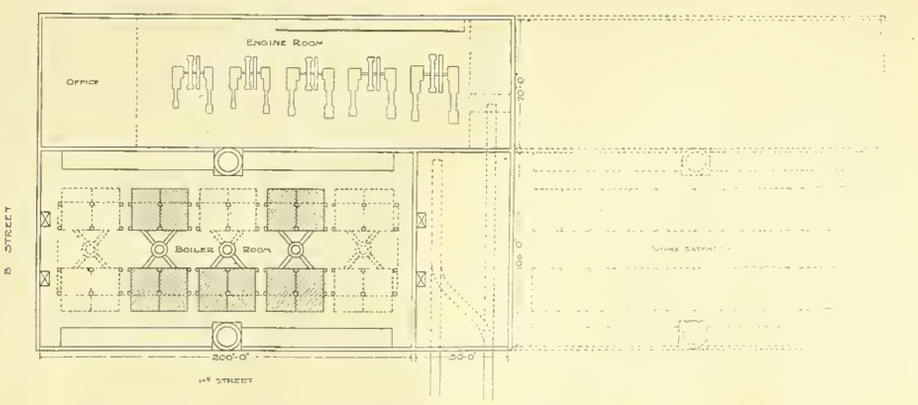


FIG. 2. PLAN OF PROPOSED CENTRAL PLANT FOR GOVERNMENT BUILDINGS IN WASHINGTON, D. C.

the above group of buildings is made less than that of the total equipment for segregated plants in the same building; first, because of the higher steaming efficiency practically obtainable in the boilers of a highly organized and skillfully operated power plant; and, second, for the reason that the isolated plants must each be given a generous factor of safety for performing occasional exceptionally heavy duty as well as providing against breakdowns and other emergencies. The serving of the executive group of buildings from one common plant would remove the necessity of furnishing a surplus of power and equipment equal to performing such duties or to meeting such emergencies in all of the buildings at one and the same time. Because of that fact a substantial reduction in the steam-generating plant of a central station may be safely made. In place of the present 73 boilers in 20 or more isolated stations, aggregating some 4,500 horsepower, a central-station equipment, which shall include boilers for the three additional and large buildings, may not contain more than 10 boilers of 400 horsepower each, all in one boiler room. On an emeregency, high-efficiency boilers having a nominal capacity of 4,000 horsepower could be easily forced to a 6,000-horsepower steam output.

Objection to the selected location would be reasonable on the ground of smoke nuisance if a smokeless operation of the plant were not assured, for wherever the plant may be located the prevailing winds of winter and summer will carry the chimney products eastward, with a trend to north in summer and to south in winter.

Smoke may be prevented, however, with certainty and constancy by suitable methods of feeding and burning and by an avoidance of irregularity in firing. The low cost of bituminous coal and the high thermal value which it possesses justify both the initial expense of providing proper furnaces and appliances and also the continuous but remunerative expenses of intelligence, faithfulness and skill on the part of attendants in charge of the firing and the further cost of a storage battery for meeting emergencies and easing fires.

The central station, or power house, located where proposed would be in close proximity to some of the principal government buildings, and should be designed to comport with the architecture which does now or shall in future characterize them. Its walls and its chimneys, of some 125 feet in height, should be made in architectural harmony with their surroundings. The station performing so unique a service and equipped with the most modern and powerful apparatus will doubtless be a continuously attractive object to visitors, and all its appointments and finishing should have reference to the educational service the chief national plant of this character might fittingly render. (Fig. 2 is a plan proposed for the station.)

Equipment for the central station would require one 750-kilowatt generator, two of 500-kilowatt capacity and one of 300 kilowatts for the lighting service. For the power service there would be one 500 and two 300-kilowatt generators required.

From a study of the lighting and power demands of the various buildings which have been included in the executive group for the supply of heat, light and power from a central station, the annual consumption and probable maximum demand for electrical energy for each building is estimated as shown in the following schedule:

No.	Buildings.	Total Annual Consumption Kilowatt Hours.	Maximum Demand, Amperes at 220 Volts.	Maximum Feeder Demand, Amperes, 20 Per Cent Increase.	Length of Feeder ÷ 100 Feet for Joints.	Ampere-Feet, Station Located at Square No. 230.
					Feet.	
1	State, War and Navy, including White House:					
	Present service....	370,000	640	770		
	For electric elevators, etc.....	100,000	600	600		
2	Winder:				[a]2,060	3,646,200
	Present service....	17,500	125	150		
	For electric elevators, etc.....	15,000	100	100		
3	Court of Claims.....	28,000	125	150		
4	Treasury:					
	Present service....	279,000	900	1,080		
	For electric elevators, etc.....	75,000	360	360	2,420	3,484,800
5	Postoffice	718,000	900	1,080	2,090	2,257,000
6	Bureau of Engraving and Printing:					
	Present.....	818,000	1,400	1,680	2,920	6,044,400
	For new building..	180,000	390	390		
7	Agricultural:					
	Present service....	23,000	100	120	2,420	3,678,400
	For new building..	400,000	1,400	1,400		
8	National Museum, Smithsonian:					
	Present group.....	38,000	145	175		
	Additional lights...	76,000	300	300		
9	Medical Museum....	9,500	80	95	[b]2,870	6,227,900
10	National Museum (new)	500,000	1,600	1,600		
11	Municipal (new).....	386,000	1,355	1,355	1,300	1,761,500
12	Monument.....	30,000	230	275	1,740	478,500
	Total	4,063,000	10,750	11,680	17,820	27,578,700
	Average.....	.....	.....	.....	2,228	3,447,300

[a] Center of distribution "A." [b] Center of distribution "B."

The electrical center of balance for the group of buildings named in the schedule has been determined on the basis of the total annual electrical consumption, as the feeder loads and consequent energy losses are directly proportional to the product of the mean load and number of hours of service per annum. The position of this electrical center is shown in Fig. 1.

In order to reduce the amount of idle copper in conductors which would result from providing separate feeders for each building, those which are closely grouped may be directly supplied by a ramification of mains connected with the station by one or more feeders. Two such groups have been chosen with centers of distribution marked "A" and "B," respectively, as shown in the schedule. The size of the conductors must be determined from a knowledge of the maximum load, as the carrying capacity of the feeders is limited by the permissible rise in temperature as well as the allowable voltage loss.

The energy losses under maximum load for properly proportioned conductors for the various buildings will be proportioned to the product of the maximum feeder demand in amperes into the distances of the building or buildings from the station in feet. These quantities or "ampere-feet" are shown in the schedule, from which it appears that the requirements for the Treasury Building do not differ greatly from the average of all buildings. As the load variations and the conditions of actual service in this building are well known, it is believed that an analysis of the application of both alternating and direct-current systems of electrical distribution in this one instance will serve to indicate quite accurately the comparison of the two systems as applied to the group of buildings scheduled. (Fig. 3 shows a system of distribution with central power station.)

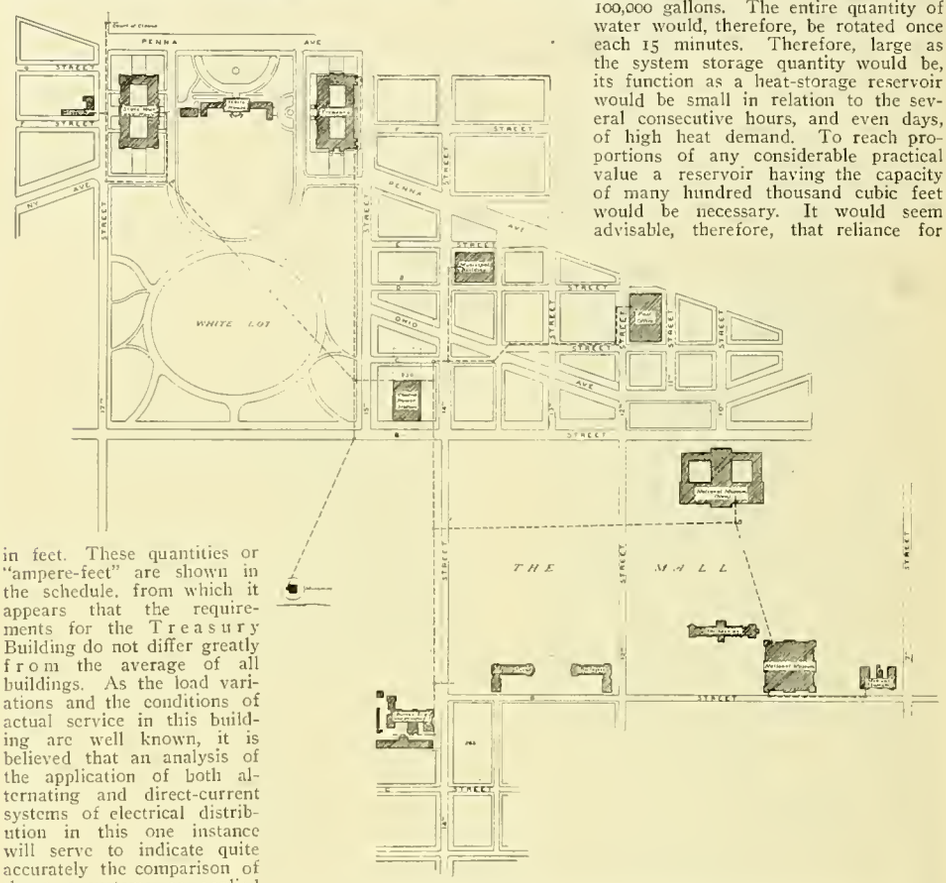


FIG 3. SYSTEM OF ELECTRICAL DISTRIBUTION FROM PROPOSED POWER PLANT FOR GOVERNMENT BUILDINGS IN WASHINGTON, D. C.

A storage of heat for meeting peak requirements is far less feasible than is electrical storage for meeting the peak demands for power and lighting. The times when an electric storage battery would be brought into use are frequent, and the periods of use are relatively short. In the case of heat, however, the exhaust steam from power engines is, in this instance, generally much too small to meet heating requirements.

The occasions when heat could be stored from exhaust steam would, therefore, be few. On the other hand, the periods of heat peak requirements, when they do occur, are measured by days rather than hours. To these conditions of infrequency of heating peak periods and their length of duration, both of which are unfavorable to the adoption of a heat-storing plan, are to be added other deterring considerations relating to the space required for an adequate storage tank, and to the cost of construction and insulation of such tank, both of which would be excessive when considered with reference to the few occasions yearly when the weather temperature drops sharply below that of the winter low average.

The hourly maximum heat required for warming and ventilating the executive group of buildings during the periods of extreme weather is considerably reduced by the massiveness and the high specific heat of the material of which the buildings are constructed. Such material in such mass in itself stores large heat quantities, which it partially yields to contained air whenever the temperature of that air falls even a little below the temperature of the material. Such storing and yielding of heat in buildings of monumental character make unnecessary that provision in the power of the heating system which is requisite in lightly constructed buildings for maintaining an even internal temperature during short and sharp depressions of weather temperature. Buildings are of less value as reservoirs of heat as their walls and other construction are light, their window surface large and their ventilation free, in which cases the heat generated for warming must, in counterpart fashion, follow closely the degrees of weather temperature fluctuation. In the present instance the older buildings are of a high order of heat-conserving type, while the newer are to be of lighter interior construction and are to be given larger window area and are to be provided with freer ventilation.

The peak heat requirement of the buildings which a central plant would immediately serve is approximately 2,650,000 thermal units per minute, if the amount of ventilation furnished in zero weather is liberal; or, expressed in gallons of water and temperature change in Fahrenheit degrees, 10,700 gallons and 30°. The water capacity of a hot-water system adapted to that work for the executive group, and including underground and building piping, radiators, tanks, etc., would approximate 100,000 gallons. The entire quantity of water would, therefore, be rotated once each 15 minutes. Therefore, large as the system storage quantity would be, its function as a heat-storage reservoir would be small in relation to the several consecutive hours, and even days, of high heat demand. To reach proportions of any considerable practical value a reservoir having the capacity of many hundred thousand cubic feet would be necessary. It would seem advisable, therefore, that reliance for an adequate performance of extreme duty be placed primarily, on the boiler power provided; secondly, on the conserving action of the buildings themselves, and, finally, on a reasonable restriction of ventilation during the sharper cold, when the necessity for free ventilation is less urgent than in warmer weather.

Heat may be conveyed from a central station to the buildings of the executive group either by steam or by water. If by steam at low pressure the conveying pipes must be given suitable sizes to carry the needed heat at the low-heat quantity possessed by each cubic foot of steam when moved under the small pressure differences then available between the feed and the delivery ends of such pipes. If prohibitively high back pressure on engines is to be avoided, the pressure used for distributing steam must then be made correspondingly low and pipes proportionately large. The maintenance of any degree of vacuum at the engines by a reduction of steam pressure below atmospheric within the distributing pipes and the radiator systems would be impracticable, because of the greater vacuum which would be made necessary at the buildings in order to produce a vacuum result at the engines.

The difficulty, if not the impossibility, of maintaining such partial vacuum throughout the entire system would be serious, if not practically insurmountable, on account of the multiplicity of possible and probable leakages at fittings, valve and fixture joints, valve stems, and also through a considerable aggregate of "pin," "sand" and like holes in the 500,000 square feet of metal surface involved. Furthermore, the large surface of low-pressure distributing pipes required would result in a corresponding leakage and loss of heat from the pipe lines.

Low-pressure live steam for heat transmission is economically disadvantageous on account of the

larger cost of piping material, of trenches and of insulation, and because of the large loss of heat in exhaust steam, which, under such conditions, would probably be thrown to waste. High-pressure steam service is superior to low only on the score of lower first cost of pipe installation and a somewhat lower rate of heat loss, the small pipe surface more than offsetting its greater per-unit-of-surface rate of heat loss.

The erection of a central station at site "A" built of material and in a style of architecture appropriate to the monumental type of buildings of which it would be one, and the installation of a complete equipment for the generation of steam and power, and the connection of that power house with the several buildings it would immediately serve with heat and power and light, and the changes in the present equipment of these buildings to adapt them to a common service from the central station and the providing of such service, are shown to be practicable and also economically advisable. The amount of investment required would be about $1,000,000.

An Electric Accelerometer.[1]

By R. B. Owens.

The advent of the electric motor as a competitor of the steam engine, especially in the traction field, has given rise to certain acceleration problems unfamiliar to engineers of a generation ago. At a

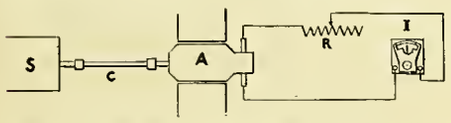


FIG. 1. ACCELEROMETER WITH PERMANENT-MAGNET DYNAMO.

time when the train-mile was a satisfactory unit in which to reckon haulage costs, there was little occasion to bother with acceleration. Now, however, when neither the train-mile, car-mile nor ton-mile suffice, even when coupled with a speed factor as a basis of estimation and analysis, when to maintain certain schedules more energy is expended in accelerating than in overcoming frictional and grade resistances, a simple, accurate and reliable means of measuring acceleration is urgently demanded—a means at least comparable in simplicity and accuracy to those employed in the measuring of the quantities of which it is the second and first differential with respect to time. The measurement of length is familiar to all. Of practical methods of measuring velocity or speed, at least of machines, one of the most satisfactory, if not the most satisfactory, involves the use of a suitable constantly excited or permanent-magnet dynamo mechanically driven by the piece whose velocity is to be measured, and electrically connected through an ammeter to a circuit of constant coefficients as shown in Fig. 1. (S) is the shaft whose velocity is to be measured. (C) is a mechanical coupler. (A) is the armature of a small permanent magnet or constantly excited continuous-current dynamo, wound so as to have a negligible reaction within the limits of its use. (R) is a variable non-inductive resistance and (I) is a zero-center direct-current ammeter. The reading of (I) will be proportional to the speed of (S), and by adjusting (R) can be calibrated in revolutions per minute, feet per second, or miles per hour, as desired. As the current through (I) is proportional to speed, it is only necessary to determine the rate at which the current varies in order to have a measure of accelera-

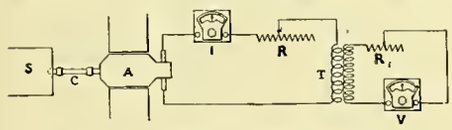


FIG. 2. ACCELEROMETER USING TRANSFORMER.

tion. This is simply and easily done by inserting in the circuit with (I) a transformer (T), with its secondary connected, for purposes of adjustment, through a non-inductive resistance (R), to a zero-center direct-current voltmeter (V) (see Fig. 2). The reading of the voltmeter (V) will then be proportional to the acceleration, positive or negative, of the shaft (S).

Substituting recording instruments for the indicating ones shown, we have a recording speed indicator and a recording accelerometer. The transformer must have a straight-line saturation curve and a large transformation ratio as the secondary induced voltage is necessarily small, and the voltmeter (V) must also be sensitive. The calibration of the ammeter as a speed indicator is effected by driving the armature (A) at different constant speeds, as shown by ammeter reading, and taking the revolutions in a given time by means of a revolution counter and stop-watch. The calibration of the voltmeter as an accelerometer is best done by driving the armature (A) by a separately and constantly excited motor having applied to its armature, preferably of small momentum, a voltage varying approximately as a linear function of time. With proper manipulation of apparatus the ammeter readings plotted against time will be a straight line whose slope will be constant and equal to the acceleration and to the constant reading of the voltmeter to within a constant.

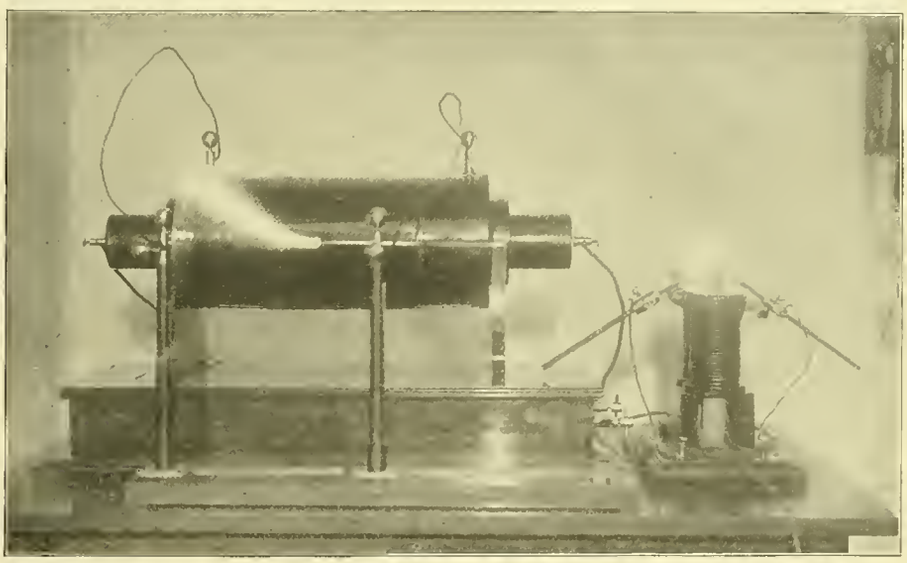
In some tests made in the writer's laboratory not long ago, (A) (see again Fig. 2) was the armature of a small, low voltage separately excited direct-current generator; (S) the shaft of a three-horsepower separately excited direct-current motor to whose armature, by a potentiometer arrangement, a steadily increasing or decreasing voltage could be applied; (I) and (V) Weston ammeter and millivoltmeter, and (T) a small lighting transformer with a transformation ratio of 1 to 20; and excellent results were obtained, speed and acceleration being read to exactly the same degree of accuracy that Weston direct-current ammeters and voltmeters are capable of. With recording instruments substituted, this would seem to meet every requirement of a practical apparatus for the measurement and recording of velocity and acceleration in railway work, both steam and electric, and is applicable, of course, in many other connections.

[1] Paper read before the Electrical Section of the Canadian Society of Civil Engineers on November 2, 1905. The author is professor of electrical engineering at McGill University, Montreal.

"Flame-arc" Interrupter for Induction Coils.

Experimenters have tried to use the "singing" or "speaking" arc as an interrupter for induction coils. Owing, however, to the unfavorable behavior of the current curve of this arc the results obtained in this direction have so far been rather poor.

E. Ruhmer of Berlin, the well-known pioneer in the field of space telephony, has recently constructed a fairly efficient apparatus to suit this purpose, it being what he calls a "flame-arc interrupter." In this apparatus a "singing" flame arc placed in a strong magnetic field is used. The behavior of the current curve is in this case favorable, and, as inferred from observation by means of Braun tubes of cinematographical views, is quite equivalent to that of a liquid interrupter.



"FLAME-ARC" INTERRUPTER FOR INDUCTION COILS.

As the "flame" arc is blown out entirely by the magnetic blower, the current oscillations produced are considerably higher than those of ordinary "singing" arcs. Moreover, Mr. Ruhmer's device enables any amount of electrical energy to be interrupted, whereas the phenomenon of the "singing" arc is known to take place only with relatively small current intensities.

The frequency of the novel interrupter is varied from a few per second up to about 400,000 per second, which range is embraced by none of the interrupters so far designed. Mr. Ruhmer chooses a frequency of the induction coils operated by means of this interrupter so as to bring about resonance with the characteristic vibration of the secondary system. In the case of a standard 30-centimeter induction coil it will be about 1,600 per second, which frequency corresponds with the minimum intensity of the current feeding the flame arc. The latter will be about two to four amperes if an effect is obtained equal to a Wehnelt interrupter with 16-25-ampere current intensity.

In the accompanying illustration is shown an instantaneous view of an induction coil operated by means of the Ruhmer "flame-arc" interrupter, the latter being placed at the right. The "flame-arc" will be distinctly seen to spread in the shape of a fan under the action of the magnet, an extremely intense high-tension flame discharge passing between the plate and point of the induction-coil discharger (corresponding with about one-half the fully explosive distance of the latter). The induction coil gives its full explosive distance with a frequency of interruption properly chosen; on the latter being altered the sparks are immediately discontinued.

The novel interrupter is likely to be used in many ways, for example, in connection with the oxidation of the nitrogen of air, for the generation of ozone, operation of Röntgen bulbs and space telegraphy and telephony, to which last the possibility of generating undamped electric oscillations will be found especially valuable. A. G.

Electrical Exports for October.

Electrical exports from the United States for the month of October amounted to a total value of $981,893. This is $31,778 less than the value of similar exports for October, 1904, but an increase of $129,124 over September, 1905. Comparing the figures for October with those of the corresponding month in 1904, it is seen that the decrease is due to a considerable falling off in the export of electrical machinery. Electrical appliances, which include telegraph and telephone instruments, show a good increase. The figures in detail are as follows: Electrical machinery—October, 1904, $661,267; October, 1905, $527,669. Electrical appliances—October, 1904, $352,404; October, 1905, $454,224.

Considering electrical machinery only, the following figures show the value of such machinery exported to the principal buyers from the United States for the month of October, 1905: British North American, $182,304; United Kingdom, $81,805; Mexico, $66,516; British Africa, $27,552; Brazil, $26,189; Cuba, $19,235; France, $18,986; British Australasia, $16,419; Japan, $14,700; Germany, $9,397; Philippine Islands, $7,392; Argentina, $6,797; British East Indies, $4,788; Central American States and British Honduras, $2,601; Chinese empire, $1,835.

Comparing the above figures with similar ones for October, 1904, it will be seen that the Philippine Islands, Japan, the United Kingdom and British Australasia show the largest falling off, while France, Cuba, Brazil, British Africa and British North America show the largest increase over October, 1904.

Electrical Inspection in La Crosse.

At La Crosse, Wis., there is a clash between the municipality and the local fire agents' association over an electrical inspection ordinance which was recently submitted for adoption, referred to the fire and ordinance committees and failed of approval, two objections being made by the opposition as follows:

First—That the city could not afford to be put to the necessary expense.

Second—That it was the duty of insurance companies to supervise all electric wiring.

Both of the lighting companies favor inspections and appeared before the committees to urge adoption of the ordinance. Prominent business men also interested themselves in behalf of the measure without success. The matter is still being agitated in the hope that the City Council may yet be induced to consider the importance of passing the ordinance as submitted.

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DATES AHEAD.

New York Electrical Show, Madison Square Garden, New York city, December 12th to 23d.

Independent Telephone Association of Wisconsin (annual convention), Hotel Pfister, Milwaukee, December 20th and 21st.

Automobile Club of America (annual exhibition), Sixty-ninth Regiment Armory, New York city, January 13th to 20th.

Chicago electrical show (first annual exhibition of Electrical Trades Exposition Company), Coliseum, Chicago, January 15th to 27th.

American Electrical Salesmen's Association (first annual meeting), Grand Pacific Hotel, Chicago, January 20th, 9 a. m.

DISCUSSING a subject which gives rise to endless speculation—the constitution of matter—Prof. Rowland of Johns Hopkins University once remarked that a grand piano is simplicity itself in comparison with an iron atom. A piano of eight octaves is capable of giving out 700 or 800 distinct and recognizable tones, but an iron atom when set in sufficiently rapid vibration will give out at least 10 times as many distinct and recognizable kinds of light or color shades. Evidence which physicists have thus far been able to obtain, though more or less circumstantial, seems to point to the fact that the atom is of a complex character. Matter is now quite generally supposed to be made up of electrons contained in "positive jelly." Inertia is apparently the common inherent quality of all matter equivalent to mass, and it has been shown that inertia may be entirely electromagnetic. By this line of argument the interesting conclusion is arrived at that there may be nothing really but negative electricity, the electron being in reality only a charge of negative electricity, and positive electricity a condition caused by it. Matter is thus, perhaps, electricity. But what is electricity?

IT IS gratifying to observe that there is a fair prospect of a Chicago celebration next month of the two-hundredth anniversary of the birth of Benjamin Franklin, as urged by the Western Electrician several months ago. Franklin was born on January 17th, which in 1906 comes on Wednesday. The date happens to fall during the period of the Chicago Electrical Show at the Coliseum, and it is planned, therefore, to celebrate "Franklin Day" on that occasion with appropriate exercises. The Philosophical Society of Philadelphia, of which Franklin was one of the founders and which is still extant, will be invited to participate, and the technical schools or departments of the colleges in the West will probably be asked to take part in the programme. It has been suggested that the representatives of the electrical industries hold a dinner on the evening of Franklin Day, at which everything served will have been cooked by electricity. Even the far-reaching mind that proved the identity of atmospheric and voltaic electricity could scarcely have foreseen such a banquet, which would be peculiarly appropriate.

It is fitting that Americans should honor the memory of one of their greatest men, and we heartily commend the idea of a Frankin celebration in the second city of the country to which he was so loyally devoted. We hope the affair will be broad enough in scope to include other than the scientific and electrical aspects of the many-sided Franklin (unless, indeed, there should be another and more general celebration), and that it will be carried out with the dignity and enthusiasm worthy of the distinguished philosopher, statesman and scientific investigator which it commemorates.

IT WAS unfortunate for Mayor Dunne that Mr. James Dalrymple, manager of the Glasgow municipal tramways, after studying the traction situation in Chicago on the ground, should conclude that immediate municipal ownership was not the best way to attain an up-to-date traction system; but it would have been wiser for the mayor to have made Mr. Dalrymple's report public rather than to refuse to divulge its contents, as he did. The people are entitled to all the light they can get on the subject, and the mayor would have been applauded for fairness if he had given out the Dalrymple report in full, with such comment as he desired to make. The mayor has gained nothing, but will rather lose, by smothering the report, for Mr. Dalrymple recently promised the Chicago City Council to supply it with a copy of his report if it would ask for it by formal resolution, and such a resolution has been adopted by a vote of 34 to 31. Thus the report will undoubtedly be published, mayor or no mayor, and His Honor has lost an opportunity to exhibit his ingenuousness.

Apparently the sentiment in Chicago in favor of "immediate municipal ownership" has subsided to a great extent within the last year. After long study of the subject the majority in the local transportation committee of the City Council is convinced that ordinances should be passed extending the franchises of the existing street-railway companies for 20 years in return for a surrender of all claims under the "99-year act," liberal compensation to the city, a rehabilitation of the systems and other carefully drawn provisions, including the city's privilege of purchase at certain specified times during the life of the ordinance. The council supports its committee. But the mayor still sticks to his municipal-ownership dogma, and his latest plan is to ask the sanction of the voters to the issuance of $75,000,000 worth of "Mueller-law certificates," to provide funds for a municipally owned and operated street-railway system. These two sharply contrasting plans will probably be submitted to the vote of the people at the election of next April, when half of the aldermen will also be elected; and it will then be seen whether in reality the municipal-ownership furore has abated to the extent which surface indications seem to reveal.

SCANNING the president's message to Congress for recommendations of more especial interest to those engaged in electrical pursuits, one notes, as bearing on the public-ownership discussion, these sentences: "I do not believe in the government interfering with private business more than necessary. I do not believe in the government undertaking any work which can with propriety be left to private hands. But neither do I believe in the government flinching from overseeing any work when it becomes evident that abuses are sure to obtain therein unless there is governmental supervision." This occurs in the discussion of railroad rates. But it expresses the view of many thoughtful students of the problem of the relation of public-service corporations to the people; that is, not public operation or even public ownership, but public supervision, equitably and strictly enforced. Farther along Mr. Roosevelt says decisively: "It is because, in my judgment, public ownership of railroads is highly undesirable and would probably in this country entail far-reaching disaster, that I wish to see such supervision and regulation of them in the interest of the public as will make it evident that there is no need for public ownership."

Block signals should be introduced upon all railroads engaged in interstate commerce as soon as practicable. Hours of labor on railroads may well be shortened.

Treating of the needs of the navy the president says: "Under exceptional circumstances submarine boats would doubtless be of use." This is faint praise for the submarine torpedo boat, in which electrical men are interested to some extent, owing to its dependence on storage batteries and electric motors when proceeding under water. But it seems to be conceded on all hands, to an increasing degree, that the usefulness of the submarine boat in warfare is limited and doubtful.

Construction of great irrigation works in the West is mentioned as proceeding rapidly and successfully, but the president makes no reference to the power-transmission possibilities which some of these works possess.

It is recommended that more stringent measures be taken forbidding the "smoke nuisance" in the city of Washington. Imprisonment should be provided as a penalty in case of repeated violation of the law, and plants which are persistent offenders should be enjoined from operation.

Those interested in power utilization at Niagara will be interested in this: "Nothing should be allowed to interfere with the preservation of Niagara Falls in all their beauty and majesty. If the state cannot see to this, then it is earnestly to be wished that she should be willing to turn it over to the national government, which should in such case (if possible, in conjunction with the Canadian government) assume the burden and responsibility of preserving unharmed Niagara Falls."

The message as a whole is a long and able document, discussing all the great problems which confront the people of the United States in conducting their government. Perhaps not so brilliant or striking as the message of last year, the present letter to Congress, especially in its treatment of trusts, capital and labor and railroads, will rank well among those papers with which Mr. Roosevelt has enriched the literature of the state.

Chicago Street-railway Situation.

The Chicago City Council started its meeting this week by refusing to give Mayor Dunne's "Mueller certificate" or municipal-ownership ordinance the right of way over the local transportation committee's franchise-extension ordinance on the proposed referendum ballot.

Then Alderman Hunter presented a resolution which bound every alderman to use his best efforts toward getting up a necessary petition for a referendum of the two traction propositions to be voted on at the spring election. But Alderman Dever moved to substitute his resolution of the meeting before which provided, in effect, that the ordinance advocated by the mayor providing for the issuance of $75,000,000 worth of Mueller law certificates for the establishment of a municipal street-railway line be passed at once by the council; while the programme for the franchise ordinances is that they be considered in committee of the whole, but their passage be delayed until after the referendum vote. The Dever substitute was defeated by a vote of 44 to 22.

The majority and minority reports of the committee on local transportation were then formally introduced and were ordered deferred and published. The minority—four aldermen—submitted the mayor's ordinance providing for Mueller certificates to purchase the street railways, while the majority submitted the 20-year franchise extension ordinance prepared by the committee after numerous conferences with the traction interests.

Much interest was manifest in the revival of the Dalrymple episode. Alderman Young called attention to a set of resolutions introduced four weeks ago asking the mayor to make public the report of James Dalrymple of Glasgow. Mr. Young explained that the object of the resolution was to find out what was meant by the mysterious delay in publishing the report. He said he had written a letter to Mr. Dalrymple asking him if he considered his visit to this country to be an official or private one, and received an answer which he read. Mr. Dalrymple made it clear in his letter that he, the lord provost and the City Council of Glasgow considered the visit as one to the municipality and they thought that anything he might have to say on the traction question would be public property. He said if the Chicago Council would pass a resolution asking for his views on the traction question he would send a copy of the letter sent to Mayor Dunne. The letter concludes: "I have often said to Chicago people who have written to me on the subject that I trust you will soon have an up-to-date traction system, and that, possibly, at no distant date, the City Council of Chicago may be in a position to carry on the whole undertaking as a department of municipal enterprise. I may say candidly, however, that I do not think immediate municipal ownership is the best way to attain that end."

A resolution asking the Glasgow traction manager to furnish his views to the council was then adopted.

Rebuilding of the Colorado River Dam at Austin, Texas.

The rebuilding of the great dam across the Colorado River at Austin, Tex., is practically assured; the project is to be undertaken by Stone & Webster of Boston, with the co-operation of the Old Colony Trust Company of that city. E. M. House of Austin returned recently from Boston, where he spent several months enlisting support of his plan to have the dam rebuilt. It was through his efforts that the Old Colony Trust Company and Stone & Webster became interested in the project. Expert hydraulic and electrical engineers investigated the feasibility and practicability of the proposed project and made favorable reports. They estimate that the cost of rebuilding the structure will be about $538,000.

The old dam was built about 10 years ago at a cost of $1,000,000. The electric-light plant, power house and waterworks plant which were erected at a point on the bank of the river just below the dam cost an additional $600,000. In the spring of 1900 an unprecedented flood in the river swept away a part of the big granite dam and wrecked the power house.

In rebuilding the dam it is proposed to utilize the portions of the structure that are still standing. The power house can also be repaired and placed in condition for use at comparatively small cost. The ruins of the dam and power house are owned by the city of Austin, but they will be sold or leased to Stone & Webster. There are certain legal affairs to be straightened out in connection with the enterprise before the formal transfer of the property can be made.

Life and Efficiency of Tantalum Lamps.

Interesting life and efficiency tests of tantalum lamps were recently made by Prof. W. Wedding and published in the Elektrotechnische Zeitschrift of Berlin. The three accompanying illustrations show graphically the results of these tests.

Distribution of light in a vertical plane of a 25 candlepower 110-volt lamp is shown in Fig. 1, the current taken by the lamp being 0.3625 ampere. The mean spherical intensity was found to be 19.3 Hefner candles, so that the consumption per mean spherical candlepower works out at 2.065 watts, the consumption per candlepower in the horizontal plane being 1.6 watts. As regards the

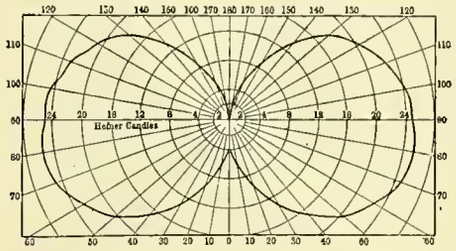


FIG. 1. DISTRIBUTION OF LIGHT IN VERTICAL PLANE.

absolute efficiency of the lamp, the author calculates it to be less than one per cent., 0.866 of one per cent. to be exact.

Four new 25-candlepower lamps were tested until they collapsed. At the same time four ordinary filament lamps of 25 candlepower and 16 candlepower, respectively, were tested in the same manner. The average results are shown in Fig. 2, the four small crosses indicating the first breakage of filament in each of the tantalum lamps. As is well known, a breakage of the tantalum filament does not necessarily terminate the lamp's life; on the contrary, the broken ends generally make

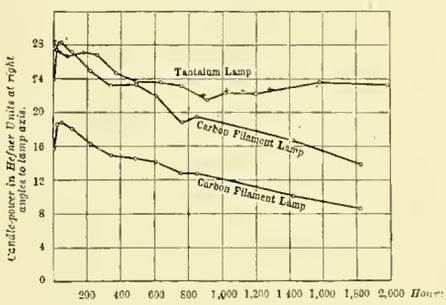


FIG. 2. CURVES SHOWING VARIATION OF CANDLEPOWER WITH TIME.

contact with some part or other of the filament and the lamp continues to burn. But the breakages afterward generally occur at shorter and shorter intervals until the lamp becomes useless (see Fig. 3). At the commencement of the tests the average consumption of the four tantalum lamps per candlepower at right angles to the lamp axis was 1.68 watts. This figure dropped to 1.57 watts after seven hours and then rose to 1.60 watts after 17 hours, 1.62 watts after 37 hours, 1.67 watts after 85 hours, 1.64 watts after 179 hours, 1.66 watts after 256 hours, 1.79 watts after 370 hours, 1.89 watts after 637 hours, 2.04 watts

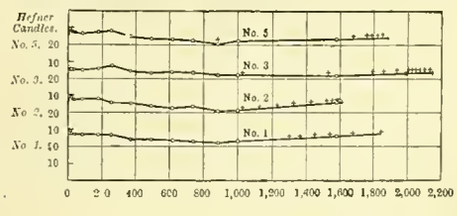


FIG 3. LIFE TESTS OF FOUR TANTALUM LAMPS.

after 905 hours and 1.94 watts after 1,582 hours. The efficiency of the last lamp which survived measured after 1,989 hours of burning, was found to be 2.03 watts per candlepower.

The 25-candlepower carbon-filament lamps commenced with an average efficiency of 3.44 watts. After 21½ hours this figure had dropped to 2.79 watts, after 110 hours to 2.94 watts, after 744 hours to 3.36 watts, after 609 hours to 3.52 watts, after 850 hours to 3.85 watts, after 1,420 hours to 4.38 watts, and after 1,826 hours, finally, to 5.25 watts. Similar figures were obtained for the 16-candlepower lamp, viz., 3.23 watts per candlepower at the start, 2.81 after 21½ hours, and 5.44 after 1,826 hours.

Electrical Construction in Minnesota Cities.

There is a tendency in several of the larger cities in Minnesota to improve the conditions in electrical wiring. The committee on fire protection engineering of the Western Fire Underwriters' Association, reporting on electrical conditions at St. Paul, finds that the standard for inside wiring is being maintained with difficulty, owing to the large amount of new work being installed, and there is a prospect of the appointment of an assistant electrical inspector after the first of the year. Some progress is being made toward removing old and defective wiring, but present demand on the inspector's time necessarily impedes the work. An ordinance is to be introduced in the City Council requiring places used for public congregations to be wired in iron-armored conduit systems.

The state law, applicable to St. Paul, Minneapolis and Duluth, requiring electricians to secure a license before doing work in the state, has been revised and will be enforced. The city inspector is secretary of the board having in charge the issuance of licenses.

At Minneapolis there promises to be a lively political fight over the appointment of an electrical inspector for which the tax commissioners have appropriated $1,500. It is said that linemen having political influence are working for the appointment. The lighting company is preparing to submit a proposition for underground work and other improvements, so that if acceptable to the city changes can be made systematically. No effort has been made to remove transformers and wires from the roofs of buildings in the business district.

Reports from Duluth, where there has been agitation of late in connection with the electrical equipment of the city, say that a conference was recently arranged between the local inspection bureau attached to the Western Underwriter Association and engineers of the Great Northern Power Company for the purpose of considering the hazards involved in aerial distribution systems carrying high-voltage current. The power company is impressed with the importance of maintaining safe conditions, and will provide every reasonable safeguard. Underground systems will be installed where lines approach the congested district, and where overhead wiring is employed a substantial guard equipment will be provided to prevent broken wires from falling into the street or on other conductors. As fast as the routes traversed become built up the wires will be placed underground. No wooden poles will be used and conductors will be carried sufficiently high to preclude the possibility of other wires being placed above them. The potential on lines leaving sub-station will be 13,500 volts.

Where main lines from the power plant approach other systems routes will be changed to remove possibility of contact through accident, and where other lines are crossed they will be placed underground, or high towers will be placed on each side of line crossed, making the span so short that any conductor attached to the towers could break and not come in contact with the lower line. Streets in the viciniy of the sub-station will be crossed in this manner. Plans are under consideration for entering Superior, Wis., and the same precaution will be observed as in Duluth.

At Stillwater electrical conditions are reported as poor, owing to the absence of a proper supervision of wiring. The lighting company has long struggled to have new work comply with the National Electrical Code requirements, and to this end has invoked the aid of the city inspector at St. Paul. Municipal authorities are impressed with the advisability of adopting an ordinance providing for the appointment of an electrical inspector. The real problem has been to get some one to fill the office, and the suggestion has been made that the man in charge of the fire-alarm system could, with some training, be taught to make acceptable inspections of the more common installations.

Outside wiring conditions are asserted to be dangerous, owing to the presence of a high-voltage system crossing signal and other wires without the installation of a guard equipment to prevent contacts in case one of the upper wires break. It is also said that there is possible hazard to life where conductors cross the river on the bridge.

Directors of the Fairmont and Fairview Traction Company of Fairmont, W. Va., have chosen E. L. Rutherford of Scottdale as president. The company was formed to build an electric railway between Fairmont and Fairview, a distance of 12 miles. It will form connection with a valuable oil field.

Natural Gas under Steam Boilers.[1]

By Jay M. Whitham.

The writer was recently called upon to give an opinion regarding the commercial operation of a particular mill, both with natural gas and with coal, at a certain price. No detailed data of any special or determinative value could be found in available handbooks and other publications. This paper has been prepared to put on record the results of the author's investigations so as to aid engineers in reaching a fair conclusion on the problem from a commercial standpoint.

Composition of Natural Gas.

The composition of natural gas varies somewhat with the locality, as is shown in the 1903 report of F. H. Oliphant to the director of the United States Geological Survey in a paper entitled "The Production of Natural Gas."

The heating values of natural gas per cubic foot, in the report, vary from 1,037 to 1,287, being referred to 32 degrees Fahrenheit and 29.92 inches barometer.

Supplemental to the analysis of the West Virginia gas, as given in the report, are the following made for the writer. These tests relate to gas from nine wells in Lewis County, W. Va., three miles north of Weston, and used on the Cook boiler tests, given later on.

Sample number	1	2	3
Illuminants	0.45	0.15	0.50
Carbonic oxide	0.00	0.00	0.15
Hydrogen	0.20	0.30	0.25
Marsh gas	81.05	83.20	83.40
Ethane	17.60	15.55	15.40
Carbonic acid	0.00	0.20	0.00
Oxygen	0.15	0.10	0.00
Nitrogen	0.55	0.50	0.30
British heat units in a cubic foot of gas at 60 degrees F. and 14.7 pounds barometer available for useful effect	1,030	1,020	1,026

Also the following analysis of a mixture of natural gas from the fields in the three states supplying Pittsburg, Pa., made in September, 1905, for the writer, may be of some interest:

Illuminants	1.6 per cent.
Carbonic oxide	1.8 "
Hydrogen	0.3 "
Marsh gas	81.9 "
Ethane	13.2 "
Carbonic acid	0.0 "
Oxygen	0.4 "
Nitrogen	0.8 "
	100.0 per cent.

Heat units per cubic feet at 60 degrees Fahr. and 29.92 inches barometer ..... 1,098 B. t. u.

Testing of Gas Meters.

In any test, for any purpose whatsoever, of the use of natural or other gas for a useful effect, it is important that the amount used shall be truly determined. The gas meter can best be tested by the following method employed by the Equitable Meter Company of Pittsburg, which method appeals to the writer as being complete and exact. It is described by the company's engineer, Mr. George W. Barnes, as follows.

"The testing apparatus we use, in lieu of a better name, we call a 'flow meter,' and it is constructed as follows: First, we have an inner cylinder, 24 by 24 inches, perforated with as many three-fourths-inch holes as it will contain. Outside of this perforated cylinder we build another cylinder perforated with carefully calibrated holes of 1½-inch diameter, and of a sufficient number to give us a volume sufficient to test a meter using 250,000 cubic feet per hour. The rest of the apparatus is simple, consisting of gauges and a blower of sufficient size to give us the required volume of air at the required pressure.

"These holes in the outer cylinder or drum will discharge at a four-inch water pressure and at a temperature of 60° F. and a barometric pressure of 30 inches, one cubic foot per second, or 100 cubic feet in 100 seconds.

"Our connections are made up as follows: We connect the meter to the outlet of the blower and our 'flow meter' to the outlet of the meter, and operate our blower continuously and govern our pressure by a regulator placed between the blower and the meter. Our pressure is taken from the outlet of the 'flow meter,' and the temperature is obtained at the same point. If the conditions are all as just stated, we maintain the pressure of four inches of water pressure. If either the temperature or the barometric pressure vary from the above, we vary our pressure to suit the conditions, thereby maintaining a constant flow of one cubic foot per second for each hole, in the shell of the outer drum. We then take time with a stop-watch, allowing the meter to run 100 feet, when we note the time required. If more or less than 100 seconds are required, the error is computed from the 100 seconds, and an adjustment is made in the meter, and the corrections are made accordingly. The run at one 1½-inch hole or outlet will give a test on a meter at a flow of 3,600 cubic feet per hour. After making the above test we remove the stopper of another 1½-inch hole and make the flow at the rate of two cubic feet per second, or 7,200 cubic feet per hour, or two revolutions on the 100-foot dial of the meter in 100 seconds, and correct as above noted. This we continue to do in multiples of 3,600 cubic feet per hour until the full rate of capacity of the meter has been reached and adjustments have been made at each period through the run.

"This method we think the most nearly perfect to be had, inasmuch as it gives us our tests upon the meter with the actual volumes as required in general service.

"The formula used in determining the pressure required with different temperature and barometric pressures was arrived at by making the runs through the orifices from an accurately calibrated displacement prover. The experiments covered a period of some 18 months, and have been tried under all of the varying conditions obtainable during that period, while we have also checked back, by the formula, to the barometric reading, temperature and pressure, where each was obtained accurately from instruments, and in all cases we have proved that our formula was absolutely correct for the aforesaid 1½-inch orifices."

Burners to be Used.

The writer has investigated several of the gas burners upon the market, and concludes that there is but little difference between them from an efficiency standpoint.

The following boiler tests made separately with 10 Gwynn and 10 Kirkwood burners supplying a 250-horsepower Cook water-tube boiler having a "dog-house" furnace, the burners being placed in the front and at a level slightly above the furnace doors, the furnace having an imperfect "check-wall" in each case, and the burners being operated by experts in each case, shows that the question of burners may be eliminated.

Test number	790	791
Kind of burners	Gwynn	Kirkwood
Duration of tests in hours	8	8
Barometer, pounds	14.25	14.25
Boiler gauge pressure, pounds	126.5	122.0
Draft under damper, inches	0.24	0.13
Gas pressure at burners, ounces	3.84	4.50
Gas temperature at burners, Fahr.	45	45
Chimney temperatures, Fahr.	557	573
Feed-water temperature, Fahr.	33.0	33.6
Cubic feet of gas used	95,551	94,388
Cubic feet of gas at 60 Fahr. and four-ounce pressure	98,348	97,420
Water pumped and evaporated, pounds	70,240	70,030
Boiler horsepower rated	250	250
Boiler horsepower developed	254.5	253.7
Actual cubic feet of gas per boiler horsepower	46.8	46.4
Cubic feet of gas at four-ounce pressure, 60 Fahr. and 14.25 pounds barometer per boiler horsepower	48.3	48.0

Blue versus Straw Flames.

The writer has always been led to believe that a blue flame meant the burning of carbonic oxide into carbonic-acid gas, although some authors define it as representing the burning of hydrogen into water. Whichever is denoted by the blue flame, no flame of any color is formed at a temperature below about 1,000° F.

The writer conducted tests on six of the aforesaid 250 horsepower Cook boilers with such a blue flame in the combustion chamber, and also complementary tests upon them with a straw-white flame with the following results:

Kind of flame	White.	Blue.
Test with four-ounce gas pressure at burners, test number	793	798
Number of 250 horsepower Cook boilers tested	6	6
Steam-gauge pressure, pounds	112	88
Draft under boiler damper, inches	0.42	0.52
Pressure at the meter registering the gas used, ounces	18.9	19.8
Gas temperature, Fahr.	46	42
Chimney gases, Fahr.	436	503
Feed-water temperatures, Fahr.	172	178
Cubic feet of gas used at meter pressure	167,420	147,310
Cubic feet of gas used at four ounces pressure and 60 Fahr.	182,255	162,210
Water evaporated, pounds	141,566	123,344
Equivalent water evaporated from and at 212 Fahr., pounds	153,400	132,311
Boiler horsepower made by six 250-horsepower boilers	1,482.1	1,278.4
Boiler horsepower made per 250 horsepower boiler	247	213.1
Cubic feet of gas used under actual gas meter pressures and temperatures per boiler horsepower	37.7	38.4
Cubic feet of gas at four-ounce pressure and 60 Fahr. per boiler horsepower	41.0	41.0
Openings of gas burner lids	Throttled	Wide open
Number of six-inch Kirkwood burners used by the six boilers	60	60

These tests showed an advantage in capacity in favor of the white flame in the furnace at four ounces gas pressure at the burners, but no advance in economy.

Kind of flame	White.	Blue.
Test with six-ounce gas pressure at the burners, test number	794	797
Number of 250-horsepower Cook boilers tested	6	6
Steam-gauge pressure, pounds	116	99
Draft under boiler dampers, inches	0.51	0.52
Gas pressure at the meter, ounces	16.5	19.1
Gas temperature, Fahr.	44.3	42
Chimney temperature, Fahr.	478	511
Feed-water temperature, Fahr.	144	151
Cubic feet of gas used	222,320	185,218
Cubic feet of gas at four ounces and 60 degrees Fahr.	241,516	205,424
Water evaporated in the boilers, etc.	165,365	152,600
Equivalent water evaporated from and at 212 Fahr., pounds	184,167	168,333
Boiler horsepower made by six 250-horsepower boilers	1,779.4	1,626.4
Boiler horsepower made per boiler	296.6	271.1
Cubic feet of gas used under actual gas meter pressures and temperatures per boiler horsepower per hour	41.6	37.9
Cubic feet of gas at four-ounce pressure and 60 Fahr. per boiler horsepower per hour	45.2	42.1
Opening of gas burner lids	Throttled	Open wide
Number of six-inch Kirkwood burners used	60	60

Again, these tests showed a capacity advantage in the use of the white flame, but in this case at the sacrifice of economy.

Tests were then made with the gas at a burner pressure of eight ounces with the following results:

Kind of flame	White.	Blue.
Tests with eight-ounce burner pressure, test number	795	796
Number of 250-horsepower Cook boilers used	6	6
Steam-gauge pressure, pounds	128	128
Draft under boiler dampers, inches	0.51	0.54
Gas pressure at the meters, ounces	19.8	18.9
Gas temperature, Fahr	42	43.3
Chimney temperature, Fahr.	502	508
Feed-water temperature, Fahr.	157	184
Cubic feet of gas per meter	183,600	176,510
Cubic feet of gas at four ounces pressure and 60 Fahr.	203,044	194,004
Water evaporated, pounds	143,864	131,570
Equivalent water from and at 212 Fahr., pounds	158,596	141,319
Boiler horsepower made	1,532.2	1,365.4
Boiler horsepower per boiler	255.4	227.6
Cubic feet of gas used under actual gas meter pressures and temperatures per boiler horsepower per hour	40.0	43.1
Cubic feet of gas at four-ounce pressure and 60 Fahr. per boiler horsepower per hour	44.2	47.2
Opening of gas burner lids	Throttled	Open wide
Number of six-ineb Kirkwood burners actually used by the six boilers	42	46

These eight-ounce burner-pressure tests showed an advantage in both economy and in capacity in favor of the white flame.

Summarizing these six tests in two sets we find:

Kind of flame	White.	Blue.
No. of 250-horsepower Cook boilers used	6	6
Average gas pressure at burners, ounces	6	6
Cubic feet of gas used when reduced to four ounces and 60 degrees Fahr.	626,815	561,638
Equivalent water evaporated from and at 212 Fahr., pounds	496,163	441,963
Average boiler horsepower made	1,597.7	1,423.2
Horsepower made per 250-horsepower boiler	266.3	237.2
Cubic feet of gas reduced to four-ounce pressure and 60 Fahr. used per boiler horsepower per hour	43.6	43.8
Kind of burner	Kirkwood	Kirkwood
Burner lids	Throttled	Open wide

The six tests when thus consolidated in two tests show that the economy is the same with each and that the capacity is greatest with the white flame.

Accordingly, the remaining tests by the writer, and named herein, were made with straw-white flame.

Test of Six 250-horsepower Cook Boilers.

The following tests were made under the most careful conditions upon the same boilers previously referred to and equipped with Kirkwood burners. They were conducted after several weeks had been consumed in "check-wall" duration tests:

Test number	799	812
Duration, hours	16	9
Barometer, pounds	14.3	14.25
Boiler-gauge pressure, pounds	120.1	132.7
Draft in front of damper, inches	0.18	0.20
Gas pressure at meter, ounces	16.6	18.0
Gas pressure at burners, ounces	6.9	6.4
Temperature of air	40	69
Fire room	57	73
Natural gas	49	70
Feed water	151.2	185
Chimney	521	494
Gas metered, cubic feet	1,101,350	541,420
Equivalent gas at 60 degrees Fahr. and under four-ounce pressure with 14.7 pounds barometer	1,179,666	555,617
Water evaporated, pounds	818,700	435,625
Equivalent water from and at 212 degrees Fahr., pounds	906,301	467,948
Boiler horsepower made	1,641.8	1,507
Cubic feet of gas, actual, per boiler horsepower per hour	41.92	39.92
Cubic feet of gas at four ounces and 60 degrees Fahr. per boiler horsepower per hour	44.9	40.96
Boiler efficiency, per cent	72.7	....

Test of a 200-horsepower Heine Safety Water-tube Boiler at Herron Hill Pumping Station, Pittsburg, Pa.

Heating surface	2,032 square feet		
Shell	42 inches by 21 feet 6½ inches		
Tubes	116 3½ inches by 18 feet		
Number of natural gas burners in use	6		
Test made	Jan. 7, '05	Oct. 21, '04	Sept. 6, '05
Kind of gas burners used	Kirkwood	Kline type	Kirkwood
Duration of test, hours	10	10	10
Test made by	G. I. Bouton	Bouton	Whitham
Test number	....	....	820
Steam-gauge pressure, lbs.	145.8	144.1	149.6
Draft in front of damper, inches	0.14	0.18	0.34
Gas pressure at meter, inside of mercury	1.93	2.35	1.81
Barometer inside of mercury	28.54	28.63	28.99
Temperature of external air, Fahr.	25.3	56.1	69
Temperature of fire room, Fahr.	72.8	74.1	78
Temperature of feed water, Fahr.	40.9	61.1	74
Temperature of escaping gases, Fahr.	386	450	465
Temperature of natural gas at meter, Fahr.	58.8	70	79.8
Cubic feet of natural gas used	73,720	92,200	105,400
Cubic feet of natural gas reduced to 60 Fahr. and 29.92-ineb barometer	.....	.....	104,521

1. A paper, slightly condensed, presented at the New York meeting (December, 1905) of the American Society of Mechanical Engineers.

Cubic feet of natural gas at 32 Fahr. and 29.92-inch barometer	71,199	88,604	98,904
Calorific value of the natural gas per cubic feet in B. t. u. referred to:			
29.92-inch barometer, 32 degrees Fahr.	1,102	.....	.....
29.92-inch barometer, 60 degrees Fahr.	.....	.....	1,098
Moisture in the steam, part of 1 per cent.	0.50	0.53	0.33
Feed water pumped to boiler, pounds	43,800	62,655	74,922
Feed water evaporated, lbs.	43,581	62,323	74,672
Equivalent feed water evaporated from and at 212 degrees Fahr., pounds	53,425	75,130	89,024
Evaporation measured in boiler horsepower per hour	154.9	217.8	258.0
Rating of boiler, horsepower	200	200	200
Cubic feet of natural gas used per hour per boiler horsepower developed with gas at:			
29.92-inch barometer and 32 degrees Fahr.	45.97	40.68	38.33
29.92-inch barometer and 60 degrees Fahr.	....	....	40.51
Combined burner and furnace efficiency, per cent.	65.8	....	74.92

The improvement shown in the last test upon this Heine boiler is largely due to the use of an under and preheated air feed supplemental to the air supply ordinarily carried in through the burners.

Tests of a 302-horsepower Vertical Cahall Boiler at Mansfield, Ohio.

Mr. J. Roland Brown contributes the following tests made with six Merrill burners, the boiler having 3,021 square feet of heating surface:

Duration, hours	7	10
Date of test	Mch. 2, '03	Mch. 5, '03
Boiler gauge, pressure, pounds	95	85.7
Draft in front of damper, inches	0.28	0.7
Gas pressure, ounces	4.8	7-30
Barometer and gas temperatures are not given	....	....
Feed water temperature, degrees Fahr.	46.5	53.3
Chimney	406	374
Cubic feet of gas used	100,700	88,370
Water evaporated, pounds	67,865	74,168
Equivalent water from and at 212 degrees Fahr., pounds	82,171	89,076
Boiler horsepower made	340.2	260
Cubic feet of metered natural gas used per hour per boiler horsepower	42.26	34

The last test was made with gas at a high pressure, varying from seven to 30 ounces, and the average pressure is not stated.

Burner Tests.

Mr. Daniel Ashworth, member, has contributed the following results of tests made by him with various gas burners on a two-flue horizontal boiler:

No.	Gas Pressure at Burners in Ounces.	Name of Burners.	Cubic Feet of Natural Gas Per Hr. Per Boiler H. P. Made.
1	0.76	Hoffmann	58.0
2	0.76	Hoffmann	59.7
3	0.34	Reno	67.0
4	0.34	James	63.0
5	2.00	Miller	74.0
6	1.10	Bailey	47.0

Possible Efficiency with Natural Gas.

The foregoing constitute all of the natural gas tests that the writer has made as well as all available and reasonable tests made by others, although there are many tests published by burner people which are wholly impossible.

The tests here given show that it is not possible to get better efficiency with natural gas than with coal, and prove rather that the best coal efficiencies cannot be obtained with gas. That is due to the large volume of "air for dilution" which must be supplied with gas burners. On the Cook boiler test, No. 799, the Orsat showed

7.8 per cent. of CO_2.
8.05 per cent. of oxygen.
0.00 per cent. of CO.
84.15 per cent. of nitrogen.

100.00 per cent. Total.

for the composition of the products of combustion at the boiler damper when 72.7 per cent. of the heating value of the gas was absorbed by the boilers for evaporation. Such a poor analysis is almost an impossibility with any boiler when burning coal.

To produce a boiler horsepower, $966 \times 34.5 = 33{,}327$ B. T. U. must be absorbed by the water in the boiler. Assume that, on an average, natural gas has 1,100 B. T. U. per cubic foot. Then, if the gas is burned at 100 per cent. efficiency, 33,327 divided by $1{,}100 = 30.3$ cubic feet of gas must be used per horsepower per hour. Yet tests are sometimes reported where from only 17.4 to 19.8 cubic feet were used per hour per boiler horsepower.

Assuming 75 per cent. to be the best efficiency obtainable with natural gas under boilers (and this is very difficult), then 30.3 divided by $0.75 = 40.4$ cubic feet of gas, at normal barometer and temperatures, which must be used per hour per boiler horsepower.

Finally.

(1) There is but little advantage possessed by one burner over another.

(2) As good economy is made with a blue as with a white or straw flame, and no better.

(3) Greater capacity may be made with a straw-white than with a blue flame.

(4) An efficiency as high as from 72 to 75 per cent. in the use of gas is seldom obtained under the most expert conditions.

(5) The "air for dilution" is greater with gas than with coal, so that possible coal efficiencies are impossible with gas.

(6) Don't expect, in good commercial practice to get a boiler horsepower on less than from 43 to 45 cubic feet of natural gas, the same being referred to 60° Fahr. and four ounces pressure above a barometer of 29.92 inches.

(7) Fuel costs are the same under best conditions with natural gas at 10 cents per 1,000 cubic feet and semi-bituminous coal at $2.87 per 2,240 pounds.

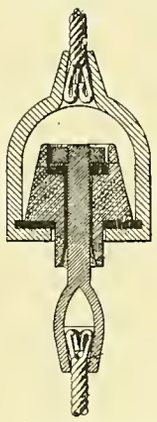
This is based on 3.5 pounds of wet coal being used per boiler horsepower per hour or 45 cubic feet of natural gas.

(8) Expressed otherwise, a long ton of semi-bituminous coal is the equivalent of 28,700 cubic feet of natural gas; while a short ton of such coal is the commercial equivalent of 25,625 cubic feet.

(9) As compared with hand firing with coal in a plant of 1,500 boiler horsepower output, coal being $2 per 2,240 pounds—considering labor saving by the use of gas—natural gas should sell for about 10 cents per 1,000 cubic feet.

Foster's Strain Insulator.

The accompanying illustration shows the form of a new strain insulator recently patented by Samuel L. Foster of San Francisco, Cal. The insulator consists of an open link-like metallic body having a flat base, through which is a central perforation. In the



FOSTER'S STRAIN INSULATOR.

opposite end is a countersunk hole for the cable connection. Passing through the central opening in the link is a bolt having at its lower end a countersunk opening for the other portion of the cable. A nut on the inner end of the bolt screws down into an opening in the top of an insulating body, as seen in the cut. The insulating body has a flat base which rests upon the flat portion of the link and is separated from it by a cushion washer.

Steam Turbines as Reserve in Transmission System.

The Missouri River Power Transmission Company, operating in the vicinity of Helena, Mont., and notable particularly for its high voltage, has begun the erection of a steam-turbine power plant to operate as a reserve to its present waterpower plant. A large part of the output of the Missouri River system is transmitted to the city of Butte and the Anaconda district mining properties, and the service has grown to such an extent as to warrant the erection of a reserve plant as a protection against serious fluctuations in the available waterpower.

Turbines of the Westinghouse-Parsons type will be installed, the initial equipment consisting of two units of 2,000-kilowatt capacity each, operating at 1,200 revolutions per minute, with 150 pounds steam pressure, 28-inch vacuum, 100 degrees superheat. They will be capable of delivering continuous overload of at least 50 per cent. condensing, or full load without the assistance of a condenser. The generators will be of the revolving-field type, and completely enclosed, with forced ventilation. This feature will entirely eliminate the peculiar hum of the high-speed turbine generator of the open type. The generators will operate at 1,200 revolutions per minute and deliver 60-cycle three-phase current at 2,400 volts. The motor-generator exciting and complete switchboard equipment accompanies the turbine plant.

A news item from Elyria, Ohio, says that the Lake Shore and Michigan Southern Railway Company will put up a plant in that city which will be one of a series of such plants for the purpose of supplying power for its system of electric signals in all the principal cities on the Lake Shore between Cleveland and Chicago.

Trade with the Philippines.

For the first time since the American occupation of the Philippine Islands there is a favorable showing in the trade conditions for the fiscal year in favor of the islands, the trade balance being approximately $1,500,000 in favor of the islands. The increase of the exports has been from $30,250,627 in 1904 to $32,352,615 in 1905. On the other hand, there has been a decrease in the imports from $33,220,761 to $30,876,350 in 1905.

During the year the importations of street cars jumped to $60,313, as against only $2,820 in 1904, although it has not been much advantage to the United States, as Belgium enjoys the major part of the trade. There has been an increase in the importations of telegraph, telephone and other electrical instruments from $54,532 to $77,636; out of which the United States supplied $57,127 as against $36,274 in 1904. The other leading sources of supply were Germany, Japan and the United Kingdom, in the order named.

There has also been an increase in the importations of incandescent lamps from $6,078 to $7,394, and here again the United States is in the lead with a value to her credit of $4,140 as against $3,189 last year.

The importations of electrical machinery for 1905 is reported as $184,334, whereas in 1904 the value was only $19,532. Out of the total value the United States supplied $177,314, as against $16,269 in 1904. The other sources of supply were the United Kingdom, Germany, France and Japan.

Duty on Powdered Carbon.

Some time ago a protest was entered with the United States Board of General Appraisers as to the rate and amount of duty chargeable on certain importations of powdered carbon entered through the port of New York, where it was returned for duty at the rate of 35 per centum ad valorem, under the provisions of Section 97 of the present tariff act.

This powdered carbon was intended for use in the construction of electric dry batteries, and is a product of a manufacture of carbon; was invoiced as carbon and was designated as such in the protest, in which the importers claimed that Section 97 only applied to such carbon as was capable of being ornamented or decorated, and that it provided only for articles or wares manufactured from carbon, and not for the crude material itself.

The first contention raised by the importers had already been disposed of by the board in the matter of an earlier protest; further, the board did not sustain them in their contention that carbon in the form of powder should not be included under the paragraph named.

It was held that the words "or carbon" are new matter, and in the opinion of the board include all carbon in whatever form or condition imported; but, were such not the case, the term "articles" has been judicially held to embrace all imported merchandise, whether crude, partly or wholly manufactured. The protest was therefore overruled and the collector's decision affirmed.

Another Section of the Chicago and Milwaukee Electric Railway Opened.

With the opening of the Kenosha division of the Chicago and Milwaukee electric railway hourly service was established between Kenosha, Wis., and Chicago. Representatives of 18 municipalities along the North Shore attended a banquet given in Kenosha on December 2d to celebrate the opening. A feature of the celebration was a trip over the line taken by more than 400 guests. In his address President A. C. Frost of the compan said that next summer traffic would be opened as far north as Racine, Wis., and before the end of 1906 as far north as Milwaukee. City Attorney John C. Slater of Kenosha acted as toastmaster, and speeches were made by Mayor James Gorman of Kenosha, Mayor Gade of Lake Forest, Bion J. Arnold of Chicago, A. C. Frost of Chicago, Peter Fisher of Kenosha, Mayor Peter B. Nelson of Racine, Judge Jones of Waukegan and Charles Whitney of Waukegan.

Books Received.

Proceedings of the Twenty-eighth Convention of the National Electric Light Association held at Denver-Colorado Springs, June 6-11, 1905. In two volumes. Published by order of the executive committee.

"Synchronmaschinen für Wechsel und Drehstrom" (Synchronous Machines for Alternating and Direct Current). By W. Winkelmann. Published by Dr. Max Jänecke, Hanover, Germany. (Price in Germany, four marks, equivalent to 96 cents.)

"Zur Klarstellung der Begriffe Masse, Gewicht, Schwere und Kraft" (Aid to a Clear Understanding of the Conception of Mass, Weight, Gravity and Energy). By Olof Linders. Published by Jäh & Schunke, Leipsic. (Price in Germany, one mark, or 24 cents.)

Technical Education of the Twentieth Century.[1]

By John Cassan Wait.

The foundation of a technical training consists of nature's laws and phenomena, and as nature's laws are fixed and inexorable, a student possessed of a knowledge of what has been, knows what will be, and it is this that forms the groundwork of the twentieth-century system of education. But this is not all; it should go further; it should elevate the new generation to a higher plane than mere investigation; it should cultivate powers, a higher ideal and a struggle for genius, the divine, the creative.

An education implies, first, a student or scholar to be educated; second, a process or method by which the education is to be acquired, and, third, an ulterior purpose or ultimate utilization of the education to some good aim and end.

When the high school or seminary training is finished, several questions present themselves to a young person, among which are three, viz.: (1) What shall I do or become? (2) Shall I attend school or become an apprentice? (3) Shall I enter the general or technical courses of instruction? The first question must be answered by the tastes, qualifications and opportunities possessed by the person. The second question is usually determined by the pecuniary limitation of the person. The third question depends upon the advantages to be secured or benefits to be derived, and is a subject for discussion under our topic.

It is not a new subject, but there may be some new things in it, in the light of another's experience. I am not an advocate of an extended general course in college as a condition precedent to technical training.

I am no advocate of 16 years of education before a man or woman becomes self-supporting. He or she is depending too long upon charity or is assuming a debt which he may never repay. It dwarfs the spirit of independence and self-reliance which the twentieth century needs so much. A young man who accepts his parents' or relatives' support to the age of 24 or 26 years has forfeited one of the heavenly attributes of human character—that of manly self-reliance. I would not expect great things of such a young man. If not blessed with influential relatives or friends, he must gain his experience and acquire a clientele. His married life is postponed and his ideal life shortened by a decade.

In the earlier days of education, theories and laws were assumed by one school, and controverted by others. Fortunately, all this has been changed, and modern methods of education are those where observation is cultivated and the reasoning faculties directed to explain the phenomena observed. This is the process of imparting information by directing the student in paths richly bordered with the fruits of wisdom.

The difficulties are removed. The student, though in quest of exercise, has had everything done to lessen the labor. Those obstacles that give to the forest trail its glories, or to the mountain stream its power, have been removed and the Venetian canal has been substituted.

What is the result? It is that all students have been to Venice; all have observed and been taught the same things. The original trend or natural taste of the child or youth has been limited to the banks of your canal. Your graduates are all alike. Genius has been dwarfed and freedom enslaved.

We need to cultivate heroes whose spirits no conventionalities could restrain and who overcame and turned the tide of the world's ignorance, prejudice and jealousies to the light and the truth. They are originators. They have visions unlike the average man.

These limitations in education do not differ solely with the period, but they are greatly affected by the conditions and localities. They are less marked in the smaller and outlying schools than of those in our great communities.

In cities and the great universities located therein the people forget that the sky overhead is not adamant or lignum. Their chief sources of knowledge are books. Much profitable learning comes from primitive life and from the discomforts of human existence. A millenium of human comfort and convenience is not healthful to intellectual progress nor to physical development.

It is notorious that the strong men and women, those who possess mental and physical superiority, in our schools, in business and in our industrial and professional occupations, are largely from the country.

In the general courses the studies that you pursue are determined, in the larger universities, by the students' own election. The tendency is toward this plan. By it the student may take his collegiate course and at the same time pursue courses required in the professional classes. This will lead to the three years' collegiate course, and is a step in the right direction, if the work of the student be directed or supervised. If he be required to elect his profession or business, and to take subjects prescribed or acknowledged to be advantageous in the vocation adopted, then it is, to my mind, most desirable. If the student be permitted to follow his own inclinations, which in four cases out of five will be those avenues of least effort, then the system is detrimental. The student may know less at graduation than at entrance. If he elect the elementary subjects in the various departments, acquire what is popularly known as general culture, and secure the requisite number of points or half courses, he can graduate with a degree, though that may mean positively nothing as an indication of what the student knows.

There is the choice of schools to consider, the large and the small, those in cities and those in country, the general and the technical. But outside of these there are also for consideration the systems that prevail. Some of the schools believe in pursuing several subjects at once, while others pursue one or two subjects only at a time. The various systems have many advocates. Each maintains that its system is the system. There is the choice between the elective and the prescribed courses of study, the experimental and the theoretical systems of teaching sciences.

In my opinion, it is those institutions which combine the theoretical and the practical, which limit to a moderate degree the number of courses, which prescribe courses for lower classmen and leave the election to upper classmen, that truly derive the benefits of both systems.

Cultivate exquisite care and practice heroic effort. As our country grows older and competition becomes greater, the requirements of an education increase. Students who expect and hope to excel in the competition that prevails in our great cities must have something better or something different from that possessed by others.

Refinement should be applied to all that you do and undertake. Your mental training should be refined on the same plan. Put an exquisite finish upon your work. That is what makes the artist; it is what distinguishes the actor and soldier from the business man or laborer, and it is what makes the successful technician or engineer in the present day.

Technical training as offered by our industrial schools tends to develop abnormally particular lines of the intellect and greatly enlarges the scope of one's observations and power in certain directions. Such a development has been compared to the abnormal development of the five senses. Yet the world has need of such men. He may not be wanted frequently, but occasionally his services are required, when they command great prices.

The prevailing idea is that a complete education should be acquired at school. The average graduate from college or technical school hails his degree as the final goal of his educational ambitions. Few study or expect to study after graduation, except perhaps in short crams for a civil-service or professional examination.

Such is not the object. The school's aim is to qualify you to study. If you do not continue with your studies you are soon going backward, and at a rate that will appall you when you come into competition with some recent graduate fresh from his studies.

A far-seeing man will, before spending very much time or money for a thing, inquire what specific uses he will make of it, and he will select the object of his purchase with a view to its qualities and its adaptations. A young man who enters college or a technical school should have some idea of what his tastes and capacities are and should be directed in the lines where his abilities would be best applied and cultivated. I am not one to advise that every man should be a perfect man; neither do I advocate that a whimsical and indolent youth should be permitted to escape essential training in mathematics and sciences by his declaration that he doesn't like them and he does like music, art and other subjects which gain flattery and applause. Yet, for one's life work, it is a grave misfortune for one to school himself or herself in a business in which they have not a real liking and to which they cannot bring enthusiasm. Elect something to your liking and something in which there are opportunities and for which there is a demand.

The utilization of technical training in the industrial pursuits and development is everywhere apparent in this country. To no other one element are the country and the people more indebted for their wealth and prosperity. The physical comforts of home, of business and of travel are due to the marvelous provision of the technician.

The economic value of this training is illustrated by the trade, domestic as well as foreign. No country can have claims to world power until it develops the industrial talents of its people and the natural resources of the land. The balance of power remains where the scientific, industrial and mechanical arts are best treated.

Education of this century should not be confined to book learning nor to the study of mathematical and physical laws. Some time should be given to economics and sociology. Methods and means of conserving and protecting what is acquired are quite as important as are the ways, methods and means of acquiring. Close upon the footsteps of progress in its march is trade, with its competition and its protector, economy. The wasteful methods of the pioneer cannot survive the rivalry of commerce. Economy in the production and utilization of materials or power is what effects great savings, and it is the man who can effect great savings who can command a salary commensurate with his savings.

But the twentieth-century education should not only cultivate the courage and capacity of a man or woman to cope with nature, but should also give some insight into the laws, institutions and systems of society. It frequently takes some people the best years of their life to become acquainted with themselves and to discover what they really are to the world. Some men take years to overcome the natural diffidence and timidity that possess them, which might be corrected in youth by proper surroundings and by a kindly interest of their teachers.

A discussion of technical education in this century should not omit some reflections upon the social inequalities that are certain to exist. We may look back upon a century mighty in its achievements, gigantic in its forward stride, matchless in its intellectual expansion, industry and invention, in its manifoldness and the vastness of its enterprises, the grandest of all the centuries in history. The heavy burden of labor has been taken from the shoulders of men, and the workman has been made the equal of his neighbor. He has better food, raiment and shelter, and better remuneration for his time.

The technical schools should aim to turn out men who can undertake the instruction and improvement of this class of people. Trade schools should be erected and instruction offered in the useful arts. They control the great avenues of commerce, the necessities of life—food, fuel and raiment. Never was there the necessity for the unity of men and the realization of the dependence of the polite upon the industrial.

The education of the twentieth century will, I predict, enlighten every continent on the globe. What has been begun in the past century will lead to greater and more lasting results in this century. The twentieth century should lead the human race to heights which shall strengthen the faltering steps of art, philosophy and religion.

What the twentieth century demands is the cultivation of originality and the development of the creative genius of students. Creation should be the highest aim of every student. A small thing created may be truly greater than a large thing borrowed, and the original thought or design of vastly greater import than any imitation. The present century requires the development of geniuses, and especially in the technical fields. Old and trodden fields must be departed from and new though rough trails taken. New practices and methods must be devised, and these are more likely to be discovered by departure from, than by following in the channels hewn by our predecessors.

The twentieth-century education should embody artistic treatment in structural work and in mechanical contrivance—a relaxation from the intensely practical and economical to a study of what is pleasing and what is beautiful. Some have an idea that there is not much that is beautiful in the mechanical and industrial. Nothing is further from the truth.

It is for the twentieth-century education to impart the beautiful and artistic to the useful, to lend inspiration and give expression to the deeper feelings of industrial life, its burdens, its struggles, its rewards and its glorious victories. The twentieth century should make its technically educated men something more than mechanicians, something more than the mere directors of processes. Men and women should be taught to vary their employment and to seek recreation in the profitable exercise of their intellectual faculties. The spirit of man needs more than gain, more than crowning success of its efforts, more than the applause of fellowmen; it needs the hope and cheer of the life everlasting.

1. Abstract of Founder's Day Address, November 30, 1905, at the Thomas S. Clarkson Memorial School of Technology, Potsdam, N. Y.

Chicago Council Will Investigate the Cost of Gas.

At its meeting this week the Chicago City Council rejected the proposition of Mayor Dunne, which requested the passing of a 75-cent gas ordinance without investigation to determine a reasonable price. In its place the council adopted a resolution providing that the gas, oil and electric light committee inquire into the cost of manufacturing gas and report to the council by January 15th its conclusions as to what the price of gas should be. The discussion brought out by the gas question became very heated. The aldermen who favored the investigation into the cost of producing gas declared that they were being accused of insincerity and showing favor to the corporations. On the other hand, they pointed to the fact that some of the supporters of the 75-cent ordinance, who were now opposing the investigation, were at Springfield and argued in favor of a thorough investigation of the cost of production at the time the Legislature gave the city power to dispose of its surplus electricity and regulate the cost of gas and the rates for electric current.

An ordinance providing for the appointment of an electrical inspector has been adopted by the City Council of Creston, Iowa, and is now being enforced.

Instructions for Central-station Operating Men.[1]

By W. F. Wells.

Part I.

It is impossible with a rule book, by education, or by any other means to make a good man out of poor material, but by placing rules and instructions of this sort in the hands of intelligent men to be used as a guide, by requiring of them complete observance of the rules, and by questioning them as to their understanding of the various instructions, an organization may be developed which will successfully cope with any operating problem.

Rules for the Government of Employes Operating and Handling 6,600-volt Apparatus.

1. Station foremen or regulators in charge of stations will allow no one to go upon the high-tension switch galleries without first ascertaining the object of the visit; and conspicuous notices must be placed at all entrances or stairways leading to high-tension galleries prohibiting any person from entering without permission.

2. No employe shall handle or touch either with or without rubber gloves any switch, cable, bus, connection, conductor or any other apparatus which ordinarily carries high-tension 6,600-volt current until he has positively ascertained that such electrical apparatus is disconnected from all sources of 6,600-volt potential in accordance with the following instructions:

3. When work is to be done on any part of the high-tension system in regular service, notice must first be given to the system operator as to the character of the work and the time required for its completion. If any alterations are to be made in the connection or location of any of the high-tension apparatus, or any addition made to same, full information with a sketch is to be furnished the system operator by the department desiring to make the changes or additions at least 24 hours before starting the work. In case of repair work where no alteration is to be made in the connection or location of high-tension apparatus, no sketch will be required. (Station foremen and regulators in charge of stations will not allow work started on the high-tension system, or auxiliary apparatus connected therewith, without first notifying the system operator.)

4. Before starting work on any high-tension apparatus, or auxiliary apparatus connected therewith, the foreman of the electrical construction department or his representative will ascertain from the regulator in charge of the switchboard at the station in which the work is to be done that the cable switch, bus or connection on which he desires to work is dead, i. e., that it is not connected either directly or through primaries of potential transformers with any source of high-potential in any station.

5. Before permitting the foreman of the electrical construction department to begin work the regulator in charge of the station in which the work is to be done will notify the system operator that the construction department is ready to proceed with the work according to notice previously given the system operator. Upon word from the system operator authorizing the work the station regulator will block switches in accordance with paragraph No. 7, attach ground wires and place a "not-clear" card on the apparatus. In applying these ground wires the regulator will first discharge the three conductors with the wire provided for that purpose, and will then connect the three conductors together and to ground. In doing this work the regulator should wear rubber gloves and exercise the greatest care. The foreman of the electrical construction department will personally inspect the blocking of the switches and grounding of the apparatus upon which he is to work. When the foreman of the electrical construction department reports work finished the regulator will note same in high-tension log book, and if personal inspection shows that the apparatus held off is now ready to be put in service, he will notify the system operator, and on instructions from him remove the switch blocks, ground wires and "not-clear" cards. After doing this he will make further entry in log book.

6. When insulation test is to be made, or work done on the high-tension cables in the subway, the system operator will instruct the sub-station regulator as to the blocking and grounding of switches and the posting of "not-clear" cards. Regulator will record all such work in the high-tension log book. If the cable is to be tested from the sub-station end, the tester will personally inspect the discharging of the cable.

7. In blocking type H oil switches two of the iron-bound oak pieces provided for the purpose are to be placed under the yoke, the knife switch on the motor is to be opened and "not-clear" cards hung on both oil switch and pilot switch controlling it. In blocking type K switches a block provided for the purpose is to be placed between handle and panel and "not-clear" cards are to be hung on the K switch handle and pilot switch controlling it. In blocking E. A. circuit-breakers a cap provided for the purpose is to be placed on the under side of the air dashpot and a "not-clear" card hung in a conspicuous place on the panel. When work is being done on cables special care should be used in blocking switches—posting "not-clear" cards, and in returning to service those cables connected to sub-station switches which cannot be grounded.

8. The regulator will immediately report to the system operator any fault which develops in any part of the transmission or transforming system, or any incident which in any way affects the service or necessitates taking any of the transmitting or transforming apparatus out of service for testing or repairs.

To Start Up System After a Complete Shutdown—Rules for Waterside Station in New York.

In case of any accident causing a total shutdown, regulator will immediately advise engineer that all load is off; the engineer will then shut down two engines and immediately advise regulator that same are ready for service. The engineer will then "turn over" slowly all other available engines and advise regulator that they are ready for service.

The system operator will immediately give Waterside regulator list of feeders to be cut over to the second bus which is free or not in operation, and clear all feeders at the sub-station; then have 14,000 kilowatts of rotaries in sub-stations where necessary connected to high-tension feeders, seven rotaries, or the equivalent of 7,000 kilowatts, connected to main bus of Waterside and a similar capacity of 7,000 kilowatts to auxiliary bus, the fields of the rotaries and one pole of the armature to be left open.

System operator will also advise regulator to connect to the main bus one of the engines shut down and the other one to the auxiliary bus, both with the fields closed and the rheostats all cut out.

When sub-station regulators are ready system operator will notify regulator to start both engines slowly. The engineer will then start and turn these engines at the slowest possible speed at which they will revolve. When the fields of the rotaries in the sub-stations have been closed regulator will gradually weaken the generator field by cutting the rheostat all in.

On word from the system operator, regulator will signal the engineer to raise the speed of the engines if necessary until each engine has a load of about 350 amperes.

Regulator will then signal for another engine and synchronize it with the main bus engine, and on word from the system operator signal in the regular way for increased speed until the engine has a load of 350 amperes. Engineer will not open throttle when signal lamps at throttle go out and will only give engine more steam on a signal from regulator.

Regulator will then signal for another engine and synchronize it with the auxiliary bus engine and continue putting in engines on the main and auxiliary busses in this manner until pressure is up to standard.

The system operator will advise the sub-stations what feeder to put each rotary on so as to keep the load on the two busses balanced.

As each engine is synchronized, regulator will not increase speed until notified by the system operator, the system operator having first ascertained that the sub-stations have synchronized other rotaries before giving regulator word to increase speed.

Regulator in synchronizing at low speeds will use the special plug provided with candelabra lamps.

In deciding upon the number of rotaries to start in the sub-stations the system operator will base his decision on the approximate ratio which the total load carried just before the disturbance bears to the 14,000 kilowatts available as above to start up. If the total load was 28,000 kilowatts and the available capacity to start up with 14,000 kilowatts, the capacity of rotaries to be started in each sub-station would be one-half the load on that sub-station, i. e., if the sub-station load was 16,000 amperes only 1,000 kilowatts of rotaries are to be started.

Instructions in Case of Serious Interference with Regular Service.

It is impossible to lay down any definite rules of procedure for sub-station regulators to follow in case of severe drops in pressure or interruption of supply of high-tension current, owing to the great variety of possibilities and the different conditions affecting each sub-stations. These instructions, which are issued for the guidance of regulators, must be studied and thoroughly understood by all men, and the order in which the different operations are performed must be governed by circumstances.

If, while operating more than one direct-current bus, part of your high-tension supply is interrupted, or decreased, and you have no assurance that it will become normal very shortly, it is best to tie together all direct-current busses by closing all battery and feeder switches on both auxiliary busses. If at any time your rotary ammeters indicate that the supply of high-tension current over any feeder is discontinued, and that the rotaries connected to it have inverted and continue converting direct current into alternating current for some appreciable time, disconnect them from the alternating-current feeders, making such direct-current bus ties as may be necessary for the low-tension feeder pressure and notify the system operator that the feeder is clear. Restore pressure to normal, if possible, by cutting in additional cells of battery. Keep rotaries running from direct-current end and be ready to synchronize and connect same as soon as notified by the system operator, or pilot lamp indicates that feeder is alive. In case all alternating-current supply is interrupted and is not restored before the pressure on the system has dropped to such a point that the station lighting is no more useful, transfer the station-lighting supply to the main bus and open all main feeder switches. When positive that you can give no further lighting service to the system, open all auxiliary bus battery switches, thus disconnecting the battery from the direct-current system, leaving it available for supplying the station lighting, the rotary fields, and all electrically operated switches and relays. Keep the system operator fully informed as to your condition. Thoroughly examine all high-tension switches and relays to make sure that they opened properly when last operated, as it might be found that the voltage at the time was not sufficient to cause them to make complete movement.

Rules and Instructions for Operating Department.

System operators report to and receive their instructions from the superintendent. It is their duty to have in service at all times sufficient generating, transmitting, transforming and battery equipment to meet the demands made upon the system and they will be held responsible for the efficient co-operation of the various units of the system. If from any cause there is a possibility that the apparatus available for service will not be sufficient to carry the expected load, it is to be reported at once, and if necessary arrangements made with outside companies for current.

They will issue all orders governing the distribution of output on generators, rotaries, batteries, etc., and the manipulation of the high-tension feeder switches, and will make all necessary records in accordance with instructions. Orders for steam-driven generating apparatus must be given sufficient time in advance to make necessary preparation. Their operating board must show at all times the connection of the high-tension feeders in service, the load on each sub-station and how carried. The output will be recorded in figures and curves on forms provided for the purpose.

They will make arrangements for intercharge of high-tension current with outside companies and report same in accordance with detailed instructions on the subject.

They will arrange for all periodical and special battery discharges, making proper records.

They will note all irregularities in the service or damage to equipment, giving full details, and, if seious, will report same at once. In case repairs should be made immediately they will notify some representative of the electrical construction department, or underground department, by telephone. If in case of serious irregularity in service, or accident greatly reducing the capacity of stations, report cannot be made to the superintendent (or assistant), they will notify representative of some other district, and also the associate general manager.

They will keep on file, corrected to date, schedule showing in detail capacity of all stations, map showing sizes and connections of all high-tension feeders and diagrams showing all high-tension switch connections in generating sub-stations.

They will authorize all work on high-tension feeders and apparatus in accordance with special instructions and make arrangements necessary for the protection of employes and the service of the company. Complete records of this work will be made and filed on forms provided for the purpose.

Electrical foremen report to and receive their instructions from the superintendent. They will also comply with operating orders issued by the system operator, and in ordering on generating units they will co-operate with the engine department.

They will instruct all the electrical operating men as to the operation of the various apparatus and records to be made, and they must know that the men under their direction are thoroughly familiar with the rules and instructions and are capable of performing the duties required of them, and that they are making true and correct records on the various reports. Order and instruction books are to be kept on the high-tension and low-tension control board, and all orders issued are to be initialed by the men.

Regulators will report to and receive instructions from the electrical foremen. In the absence of the foremen they will be governed by the rules prescribed for them.

Assistant regulators, repair men, switchboard men, brushmen and wiremen will report to and receive their instructions from the electrical foremen.

[To be concluded next week.]

1. Abstract of a paper read before the Association of Edison Illuminating Companies at Bluff Point, Lake Champlain, N. Y., September 13, 1905. Mr. Wells is superintendent of the Waterside Station of the New York Edison Company.

Indiana Telephone Items.

The Cannelton and Branchville Telephone Company, which obtained a franchise in Cannelton a few months ago, will soon begin the erection of a plant and exchange in Cannelton for local and county service.

The Citizens' Telephone Company at Cambridge City has purchased the telephone lines of the Hagerstown company, increasing its capacity for free service to its patrons. It owns and operates 1,500 telephones and will extend its toll lines into Henry and Randolph counties.

An explosion followed by fire destroyed the Pike County Telephone Company's exchange at Petersburg on November 29th.

The Bell Telephone Company have finished rebuilding the exchange in Auburn. The cost, together with line extension in Dekalb County, was $50,000. The cut-over was made on Sunday with only two hours' suspension of service. S. E. Vanfleet is the local manager.

At a meeting of the representatives of Independent telephone companies, held at New Castle on November 25th, a district organization was formed with A. C. Lindersmith of Richmond as president and C. A. Phelps of New Castle secretary. The object of the organization is for closer relations between Independents, looking to a better interchange of business. The towns represented were Richmond, Cambridge City, Sulphur Springs, Springport, Spiceland, Liberty, New Lisbon, Mt. Summit, Hagerstown and New Castle.

There is good basis for the statement that the Ohio and Missouri interests, which recently took over the two Indianapolis companies, are desirous of purchasing interests in additional Indiana and Ohio Independent telephone companies. It is said these men need one or two more good properties in Indiana and Ohio to give them direct connection with their east and west interests.

An examination for young women telephone operators who desire to enter the service of the United States government will be held in Indianapolis December 14th. This has given rise to the rumor that the government intends to establish its own exchanges in the various buildings throughout the country. Applicants must have at least one year's experience at the switchboard and must be more than 18 years of age. The salaries range from $240 to $840 a year.

The telephone system on the Ft. Wayne, Van Wert and Lima electric railway will soon be in operation. The wires have been strung to within two miles of Ft. Wayne. Each car is equipped with a telephone which can be connected every 2,000 feet.

The new owners of the Indianapolis Telephone Company have carried out the arrangement made a few weeks ago and have elected voting trustees who will manage the affairs of the company for five years. The voting trustees are James J. Robinson, James S. Brailey, Jr., Breckinridge Jones, W. F. Nolker, E. C. Stifel, Ben Altheimer, A. A. Bauer and Henry Koehler. C. E. Stinson, general manager of the company, is reorganizing his forces on an economical basis. A number of employes have been dropped, some have resigned and several departments discontinued, including the press department. Mr. Stinson says he has already retrenched to the amount of $20,000 a year and still hopes to improve the service. S.

Rocky Mountain Telephone Progress.

The Interstate Co-operative Telephone Company of Moscow, Ida., has decided to commence work at once on the extension of its line to Lewiston, and numerous other improvements in the system are also under contemplation.

Improvements to the amount of over $75,000, upon which work has already been commenced, will be made in the building of the Rocky Mountain Bell Telephone Company at Salt Lake City, Utah, and a new switchboard will be installed at a cost of $30,000.

The completion of the line of the Long Valley Mutual Telephone Company between Van Wyck and Laredo, Idaho, places both cities in telephonic communication with Boise over the Independent system.

The Silver Bow Telephone and Telegraph Company has filed articles of incorporation with the secretary of state at Carson, Nev. The company is capitalized at $50,000 and will operate from Tonopah. The incorporators are W. L. McGonigill, Raymond D. Frisbie and W. J. Wheaton.

The new building of the Rocky Mountain Bell Telephone Company at Logan, Utah, has been completed. G.

Telephone News from the Northwest.

The Northwestern Telephone Exchange Company has outbid its rival in the negotiations for the purchase of the Glenville (Minn.) local exchange and rural connections. This gives the Northwestern better connections in the vicinity of Albert Lea than its competitor, the Tri-state Company.

Frank Carswell, formerly manager for the Wisconsin Telephone Company in Green Bay, Wis., has been made manager of the Fox River Valley Telephone Company at Green Bay.

The Mesaba Telephone Company of Virginia, Minn., has occupied its new building and has begun giving service therefrom.

G. L. Stearns of Edgerton, Minn., has been made local manager at Albert Lea, Minn., for the Northwestern Telephone Exchange Company. George W. Johnson, the former manager, will continue with the company in charge of the work of construction.

The managers of the various stations of the Northwestern Telephone Exchange Company recently presented C. P. Wainman, the general manager, with a handsome silver loving cup. The presentation speech was made by C. P. Pettengill, the president.

The new Independent telephone line from Fort Dodge to Sioux City, Iowa, has been completed.

The Iowa Telephone Company is building a new telephone line from Fort Dodge to Humboldt, Iowa.

The Muscatine-Louise County Telephone Company will put in a new exchange at Columbus Junction, Iowa.

The Northwestern Telephone Exchange Company has purchased the Phœnix exchange at New Richmond, Wis., and will combine that line with its system.

The Star Telephone Company has put in an exchange at Savage, Minn. R.

Ohio Telephone Notes.

Application has been made to list the stock of the Newark Telephone Company of Newark on the Columbus Stock Exchange. The company will issue $50,000 preferred stock, paying six per cent. dividends, which the Columbus brokers will place.

J. L. Sayre of Richwood is organizing a company to build and operate an exchange at Ostrander. He will also build lines in the territory between Marysville and Delaware.

The Central Home Telephone Company of Wauseon has been incorporated in Delaware for the purpose of operating exchanges, toll lines and long-distance lines. The capital stock is placed at $5,000. Edwin L. Barber of Wauseon, J. D. Powers of Louisville, Ky., John C. Montelrith of Bloomington, Ind., and James E. Bergin of Nanticoke, Pa., are the incorporators. The new company will take over some of the properties in the South, including the plant at Louisville, Ky., it is said.

Telephone men believe that if negotiations for the bonds of the Cuyahoga Telephone Company go through, the bonds of the United States Telephone Company will be next in demand. The same people will in all probability want the securities of this company, as they are now but a few points under those of the local company. The gross earnings of this company are increasing gradually, and the management is taking steps to make the earning capacity still greater.

The People's Telephone Company of Barberton has made a proposition that for $4 a month the exchange will take the police calls every hour, thus giving a good police service. In the past the exchange has operated a red light in a prominent place when a police officer was wanted, and he would then call the the exchange for instructions. It has been suggested that four of these lights be placed in prominent localities to make the call system more complete. C.

NEW COMPANIES.

Plans are on foot for the organization of an Independent telephone company at Tecumseh, Neb.

The New Milford (Ill.) Telephone Company has been incorporated with a capital stock of $5,000. The incorporators are T. W. Evans, E. C. Bell and A. T. Chase.

The Central Home Telephone Company of Dover, Pa., has been incorporated by Edward L. Barber of Wauseon, Ohio; John C. Monteith of Louisville, Ky., and others.

The South Porto Rico Telephone Company of Portland, Me., has been incorporated with a capital stock of $30,000. H. L. Cram is president and A. F. Pine is treasurer.

The Inwood Rural Telephone Company of Inwood, W. Va., has been incorporated for the purpose of building a system at that place. E. S. Henshaw is president and Gray Silver, general manager.

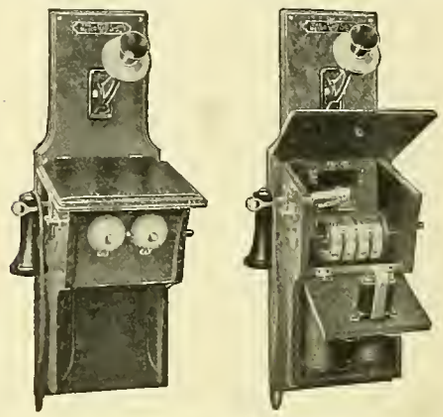
The Green County Telephone Company has been incorporated to build a telephone system about Blacksville, W. Va., the capital stock being placed at $100,000. Edward McSweeny of Pittsburg, F. E. McSweeney and Thomas B. Lee of Crafton, Pa., and Edward Barrett and E. T. Galway of Waynesburg, Pa., are the incorporators.

The following-named telephone companies have recently been incorporated: Homestead Telephone Company, Ray, Kan.; Anadarka and Apache Telephone Company, Anadarka, Okla.; Farmers' Co-operative Telephone Company, Geronimo, Okla.; Johnson County Telephone Company, Tecumseh, Neb.; Deerfield Telephone Company, Deerfield, Wis.; Farmers' Mutual Telephone Association, Americus, Kan.

The "Ideal" Cabinet Telephone.

Although strictly a utilitarian device, it is nevertheless a fact that there is an element of style or fashion which enters into the construction of the telephone, and there are many marked differences between the telephone of today and the cabinet magneto telephone of the past. A type of the latest "style" of telephone is the "Ideal" instrument, manufactured by the Wesco Supply Company of St. Louis, and which is illustrated herewith.

Among the advantages of the Ideal telephone is the fact that the line terminals are inside of the cabinet, entering from the rear of the backboard, thus placing these binding posts out of the reach of the customer and avoiding the trouble so often



THE "IDEAL" CABINET TELEPHONE.

experienced by customers tampering with the line terminals.

In this instrument all the wiring is done from the rear and all the parts are firmly secured to the backboard, no shelves being used. Another point in its favor in contradistinction to the compact cabinet is that the transmitter arm is attached to the backboard, which gives it a solid base and avoids the tendency to vibration experienced in the compact style of instruments, where the cabinet itself acts in the manner of a sounding board to the transmitter.

Bell Telephone Output.

The gross output of instruments reported by the American Telephone and Telegraph Company for the month of October exceeds the previous high record figure—that for the month of April—by 8,965, while the net output was also in excess of the April figures by 3,973 instruments, and more than double that for the corresponding month last year. The total number of instruments now outstanding—5,457,416—shows a gain over last year of 1,113,227.

Comparative figures giving the results for the month and for the 10 months of the current year to October 31st, are in detail as follows:

	1905.	1904.	Increase.
Gross output	193,272	113,760	79,512
Returned	60,073	50,772	9,301
Net output	133,199	62,988	70,211
Since January 1:			
Gross output	1,494,330	990,369	503,961
Returned	517,478	425,697	91,781
Net output	976,852	564,672	412,180
Total outstanding	5,457,416	4,344,189	1,113,227

MANUFACTURERS AND DEALERS.

The Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y., reports having closed contracts for switchboards for Fulton, Kan.; Jamestown, N. Y.; Spanish Fork, Utah; Tonopah, Nev.; Tremonton, Utah; Columbus, Ohio; Robinson, Ill.; Lakewood, Ill.; Chillicothe, Mo.; Garland, Utah; Herrick, Ill.; La Grange, Ky.; Streator, Ill.; Seattle, Wash.; Germantown, Neb.; Leechburg, Pa.; Whiting, Ind.; Tingley, Ia.

Something novel in the line of souvenir postal cards is furnished by the Kellogg Switchboard and Supply Company of Chicago to its salesmen to help them in getting new business and holding old customers. The picture side of the card is pleasing, showing a rainbow arching from the traditional bags of gold, and some typewritten matter is to the effect that "As gold is the standard of monetary values, so are Kellogg telephones and switchboards the standard of telephone equipment."

Robert L. Fairbrother, wire chief of the Interstate Telephone Company at Sandwich, Ill., recently made a test of the Sandwich ohmmeter which had been bought from the Sandwich Polechanger Company of that place. A line of the telephone company broke somewhere between Sandwich and Aurora, 95 miles away. The instrument located the break in the wire 33 miles from Sandwich, the exact indication of the instrument locating the break within 250 feet of where it actually was.

Cincinnati Independents Get Unfavorable Decision.

Under a decision of the Ohio Supreme Court, the Queen City Telephone Company has failed to secure a franchise in Cincinnati. The fight has been in progress for a long time and seemingly the decision is a severe one to the independent interests. The Probate Court gave the company a franchise in the city, but the Common Pleas Court reversed the Probate on the ground that the company was not properly organized and that the court had no authority to grant the right to place lines in underground conduits, that being only within the sphere of the legislature. The Circuit Court sustained the latter decision and an appeal was taken to the Supreme Court.

Four companies had made application for franchises in Cincinnati, and Judge Nippert, then on the probate bench, elected to take up the Queen City's case. The other companies are the Fitzsimmons, Cincinnati and the United States.

The last paragraph of the syllabus in the case reads: "The statutes of Ohio do not confer power on the Probate Court to grant to a telephone company the right to put its wires and apparatus in conduits under the streets of a city in the absence of consent by the municipal authorities."

GENERAL TELEPHONE NEWS.

The Union Telephone Company is putting in an exchange at Sheldon, Iowa.

The Northern Telephone Company is applying for a franchise in Minot, N. D.

A private telephone system is to be installed in the New Chicago Hotel at Sioux City, Iowa.

The Interstate Telephone and Electric Company may build a telephone exchange in Bismarck, N. D.

Mayor George W. Ball of Iowa City, Iowa, has been elected president of the Johnson County Telephone Company.

The People's Home Telephone Company of Birmingham, Ala., is going to rebuild the structure which was destroyed by fire.

The Paducah Home Telephone Company is completing arrangements for constructing a telephone system from Paducah to Cairo, Ky., connecting with St. Louis, Mo.

A 30-year franchise has been granted at Bismarck, N. D., to the Interstate Electric and Telephone Company.

John McMurray, A. L. Dorsey and associates have incorporated as the Springfield Home Telephone Company to operate a telephone system in Springfield, Tenn.

B. F. Wasson of the National Telephone and Electric Company of Clinton, Ill., has let the contract for a new telephone office building to be built in Clinton.

The Canadian County Mutual Telephone Company of El Reno, Okla., has been incorporated with a capital stock of $10,000 by John D. McLean, William J. Newland of El Reno and James Chappell of Union City.

While the family of R. M. Johnson was at dinner in his home in a suburb of New York two burglars were looting the home, but were discovered when the telephone bell rang and one of the family went to answer the call.

It is said that Los Angeles, Cal., has more telephones in proportion to its inhabitants than any other city in the world. The population of the city is about 126,000 and there are said to be 35,000 telephones, or one telephone to every 3.3 persons.

The monthly statement of the Chicago Telephone Company shows the number of new subscribers gained during November was 1,720 in the city and 552 in the country, making a total of 2,272 instruments installed for the month. This brings the total number of telephones now in service up to 140,187.

Official Independent telephone emblems in lapel buttons, clasp pins and hat pins are furnished by the National-Interstate Telephone Association, which has its headquarters in the Electric Building, Cleveland. The tasteful little emblems come in gold or gold plate and enamel and are considered an effective means of advertising the Independent movement.

At the meeting of the executive council of the National-Interstate Telephone Association held in Cleveland, Ohio, on November 24th the action of the president of the association in arranging for bulletins to be prepared each month for the purpose of keeping the Independent interests of the country in touch with the work being done by the organization was approved and he was authorized to continue such bulletins.

CORRESPONDENCE.

Great Britain.

London, November 21.—It is now possible to judge pretty clearly what is going to happen in Parliament in the forthcoming session in relation to electric power supply in London. So far there are four schemes, all by companies, while there is a strong likelihood that there will be at least two others, one by the London County Council and another by a company. So far as the London County Council scheme is concerned, there is still some doubt as to what will ultimately be done, for a somewhat weak resolution was passed at a conference this week with the borough council, when 14 voted for the proposal, six voted against a power scheme, six refrained from voting at all and three did not send delegates. The text of the resolution was to the effect that the London County Council should promote a scheme, providing that the interests of those borough councils owning electricity works were safeguarded, and if everything else was satisfactory. How far this will influence the County Council in proceeding will be made known in a day or two, for the time will shortly expire during which public notice has to be given of the intention to promote a bill.

The most startling proposal so far made known is that of a new company which hopes to supply at one cent per unit, nearly 50 per cent. less than the price quoted so much last year. The anticipation of success in Parliament of the promoters of this scheme rest upon the fact that they are only proposing to supply to railways or to undertakings already in existence, if these latter care to negotiate, but not otherwise. No supply is to be given to the individual power consumer. The generating station it is proposed to build 40 miles away from London and to carry a high-pressure overhead line to the outskirts of the metropolis and thence by underground mains. In face of what has been published of the intentions of private promoters, it would appear almost futile for the municipalities to enter the field, yet it will not be surprising if more public money were wasted on what must be regarded as a forlorn hope, having in mind the present feeling of Parliament on the question of municipal trading in its speculative aspect.

In no other place in Great Britain is a town split up into small areas as is London; hence the conflicting authorities are continually barring the way to progress. This is not so in the provinces, and so it is that many of the larger authorities are able to show respectable results from municipal trading. Birmingham is the latest of such towns to take up the matter earnestly, and a large generating station is being equipped for supply for all purposes, including tramways. The total capacity of these works will be 20,000 horsepower, and the chairman of the electric-lighting committee has just performed the heroic and hazardous feat of climbing to the top of the first chimney stack to set the last brick.

The engineering standards committee continues its good work, but very little is heard of it except at rare intervals. The fact that the committee still exists has once again been brought to light by a circular which it has issued summoning a conference of glow-lamp makers for the purpose of arriving at some standard in the matter of glow-lamp filaments. This question has been discussed quite recently in the weekly engineering supplement to the Times, where many manufacturers have been stating their views. Most of the conferences of the standard committee are held with closed doors, so that, except for the final report of the committee, very little of what takes place is published.

The time is rapidly drawing near when the last of the steam trains will be seen upon the Inner Circle. The electric locomotives for drawing the trains of another company which has running powers over the District company's lines, are almost ready for delivery, and when that is an accomplished fact—December 31st is the date given—a complete electrical and accelerated service will be given.

Another of the main-line railway companies has in view the changing over of a portion of its lines out of London. The lines in question belong to the London and Northwestern Railway Company and are situated near Manchester.

A statement has just been issued by the makers of the Curtis turbine in this country that their sales to date aggregate 24,000 kilowatts, of which, however, 12,250 kilowatts have been sent abroad, leaving a total of 11,750 kilowatts distributed in power stations throughout the United Kingdom. Some 1,500-kilowatt sets have been ordered, but generally orders for the smaller sizes have predominated.

The Torquay corporation has at last come to terms with the tramway company in that town, and, from appearances at present, things have reverted to the statu quo ante. Both parties have made concessions in an amicable spirit, although the company seems to have come out on top. The history of the trouble in Torquay has been fully given here from time to time, and need not be repeated. The time for the provision of a supply of current for the tramways has been extended from December, 1905, to March, 1906, in order to allow the corporation time to erect the necessary machinery, about the loan for which there has been considerable difficulty with the Local Government Board. G.

New York.

New York city, December 2.—The committee of 21, assembled at the instance of the National Civic Federation, commenced its investigation into the conditions of municipal ownership and operation of public utilities this week. Mr. August Belmont, president of the Interborough Rapid Transit Company and a member of the National Civic Federation, has told the committee that he would be quite prepared to hand over his traction interests to the city, as he recognizes that the question of public traction is not primarily an individual matter. This is how Mr. Belmont is reported.

At four o'clock on Monday afternoon an Italian workman removed the last spadeful of earth in the tunnel under the East River between Manhattan and Brooklyn, the junction being made at a point under the Temple Bar Building, Brooklyn, some considerable distance from the under-water portion of the work. The event was duly celebrated.

What kind of political or other deal is pending in respect of the extension of the subway under Flatbush Avenue, Brooklyn, is not yet revealed. The Interborough Rapid Transit Company wishes to do the work in a certain manner, but Park Commissioner Kennedy stands in the way of this by refusing an order for the removal of about 200 trees which prevent the proposed work being carried out. Controller Edward Grout is backing up Kennedy and has admitted that he owns property which would be affected by the removal of the trees. The Interborough officials are declaring that if the company cannot get what it wants it will not do anything at all, and the Flatbush public is taking sides in a way that still further complicates matters.

The directorate of the Brooklyn Rapid Transit Company made some staff changes on Wednesday. Mr. W. B. Graham, who has been superintendent of surface lines, leaves the company's staff and has taken a position in Chicago. W. O. Wood has been appointed as assistant general manager after having been superintendent of elevated lines, and L. V. Smith, his former assistant, succeeds him.

In accordance with the provisions of recent legislation the Brooklyn Rapid Transit has equipped 408 of its surface cars with vestibules, which is approximately one-third of the entire rolling stock in daily operation. The company has two years in which to complete the conversion.

Bridge Commissioner Best again announces that he has completed plans and drawings for the terminals of the Manhattan Bridge. The fundamental fault of all of Mr. Best's plans is that they provide for "terminals," whereas the obvious need of the city is for continuous communication. Before now, however, the bridge department has argued that because a hundred thousand persons get on and off the cars at Brooklyn Bridge every day, it is proof positive that they want to get off there. The bridge department even went to the extent of counting the alighting passengers and is trying to discover their subsequent destinations.

Charles E. Yetman, inventor of a typewriting machine for the transmission and receipt of telegraphic messages, is interested, as vice-president, in a petition in bankruptcy which has been filed against the Yetman Transmitting Typewriter Company. This concern was organized in 1904 with a capital of $500,000.

Joseph Nolan, an electrician in the employment of the National Electrical Construction Company, was instantly killed on Thursday while superintending the placing of a new motor in a house at East New York. He placed his hand in an unguarded moment on the switch, not knowing that it had been connected with the mains.

The state lighting investigating committee began its work in this city this week, but so far has only considered formal evidence and listened to the rereading of the reports of the former investigation.

The Supreme Court at Utica, N. Y., has upheld the constitutionality of the new law which allows a public lighting company the right to condemn land needed for its purposes. This point arose out of the desire of the East Creek Electric Light and Power Company to acquire lands for the completion of a dam for power purposes.

The H. P. Meter Company, to deal in electric meters, has been incorporated with a capital of $100,000. The directors are H. Hertzberg, W. P. Snyder and H. I. Bernard, all of New York.

The Franco-American Electric Company has been incorporated by B. Baunstein and associates with a capital of $50,000.

The Board of Estimate and Apportionment has appropriated $170,000 for putting fire-alarm wires underground in the boroughs of Brooklyn and Queens.

The New York Telephone Company announces a net gain of 3,274 telephones for the month of November in Manhattan and the Bronx, making a total net gain for 11 months of 30,270 instruments and a total service of over 182,000. D. W. W.

New England.

Boston, December 2.—An issue in the municipal election this month in Cambridge will be the matter of constructing a subway in that city from the new West Boston Bridge through Main Street and Massachusetts Avenue to Harvard Square instead of building elevated tracks. The question, by vote of the City Council, will be submitted to the voters. Another subway through East Cambridge to Boston is also projected. The Boston Elevated Street Railway Company now has a franchise for an elevated road in the city of Cambridge, but has shown a willingness to meet the citizens half way and unite with them on a subway plan on terms mutually advantageous.

The Old Colony Street Railway Company has inaugurated a through line without change of cars to Fall River, a distance of 53 miles, connecting at Fall River with the steamboat line from that city to New York. The cars will leave Postoffice Square in Boston daily at 2 p. m.

Worcester Polytechnic Institute is installing a 105-kilowatt generator and a 175-horsepower engine at the power laboratory.

A special meeting of the stockholders of the Southern Bell Telephone and Telegraph Company has been called for December 13th to take action on a proposition to increase the capital stock of the company.

It was announced on November 28th that arrangements have been made for the transfer of the Woronoco street railway and the Western Massachusetts street railway to the Consolidated Street Railway Company, which is controlled by the New York, New Haven and Hartford Railroad Company. The price to be paid is $175 per share for the Woronoco stock. The Western Massachusetts road is a branch of the Woronoco.

A lease of the Springfield and Eastern to the Springfield Street Railway Company for 25 years has been approved by the Massachusetts Railroad Commissioners.

A blaze of fire discovered at the top of the 206-foot mast of the De Forest Wireless Telegraph Company in South Boston a few nights ago gave the firemen the hardest problem they have had, to devise means of reaching the flame. The fire burned slowly downward all night when it reached the 50-foot gaff, seven feet from the top. Shortly before noon the following day all efforts to extinguish the flame had failed, and then four firemen volunteered to climb the pole to within reaching distance. The men climbed 10 feet apart and their strength was taxed to the utmost in carrying the hose, which became heavier as they ascended, but they were successful in getting water to the fire.

Directors of the Norwich, Mystic and Westerly Street Railway Company of Connecticut have awarded the contract for the construction of their new road to the National Construction and Equipment Company of New York. The building of the road will cost about $500,000. Much of the line will be over private rights-of-way and high speed will be attained. B.

Ohio.

Cleveland, December 2.—The Supreme Court has reversed the decision of the Circuit Court and decided that the Forest City Railway Company has a valid franchise on Dennison Avenue, Cleveland. Another injunction suit is pending in the lower court, however, and that will have to be gotten out of the way before the company will be able to proceed with the construction work, which was begun two years ago. The court says that a property owner cannot limit his consent for building a street railway on a street to any particular corporation or individual. If he gives consent that a road be built in front of his property, the city authorities may grant a franchise to the company agreeing to operate on the lowest fare.

The Cleveland and Southwestern electric railway is said to have plans made for a belt line about Lorain. It will extend from Oberlin to North and South Amherst, and from there to Elyria, where it will connect with the main line to Cleveland.

The South Lorain and Eastern Traction Company has been incorporated with a capital stock of $1,000 by Arthur A. Lederer of Cleveland and others. Sigmund Lederer has been chosen president. The company plans to build a line from Cleveland to Lorain, extending the entire distance about four miles south of the Lake Shore and touching a territory that has no other railroad service.

At a meeting of the stockholders of the Scioto Valley Traction Company in Columbus a few days ago it was decided to sell $175,000 preferred stock now in the treasury at par, pro rata to present stockholders. Over two-thirds of the stock was taken immediately after the adjournment of the meeting, and the remainder will be subscribed in a short time. A majority of the stockholders voted to donate the dividends on the stock to the company, making it cumulative after April 1st next, instead of October 1st.

An amendment is proposed to the charter of the Cincinnati Gas and Electric Company, allowing it to deal in natural gas and natural-gas properties. This has come about through the attempt of the Ohio Fuel Supply Company to secure a franchise in the city to furnish natural gas. It is said this company made an offer to purchase the property of the older company, but that it was refused.

Most of the steel between Petersburg, Mich., and Toledo on the Toledo, Ann Arbor and Detroit, has been laid. At present the road will use the Toledo and Western as an entrance to Toledo.

Dispatches from East Liverpool are to the effect that the combination of electric-railway and light companies in that section of the state will be one of the largest in the West. The East Liverpool Light and Traction Company will have a paid-up capital of $3,000,000. The companies to be taken over consist of the United Power Company, the East Liverpool Railway Company, the Ceremic City Light Company, the Wellsville Electric Light Company, the Glasgow Railroad Company, the Eastern Ohio Railroad Company, the Island Run Coal Company, the East Liverpool and Rock Springs Street Railroad Company, the East Liverpool Bridge Company, the Chester (W. Va.) Light and Power Company and the People's Light and Power Company.

Frank M. Ohl has asked for a franchise on Poplar and Main streets for the Fostoria and Marion Electric Railway Company. It will connect at that point with the Toledo, Fostoria and Findlay line.

The sale of the Springfield, South Charleston, Washington Court House and Chillicothe Traction Company has been postponed until December 28th, in order to give the reorganization committee time to arrange for a bond issue to complete the road and take up the present debts.

Rumors that Standard Oil interests had gained control of the Toledo Railways and Light Company and proposed merging with the Toledo Gas, Heat and Electric Company have been denied.

The Lake Shore Electric has under consideration the installation of electric switch lights. They will be connected with the telephone booth close by, and when a light is out it will be noticed by the conductors using the telephone, as the lights will have corresponding lights in the booths.

The Lake Shore and Michigan Southern will adopt the "twin-ticket" plan at reduced rates between Toledo and Detroit, in competition with the electric roads. This plan has been adopted on several of the steam roads.

The case of Arthur E. Appleyard will be appealed from the Massachusetts Supreme Court to the United States Supreme Court. The state court decided that Appleyard would have to go back to Buffalo for trial in the bank matter.

A conference of the grand officers and delegates of the Brotherhood of Motormen will be held at Lorain on December 5th and 6th. It is possible that the interurban motormen may form a separate organization, to be known as the Brotherhood of Interurban Trainmen. O. M. C.

Indiana.

Indianapolis, December 2.—The Chicago, Indiana and Eastern Railroad Company, it is said, proposes to equip its line with electricity. The company proposes to build a branch line into Marion and has asked for a franchise to operate electric trains in and through the city.

A meeting was held in Versailles this week in the interest of an electric railway to be built between Greensburg and Madison. In addition to business men of Versailles, W. T. Durbin and Charles L. Henry, and Messrs. Rose and Ball of Muncie, and Messrs. Zoller and Minier of Greensburg, were present.

Work was begun by the Louisville and Northern Railway and Electric Light Company of New Albany this week to build north to Seymour by way of Sellersburg for the Louisville and Southern Indiana Traction Company.

Work on the new Air Line Traction Company, that will connect Ft. Wayne and South Bend, was begun this week at Cherubusco by P. T. O'Brien and A. M. Weeden, contractors. The road is 80 miles long and will require 21 bridges.

The Toledo and Chicago Interurban Railway Company closed a contract this week with the city of Auburn, which will furnish power for the line, now almost completed, until the company's large power plant can be completed at Kendallville.

William Duncan, chief engineer of the Indianapolis and Ohio Valley Traction Company, has established offices in the Rawlin's Block in Bedford and will at once prepare the estimates and profile of the line to be built from Indianapolis to the Ohio River. Bids for construction will be solicited soon.

Sargent & Lundy, engineers of Chicago, have made a report to the Winona Interurban Railway Company as to the probable earnings of the 70 miles of road from Goshen to Peru. According to the report the Goshen-Warsaw division of 26 miles will earn $176,000 a year, this being a net profit of $74,394, and after paying interest on the bonds, the annual surplus would be $39,394. The Winona company is also acquiring right-of-way and franchises for an east-and-west division, extending to Ft. Wayne and to Valparaiso.

The Electric Installation Company of Chicago has the contract for the Warsaw-Goshen line, and the electrical equipment will be put in by the Allis-Chalmers Company of Milwaukee.

The Zionsville Water and Electric Light Company has filed articles of incorporation. M. E. Wiesehan is president. The company is in the market for a full line of equipment.

The Indiana Supreme Court has just decided that bucket shops cannot compel the telegraph companies to deliver market quotations to them. The court held that the requirement of the Board of Trade that every applicant for its continuous quotations obligate himself not to use the same for illegal purposes, is not an unlawful discrimination but on the contrary is a proper and reasonable regulation to which the court gives its approval. S. S.

Texas.

Austin, December 1.—Extensive improvements are being made to the street-railway system of Laredo under the direction of Superintendent Frank R. Scoville.

Steps have been taken to organize a company to build and operate an electric railway to connect Corpus Christi with the Alta Vista resort, situated about three miles from town.

An electric-light plant is to be installed at Jasper. Local citizens are interested in the project.

The project of building an interurban electric railway between Houston and Galveston, a distance of about 51 miles, has been revived. Among the business men interested in the project are J. O. Russ, H. C. House, O. T. Holt, H. Masterson and Hyman Levy of Houston; W. J. Moore of San Antonio and F. L. Dana of Galveston.

Bids are being received for the construction of the interurban electric railway between the towns of San Marcos and Luling by the San Marcos Valley Interurban Railway Company. Judge B. G. Neighbors of San Marcos is secretary of the company.

The City Council of Uvalde has granted a franchise to J. F. Simpson, W. D. Kincaid and Gus Muller for the installation of an electric-light plant at Uvalde.

The Midlothian Ice, Light and Water Company, which was recently organized with a capital stock of $20,000, will install an electric-light plant at Midlothian.

A. T. Fisher is promoting the project of building an interurban electric railway between Luling and Leesville. W. D. H.

Mexico.

City of Mexico, November 29.—The organization of a company which will have a capital stock of $10,000,000 is now being perfected for the purpose of installing in the Parral mining district one of the largest electric power and transmission plants in Mexico. Leopoldo Iwonskey, general representative of the firm of Stallforth Hermanos of Parral is promoting the enterprise, and American and German capitalists are interested. The plant will be located between Parrel and Minas Nuevas and the power will be generated by mountain streams.

Ezequiel Salazer Enriquez of Chihuahua will establish an electric-light and power plant at Santa Eulalia. In addition he proposes to convey the current to the city of Chihuahua if a franchise can be obtained.

Alberto Schuler will install a hydro-electric plant on the Minas River in the Jalacingo district, state of Vera Cruz. The plant will furnish power for mines.

S. Pearson & Son, English contractors, will install a hydro-electric plant at Acumba Lake, state of Tabasco, the power to be used to operate the machinery of an industrial plant which this firm will establish.

Eugene Davis of Chihuahua is at the head of a company which has been granted a concession by the federal government to install an electric power plant 51 miles from Parral. The plant will consist of six units of 500 horsepower each. The power will be transmitted to mines and reduction works of that section.

A hydro-electric plant is to be installed on the Piaxtla River by the Compania Minera Guadalupe de los Reyes. The plant will cost about $500,000 and will have a capacity of 5,000 horsepower. It will be located adjacent to the mines of the company in the state of Sinaloa.

The Torreon and Lerdo Electric Railway Company, which operates the interurban electric railway between Torreon and Lerdo, has purchased the electric-light plant at Torreon and is negotiating for the street-railway system in Torreon.

A. W. Lilliendahl of Saltillo, who recently obtained a concession to install a large electric power plant 10 miles from that city, is preparing to construct an electric railway to connect Saltillo with Artega. A waterpower plant will generate the electrical energy.

Rafael Davila, an attorney of Monterey, has obtained a concession from the federal government to construct an electric railway from Allende to Zaragoza, state of Coahuila. H.

Michigan.

Grand Rapids, December 2.—Specifications have been prepared by W. H. Patterson, manager of the Grand Rapids and Kalamazoo Valley Traction Company, for six limited cars, six local cars and six package express cars, and bids have been asked for. The limited cars will resemble a standard Pullman sleeper, while the interior will be finished

in mahogany throughout. A handsome smoking apartment will be furnished with movable wicker chairs.

Chicago and Milwaukee capitalists are said to be back of a proposition to build 40 miles of electric railway from Sturgeon Bay to the north end of Door County peninsula. J. A. Brecker of Milwaukee is securing the right-of-way.

The first car operated by electricity over the South Bend and Southern Michigan railway between Niles and St. Joseph made its initial run to Berrien Springs, which is as far as the trolley wire is strung.

The electric railway which has been surveyed between Elkhart, Ind., and Pavilion, Mich., will, it is said, use the third-rail system.

Contractor A. E. French has been awarded the contract of erecting the power house for the Elk Rapids Power and Electric Lighting Company and will begin work immediately. The building will be of rock-face cement blocks, on a concrete foundation, 30 by 50 feet in size.

Detroit people have purchased the waterpower rights at Argentine owned by Derham Bros., W. B. Stiles and L. C. Sutherland. It is said that the new owners will expend about $200,000 in developing the proposition. It is thought it will develop 3,000 horsepower. A new concrete dam and suitable buildings will be installed.

The taxpayers of Croswell have voted in favor of bonding for $5,500 for electric lights.

The Genesee Avenue Bridge in Saginaw will be lighted by a cluster of Nernst incandescent lights suspended from ornamental arms fastened to each trolley post, the feed wires to be in conduits along the sidewalks. The establishment of this system will cost $1,328 exclusive of the lamps, which will be $324 more. The lowest bidder was the Saginaw Electrical Construction Company.

McArthur Bros. have stopped work for the winter on the Edison Sault power-house improvement. They have been operating since the first of June. The ground for the power house has been put into condition and the foundations laid; the dike for the canal has been built within about 100 feet of its proposed level. In the canal itself, at the foot of the power-house site, all the earth has been removed and about two-thirds of the rock, and when the company resumes work in the spring the building will be immediately commenced. The building will have nine drawpipes or flumes. The pumping facilities in use are unusual. Two four-inch and one 10-inch pump are now in use and another 10-inch pump is to be installed. One four-inch pump is operated by electricity, as will be the new 10-inch. These will give a capacity of 60,000 gallons an hour.

A deal is being negotiated for the transfer of the control of the Muskegon Traction and Lighting Company from the eastern owners to other interests. It is said that the new owners will be the Grand Rapids-Muskegon Water Power Electric Company, but this has not been verified. The power company is preparing to market power, which it will manufacture at its dams on the Muskegon River in Muskegon and in Grand Rapids. It will also furnish power for the operation of the Grand Rapids, Grand Haven and Muskegon railway. B.

Northwestern States.

Minneapolis, December 2.—The county board of Polk County, Minnesota, contemplates installing an electric-light plant for the Court House. The estimated cost is $3,500.

P. C. Thompson and others of Detroit, Mich., have bought the gas and electric-light plants at Red Wing, Minn., and will expend considerable money in improvements.

J. A. Becker of Milwaukee proposes the construction of an electric railway from Sturgeon Bay, Wis., to the towns to the north of that place.

The town of Bettendorf, a suburb of Davenport, Iowa, contemplates installing a lighting system.

The Duluth and Iron Range Railroad Company will spend about $500,000 in extensions to its machine and repair shops and electric plant at Two Harbors, Minn.

The A. R. Coats Electric Light Company of Kaukauna, Wis., is extending its wires to Little Chute to furnish that village with lighting facilities.

The Wisconsin Light and Power Company of La Crosse, Wis., has placed its new power plant in operation. It is in charge of Charles Williams.

The Des Moines-Winterset-Creston (Iowa) Interurban Company has filed articles of incorporation, and the construction of the proposed new trolley line is assured. W. D. Skinner is president of the company and Milo Ward is secretary.

The street-railway service at Duluth, Minn., and Superior, Wis., was entirely laid out by the heavy storm of November 27th and 28th, and it was several days before all lines were in full operation again.

A syndicate of Detroit (Mich.) capitalists will take over the Red Wing (Minn.) Gas and Electric Company, which will be reorganized and the plant enlarged at a cost of about $40,000. F. A. Platt of Detroit heads the list of new stockholders.

There is talk of a new company putting in a plant at Council Bluffs, Iowa, for incandescent street lighting, and the company will probably make a bid for this work, but it will not bid in competition with the City Gas and Electric Company on the arc-light proposition.

I. Steele proposes to install an electric-light plant at Hartley, Iowa. R.

Rocky Mountain States.

Salt Lake City, November 27.—The Intermountain Power Company of Nevada has filed with the county recorder at Salt Lake City a trust deed to the Capitol Savings and Trust Company as security for a first mortgage at six per cent., amounting to $750,000. The company's franchises and valuable water rights in the streams near Salt Lake are conveyed to the trust company, of which Bismarck Snyder of Salt Lake is secretary. It is the purpose of the company to establish a plant in the near future to supply electrical energy in Salt Lake and Summit counties.

The electric-light company at Laramie, Wyo., has received a generator and machinery for the full equipment of its plant.

A company which will shortly be organized at Basin, Wyo., with a capitalization of $50,000 projects the establishment of an electric-light plant in that city. The organizers are Josiah Cook, Barnette G. Robers, G. W. Richardson and associates.

Citizens of Lehi, Utah, at a recent mass meeting, decided to urge upon the City Council the importance of issuing bonds for the purpose of increasing its stock in the Utah County Light and Power Company. The company's plant is at present inadequate and it is proposed to increase the capitalization to $200,000 and to extensively improve the plant.

A franchise for the construction of an electric railway from Salt Lake City, Utah, to Garfield, a distance of approximately 18 miles, has been petitioned for by Captain Fred G. Palmer. An immense smelter plant is now being constructed at Garfield on the shores of the Great Salt Lake.

C. K. Durbin of the Consolidated Gas, Electric Light and Power Company of Denver, Colo., is now in Tucson, Ariz., arranging preliminaries for the construction of an electric railway in that place. He is accompanied by D. L. MacAfee, who will attend to the technical part of the plant.

The Union Power, Light and Water Company of Reno, Nev., has just closed a contract with the Western Pacific Railroad Company to supply light and power for the construction work of the Western Pacific railroad in the Sierra Nevada Mountains. As a result of this contract the Union company will run transmission lines from its plant to Beckwith Pass, and it is the company's intention to construct a line of sufficient capacity to supply light and power for the towns of Loyalton, Beckwith, Boca and Quincy as well as to the large ice and lumber companies in that vicinity.

The Nash Electric Supply Company, with a capital stock of $15,000, has been incorporated in Albuquerque, N. M., by M. Nash, Kittie Nash and Carl Gilman. G.

Pacific Slope.

San Francisco, December 1.—According to the announcement by L. F. Hanchett, president of the San Jose, Santa Clara and Alum Rock Park Electric Railway Company, about $1,000,000 will be expended in the improvement of that company's line in and about San Jose. The entire system will be reconstructed as a double-track broad-gauge railway. This includes the line up Alum Rock Canyon as well as the lines in San Jose and in Santa Clara. New rolling stock will be ordered, which will be equipped with high-power motors and air brakes. A 15-minute service will be inaugurated between San Jose and Alum Rock Park, with a 10-minute service on Sundays and holidays. The company has already applied for the franchises necessary for the reconstruction of its roads.

The United Railroads of San Francisco is now endeavoring to secure a permit from the San Francisco city authorities to reconstruct the present Sutter Street cable railway as an overhead trolley road. This project has met with serious opposition, as there is a strong feeling against allowing any more trolley systems to be constructed in the busy sections of San Francisco. An effort has been made to prevail on the railroad company to put in an underground conduit system, but according to the officials of the company the road will either be conducted as a cable line or reconstructed as a trolley line.

Charles Forman, secretary of the Pacific Power and Lighting Company, and one of the representatives of H. E. Huntington in street-railway and electric matters in Southern California, has filed notice of appropriation on 50,000 inches of water from the San Luis Rey River in San Diego County. It is understood that this is preliminary to the construction of a large power plant on Warner's ranch, about 20 miles from Oceanside, Cal. It is understood that a new company will be incorporated to construct and operate the power plant, transmission lines and other electric enterprises which will be established to utilize this appropriation of waterpower.

John Martin and L. B. Lowe, large stockholders in the California Gas and Electric Corporation, have purchased from James McNeil of Santa Cruz the rights and property of the Santa Cruz Electric Light and Power Company. At the present time the Santa Cruz Electric Light and Power Company is buying power from the Big Creek Power Company, which has plants at Big Creek and Watsonville; but it is assumed that the new owners will connect their plant with the lines of the Bay Counties Power Company, one of the subsidiary companies of the California Gas and Electric Corporation.

The C. E. Cook Electric Company has been incorporated at Los Angeles, Cal., with an authorized capital stock of $25,000 by C. E. Cook, W. J. Shugert and A. St. Clair Perry. A.

PERSONAL.

I. A. McCormack, manager of the Harlem line of the New York Central railroad, has been made general superintendent of the electric division. His jurisdiction will extend from Mott Haven to High Bridge on the Hudson division and to Wakefield on the Harlem division.

Frederick C. Blanchard has resigned as superintendent of production at the Fort Wayne Electric Works. Mr. Blanchard, who has been a successful superintendent, will be succeeded by Robert Harding, who for 15 years has been connected with the office of the Fort Wayne Electric Works.

A. B. Richards, for 15 years manager of the Kansas City office of the Postal Telegraph-cable Company, has been promoted to be superintendent at Kansas City. He succeeds W. I. Capen, who will be transferred to the Chicago office of the Postal company. Mr. Richards is succeeded by Harry Morlan.

J. A. Brett, until recently connected with the Chicago office of the Westinghouse Electric and Manufacturing Company, has been transferred to Cincinnati, where he has taken up duties as general manager for the Westinghouse company in the Cincinnati territory. C. W. Regester has relinquished the management of the Cincinnati office to become general railway salesman for the company in the Chicago territory.

W. L. Bowers of Davenport, Iowa, former president of the Iowa Electrical Association, seeks to recover $2,000 damages from the Davenport and Suburban Railway Company. Mr. Bowers says that through the carelessness of a motorman his carriage was struck by a car and he was thrown to the ground, sustaining injuries from which he is still suffering. Until recently Mr. Bowers was superintendent of the Davenport Gas and Electric Company.

An interesting society announcement is that of the engagement of Claude L. Matthews of the firm of W. N. Matthews & Bro. of St. Louis to Miss Jane Skinker of that city. Miss Skinker comes from one of St. Louis' oldest and best families. Her patronymic will have a familiar sound to those who visited the St. Louis Exposition, as Skinker road, which took its name from a member of the family, was one of the exposition thoroughfares. The wedding is to be some time next June.

Owing to the death of Mr. George C. Bailey, late general manager, secretary and treasurer of the John A. Roebling's Sons Company in Chicago, Mr. A. B. Conover has been elected treasurer and general manager to fill this vacancy. Mr. Conover has been connected with the Chicago office for the last 18 years, a year ago having been appointed general sales agent, to look after the business during Mr. Bailey's absence on account of illness. He has a host of friends who will see in this step in advance a promotion that has been well earned.

Charles A. Thompson, founder of the Thompson-Bonney Company, electrical contractor of Brooklyn, died on November 27th at the Brooklyn Hospital, where he had been since election day, with congestion of the brain. He was stricken while coming out of a restaurant, and was unconscious thereafter until death came. Mr. Thompson was born in Lima, Ohio, 44 years ago, and was first with the Fort Wayne Electric Works. He afterward went with the Stanley Electric Manufacturing Company of Pittsfield, Mass., and then with the Fries Light and Power Company of Winston-Salem, N. C. Eight years ago he came to New York to take the position of superintendent of the Manhattan Electric Company. Five years ago he started in business in Brooklyn, forming the Thompson-Bonney corporation three years later.

ELECTRIC LIGHTING.

Zenor & Meek have decided to establish an electric-light plant at Grand Junction, Iowa.

The University of Wisconsin is to build a new $250,000 light, heat and power plant at Madison, Wis.

The Socorro (N. M.) Water, Light and Ice Company has been incorporated with a capital stock of $30,000.

The Litchfield (Ill.) Heating Company has been incorporated with a capital stock of $15,000 by Paul McWilliams, E. F. Sweeney and G. A. Sihler.

The company will operate a heat, light and power plant.

The city of Braymer, Mo., is talking of getting an electric-light plant.

S. C. Dowell of Walnut Ridge, Ark., proposes to establish a $25,000 electric-light plant at Pocahontas, Ark.

V. J. Duncan and J. J. Joy of Ottawa, Ill., contemplate establishing a gas and electric-light plant at Marseilles, Ill.

A proposition is before the voters of St. Matthews, S. C., to issue $20,000 bonds to construct an electric-light plant and put in waterworks.

The Santa Fe railroad is installing a $25,000 electric-light plant at Shawnee, Okla., for lighting the roundhouse building and 40 miles of yards.

The Georgia Manufacturing and Public Service Company of Marietta, Ga., has been incorporated with $600,000 capital stock to enlarge waterworks, operate electric-light plants, paper mills, boxboard mills and develop waterpowers. J. H. Wallace, Temple Court Building, New York city, is the architect and engineer in charge; Moultrie M. Sessions is president and treasurer, and E. J. Powers, vice president.

The Helena (Mont.) Light and Railway Company, which took over the entire electric-lighting, street-railway and gas service of Helena, reports that the common and preferred stock now issued amounts to $935,000. The present issue of securities provides funds for acquiring the properties and more than $160,000 for improvements and additions. For 10 months of 1905 the net earnings were $66,081, nearly $14,000 more than the annual fixed charges.

A recent shipment of machinery was made to the Hawaiian Electric Company of Honolulu, consisting of a 1,200-kilowatt Westinghouse alternating-current generator, and three 500-kilowatt oil transformers, with the necessary auxiliary apparatus. This material is intended for the power station on Kauia Island, the most northern of the Hawaiian group. The shipment went direct from New York on the steamship Arizonian, and is the second of a series of similar shipments, the first having gone forward some 30 days ago.

ELECTRIC RAILWAYS

The McKinley syndicate has closed a deal with the Springfield (Mo.) Traction company by which it acquires the street-car lines of Springfield.

F. S. Granger of Los Angeles, Cal., is looking over the country with a view of establishing an electric railway from Florence, Colo., to Canon City and the adjoining coal camps.

Younger Alexander of Lexington, Ky., has been granted a franchise by the court of Montgomery County Ky., to build an electric line from Paris to North Middletown and Mt. Sterling, a distance of 21 miles, at a cost of $500,000. Several other prominent men are associated with Mr. Alexander in the new proposition.

The Eastern Wisconsin Railway and Light Company of Fond du Lac, Wis., which owns the 20-mile interurban railway between Fond du Lac and Oshkosh, has completed the laying of rails over its right-of-way into the city of Oshkosh. Formerly the tracks of the local company at Oshkosh were used for an entrance into that city. The new arrangement permits an improvement in the interurban service.

The third single-phase electric railway in Indiana is to be completed and in operation between Fort Wayne and Decatur about April 1, 1906, according to the statement of W. H. Fledderjohann, general manager of the Fort Wayne and Springfield Railway Company. Most of the grading is completed, and some ties and poles have been placed. The road is 20 miles long. A power house has already been built and equipped at Decatur, the headquarters of the company. The largest generator is a 450-kilowatt Westinghouse machine.

Large gains for the month of November, 1905, are reported by all of the elevated roads in Chicago. The percentages of gain in daily average number of passengers carried over November, 1904, are as follows: Northwestern Elevated Railroad Company, 12.50 per cent.; South Side Elevated Railroad Company, 8.22 per cent.; Metropolitan West Side Elevated Railway Company, 14.20 per cent., and Chicago and Oak Park Elevated Railway Company, 10.60 per cent. Following are the average daily number of passengers carried by the four roads for November: Metropolitan, 132,276; Northwestern, 83,597; South Side, 92,156; Oak Park, 50,611. The total for all the L companies was 359,640.

POWER TRANSMISSION.

The Great Northern Power Company of Duluth, Minn., has begun the work of stringing the wire from the new power plant at Thomsons through West Duluth to the distributing plant in Duluth, where the electricity will be distributed to local firms which have contracted to use the company's current for power.

J. H. Fitzpatrick and associates are reported as having surveys made for the development of a waterpower electric plant at Anthony Shoals on the Broad River near Washington, Ga. It is proposed to build a dam, erect an electric plant and transmit the current to Washington for industrial purposes.

The Canadian Niagara power works were visited on Friday, December 1st, by several ministers of the government of the Province of Ontario, who desired to inform themselves on the real situation at Niagara. In the party were Hon. J. J. Foy, attorney-general; Hon. A. J. Matheson, provincial treasurer; Hon. Frank Cochrane, minister Crown Lands and Mines; Hon. Nelson Monteith, minister of Agriculture; Hon. Major Hendire and Capt. J. Thompson of Toronto. The members of the party came to Niagara as guests of Hon. Evan E. Fraser, M. P. P., and they were by him escorted about. They reached Niagara Falls about 11 a. m., at once boarding the private car, Ondiara, of the Niagara Falls Park and River railway, and went to Victoria Park, viewing the river, falls and power works as they went. They went down in the scenic tunnel that leads behind the Horseshoe on the Canadian side, and later went down and through the tunnel tailrace of the Electrical Development Company of Ontario. After lunch they took a trolley ride down the river to the point where the new transmission line is being strung across the gorge, so that they might know the preparation that is being made to transmit power developed in Canada across the border to New York state.

PUBLICATIONS.

One of the first of the season's calendars comes from the Philadelphia Bourse. "To sell goods, exhibit at the Bourse," it says.

The first number of the Interurban Railway Journal, a weekly paper published at Indianapolis, Ind., is out. It is a creditable issue.

"Gas Comforts" is the title of a neat illustrated booklet issued by the Denver Gas and Electric Company. It relates exclusively to gas heating and cooking.

From the office of the National Fire Protection Association, 382 Ohio Street, Chicago, Secretary W. H. Merrill, Jr., is sending to members reminders and hints relative to hazards, at this season of the year, of Christmas decorations and displays.

The Industrial Department of the Erie Railroad Company, 21 Cortlandt Street, New York, is sending out a bulletin showing new manufacturing plants on the Erie road between Chicago and New York. Inquiries of manufacturers as to locations are treated by Mr. Luis Jackson of the company's industrial department.

A folder distributed by the Robert Instrument Company of Detroit, Mich., contains some pointed facts concerning the Robert guaranteed pocket meters. The Robert instruments are designed and adapted especially for the purpose of ascertaining the exact condition of batteries, and are useful in all classes of automobile, gas engine and telephone work.

Crushing rolls for crushing ores, rock, coal, salt, etc., as manufactured by the Allis-Chalmers Company of Milwaukee, are described in a recent catalogue which is plentifully illustrated with pictures of the various machines and diagrams showing the arrangement of the machines in a plant. The catalogue is No. 128, and the rolls described are known as styles A, B and C.

Bulletin No. 27 from the H. T. Paiste Company of Philadelphia, coming as it does just before the holiday rush, is wisely devoted to window lighting in which Fielding receptacles and new weatherproof sockets manufactured by the company play an important part. Some good illustrations of effective window lighting with Fielding receptacles are contained in the bulletin.

A very convenient book for manufacturers and others desiring locations for industries is published by the Illinois Central Railroad and entitled "Locations for Industries." The pages are descriptive in a statistical sense of the principal cities and towns along the Illinois Central and Yazoo and Mississippi Valley railroads, whose lines reach 12 states, extending from South Dakota in the Northwest to Louisiana in the South. The data was compiled by J. C. Clair, industrial commissioner of the Illinois Central road, with office at No. 1 Park Row, Chicago.

The October supplement to the National Electrical Code is out and contains a list of electrical fittings that have been examined and approved by the Underwriters' National Electrical Association. The fittings are for use under the rules and requirements of the National Board of Fire Underwriters for the installation of electric wiring and apparatus. The devices and materials upon which tests have been made under the specifications for testing given in the last edition of the National Electrical Code, and the working of which have been noted in practice, are listed for the convenience of underwriters, electrical inspectors and engineers who may desire to readily ascertain the names of the manufacturers of all devices judged to be designed in compliance with these specifications.

Fort Wayne multiphase integrating wattmeters, single-phase motors and small-power motors are described in as many bulletins sent out by the Fort Wayne Electric Works of Fort Wayne, Ind. The wattmeters are of the form known as type K, and are capable of simultaneously registering the watt-hours in the several phases of a multiphase circuit, the apparatus being embodied in a single instrument. The single-phase motors belong to a new line which has been developed by the company to satisfy the needs of many locations where such a motor of small capacity is desired, having at the same time the attribute of a high power factor. The bulletin on small-power motors treats quite fully of the company's extensive line of these machines. The company has issued also an instruction book for users of its multiphase induction motors.

SOCIETIES AND SCHOOLS.

The next regular meeting of the newly formed American Electrical Salesmen's Association will be held at the Grand Pacific Hotel, Chicago, Saturday, January 20, 1906, beginning at 9 a. m. George H. Erich of Rockford, Ill., is the secretary.

The Rejuvenated Sons of Jove held an initiation meeting in Dallas, Tex., on November 28th, when 22 candidates were initiated. Ninety members of the order of electrical men were present at the meeting. Early in the evening a novel parade took place in the streets of Dallas, after which the candidates were put through the rites of the order. After the initiation a smoker was held. The next initiation, it is said, will take place in St. Louis some time in January.

Special evening lectures given by the department of electrical engineering of the University of Washington at Seattle, Wash., will cover the three general subjects of electric traction, central-station practice and electric power transmission. There will be five lectures under each subject. Egbert G. Allen, chief electrical engineer of the Seattle Electric Company, will give the lectures on electric traction; J. D. Ross, chief electrical engineer of the Seattle municipal electric-light and power system, will lecture on central-station practice, and John Harisberger, chief electrical engineer of the Seattle-Tacoma Power Company, will give the lectures on electric power transmission. The first of the series was given by Mr. Allen on December 4th, and the rest will follow at intervals till the end of the school year.

TELEGRAPH.

It is expected that the work of placing the telegraph wires underground between London and Glasgow will be completed by the middle of December.

Consul McNally of Liege, Belgium, writes that the receipts from the government telegraphs and telephones, owned and operated by the Belgian government, for the first four months of 1905 amounted to $749,129, against $692,649 for the corresponding period of 1904, showing an increase of $56,481.

In St. Paul, Minn., Judge Sanborn, in the United States Circuit Court of Appeals, has filed a decision in which he holds that telegraph companies are only obliged to use ordinary care in determining the identity of senders of messages, and that losses sustained by persons whose names are improperly used are not to be assessed against telegraph companies.

For some 40 miles out of Zamboango, Philippine Islands, the bed of the ocean consists of coral reefs, which, aided by the strong tides that flow, frequently cut the telegraph cables and render them useless. Because of these frequent interruptions it is said that General Greely, chief signal officer of the United States Army, has decided to install a space-telegraph system between Zamboango and Jolo, to be in operation early next year.

MISCELLANEOUS.

At Winona, Minn., an electrical inspection ordinance, modeled largely after the one now in force at Duluth, is being drawn by the city attorney on request of the City Council, and will probably be adopted without serious objection.

The new Cunard steamer Carmania, one of the first of the big ocean-going ships to be equipped with turbine engines, sailed from Liverpool on December 2d. Several marine engineers were on board to observe the working of the turbines.

A unique and at the same time useful device is described in a recent bulletin from the Emerson Electric Manufacturing Company of St. Louis. It is an electric bottle washer for cleaning bottles and arc-lamp globes. One of the washers shown is driven by a one-fifth-horsepower motor, with a bracket for attaching it to a tub or sink. Another

bulletin from this company describes a line of single-phase induction motors built in sizes from one-fortieth to one-sixteenth horsepower.

The project to hold an industrial exposition of the South at Atlanta, Ga., in 1910 is receiving support. Co-operation in making the undertaking a success is manifest on the part of substantial individuals and corporations in various parts of the country.

It is promised that the electrical show to be held at Madison Square Garden for two weeks, beginning December 12th, will be formally opened by President Roosevelt, who, by the pressure of a button in the White House, will set in motion the machinery of the exhibition.

Contracts have been let for power from the new dam being constructed across the Missouri River at Helena, Mont., for a plant near Corbin, Mont., which will treat ores by an electrical process. The company is known as the Montana Electrolytic Reduction Company. It is composed of Cleveland (Ohio) capitalists.

On account of delays occasioned by the late arrival of the steamer in New York, the New York Central railroad was compelled to run a special train to get Sarah Bernhardt to Chicago in time for the announced opening performance. The train covered the 963 miles in 20 hours and four minutes, without mishap, and thus obviated disappointment to Chicago admirers of the artist. The great actress sent a congratulatory telegram to the great railroad company.

Commander Beehler of the naval station at Key West has reported to the Navy Department that the wireless-telegraph station at Key West has received an eight-word message by the De Forest space-telegraph apparatus from the station at Colon. The distance is about 1,000 nautical miles, and the Island of Cuba lies directly across the line between the two points. The De Forest company announced also that its station at Manhattan Beach has been in communication with the company's station in both Galveston and New Orleans, there being a distance of more than 1,200 miles between the stations.

Director E. H. Overshiner of the Chicago Electrical Trades Exposition hopes to secure the installation of a government space-telegraph station at the exposition, which is to be held in January. If he is successful in his negotiations through Senator Hopkins, the station will be used to carry on government tests, and it is the desire of the management that some new records in long-distance signaling be made for both direct and relay messages. The station would be under the direction of Rear-admiral Manney. It is reported that more than half the floor space of the Coliseum has already been sold for the show, and it is reasonable to believe that the entire available 3,800 square feet for exhibition purposes will be gone before the opening.

In competition with the leading British and Scotch railmakers, the United States Steel Corporation, through its Lorain Steel Company branch, submitted the lowest bid to the London County Council for the rails required in equipping the street-railway system in the northern part of London. The American price quoted was about $31 per ton, delivered on the other side, eqivalent to about $24.50 at the mills. The existing price for rails made by the acid process, for which the London contract specifies, is around $30 per ton at the mills. The lowest British bid was nearly $34.50 per ton.

TRADE NEWS.

E. L. Boise has been succeeded in the electrical supply business at Walla Walla, Wash., by Peck & Boise.

The Nash Electrical Supply Company of Albuquerque, N. M., has been incorporated with a capital of $15,000 by M. Nash and others.

Among the petitions for relief that were recently made to the Canadian Tariff Commission by representatives of various business interests at Montreal was one from electric switch companies, which desire, as they are subjected to severe competition from American manufactures, that slate and fiber, to be used in manufacture of electrical goods, should be admitted free.

The Railway Surface Contact Supplies Company has been incorporated in Delaware to manufacture various inventions and devices with which to equip railways and cars operated on the surface-contact system and other supplies for electric roads. The incorporators are W. M. Stephens, P. E. King and G. L. Campbell, all of Williamsport, Pa., and the capital stock of the concern is $3,000,000.

A dispatch from Schenectady dated December 5th, is as follows: At a special meeting of the stockholders of the General Electric Company held here today it was decided to increase the capital stock of the company by the amount of $11,674,500, consisting of 116,745 shares of the par value of $100. This will increase the capital stock from $48,325,500 to $60,000,000. The number of shares represented at the meeting was 335,000.

The largest Westinghouse property is that of the Westinghouse Electric and Manufacturing Company, covering over 47 acres at East Pittsburg, where everything electrical is manufactured. Some idea of the magnitude of the business handled at this plant can be formed from the fact that the company reports that during the month of October the shipment of electrical apparatus from this factory, exclusive of a large number of local freight and express orders, amounted to approximately 17,000,000 pounds, consisting of over 5,000 individual consignments.

The new Central Electric Manufacturing Company of 1525 Second Avenue, Rock Island, Ill., will have its new plant in operation by December 15th. It will manufacture the Black Hawk dry battery, for which remarkable efficiency is asserted. Carl Jaeger, the manager of the new concern, and his brother control the patents. Two types of cell will be made—one intended for immediate use and the other designed for dealers, who may keep it on their shelves for some time.

The Oswego Boiler Works at Oswego, N. Y., has been purchased by New Yorkers, understood to be associated with the A. D. Granger Company, the machinery house at 95 Liberty Street, New York, with branches at Philadelphia and Pittsburg. The plant, which occupies about 20 acres on Lake Ontario, was established some 12 years ago, and it is expected will be placed in active operation at once. Steel-plate work in all branches, including boilers, tanks and stacks, will be manufactured. The new company will be known as the Oswego Boiler and Engine Company, with the main office at Oswego, N. Y.

BUSINESS.

W. N. Matthews of W. N. Matthews & Bro., St. Louis, Mo., visited Chicago recently. Mr. Matthews reports a decidedly good business for the Stombaugh anchor, and is delighted also with the reception given his Kearney cable clamp by linemen all over the United States.

The Sandwich Pole-changer Company of Sandwich, Ill., calls attention to the Sandwich pole-changer as an up-to-date instrument made by the best mechanics, of first-class material. The instrument does not infringe any patent that has been issued on pole-changer apparatus.

The Phelps Company, Detroit, maker of the well-known Hylo lamp, is gratified with the constantly increasing demand for its product. The company now sends its lamps on 30 days' free trial to those who are not familiar with it. As a consequence the business of the company has been greatly increased.

The Porter Cedar Company of Saginaw, Mich., of which J. S. Porter is president and H. C. Hyde secretary and treasurer, says that it has done a larger business in 1905 than at any time in its history. This company is a big producer of cedar poles and ties, and supplies a large number of consumers, particularly in the central and western states.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) November 28, 1905.

805,439. Lightning Arrester. Arthur J. Berry, Marion, Ohio. Application filed February 25, 1905.

Concentric tubes and plugs of insulating material closing the ends of the tubes and supporting them in fixed relation are the characteristic features. The plugs have outer flanges notched in their edges to provide seats to properly position the co-operating wires.

805,448. Magnetic Separator for Ores. Henry F. Campbell, Melrose, Mass.; Jeannette L. Campbell, executrix of said Henry F. Campbell, deceased. Application filed January 20, 1904.

Magnetic ore-separating machines described in the patent contain each a magnet, a flat table composed of non-magnetic material located beneath the magnet and secured against movement in the plane of the surface of the table and means for jarring the table without bodily raising it. Means are supplied for causing a film of comminuted ore of substantially uniform thickness to travel along the table and for presenting the ore to the action of the magnet while separated from its poles by an intervening space.

805,501. Method of Producing Chemicals in Electric Furnaces. Edward R. Taylor, Penn Yan, N. Y. Original application filed April 4, 1901. Divided and this application filed January 24, 1902.

A method of continuously effecting reactions and reductions in an electric furnace consists in introducing into the furnace streams of fragmentary conductive material adapted to constitute self-renewing electrodes. The streams are fed into the bottom of the working chamber of the furnace and toward each other by gravity.

805,502. Method of Producing Chemicals in Electric Furnaces. Edward R. Taylor, Penn Yan, N. Y. Application filed June 9, 1902. Renewed February 8, 1904.

Production of chemicals in an electric furnace is done by feeding fragmentary conductive material into the bottom of the working chamber, charging the chamber with material capable of producing a gaseous product, passing a suitable electric current through the charge by means of the fragmentary conductive material, discharging a gaseous product, fusing the residue by a sufficient current and drawing off such residue in fused condition.

805,505. Automatic Regulator for Electric Circuits. Montgomery Waddell, New York, N. Y. Application filed June 28, 1904.

A dynamo has two sections of field-magnet coils wound so as to magnetically oppose each other, one end of each section being electrically connected to one armature brush and the remaining ends connected to each other between the brushes. A rheostat is connected in shunt with one of the coils and electromagnetic means are in circuit with the dynamo for varying the resistance in the rheostat.

805,509. Electric Cut-out. Willes P. Wright, Blandinsville, Ill. Application filed June 13, 1904.

A hollow bracket having a central and opposite side openings supports a tubular electrolier standard having an open end fitted in the central opening of the bracket. A cut-out is carried by the standard below the bracket, line-wires entering the bracket and passing out through one of the side openings to the cut-out. Lead wires extend from the cut-out into the hollow bracket through the other side opening and thence into the tubular standard through its open end.

805,547. Armature for Electrical Machines. William T. Hensley, Boundbrook, N. J. Application filed March 25, 1905.

Armature-disks having teeth between which the armature coils are arranged are provided with spacing pieces arranged along the coils and having shoulders engaging the teeth, the shoulders being of less width than the width of the teeth on the disk and forming ventilating-spaces between the spacing piece.

805,557. Electric-current Generator. William Kaisling, Chicago, Ill., assignor to the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. Application filed May 31, 1904.

A magneto generator for telephone work is described.

805,568. Trolley Base. Henry R. Lockhart, Westmount, Canada. Application filed July 23, 1904.

In a trolley-base are combined a trolley pole socket, a bar, a bearing vertically pivoted in the car-roof in which the bar is horizontally journaled and pivotal connections between the socket and the bar at right angles to the bearing.

805,574. Electric Gas Lighter. Joseph Mlada, Manitowoc, Wis. Application filed March 21, 1905.

An electric igniter comprises a sparking electrode connected to the controlling cock and having an arm movable across the gas outlet from the burner. A sparking electrode is supported on the burner and has an arm also movable across the gas outlet. Means yieldingly hold the arm above the outlet in the path of movement of the first-named arm.

805,597. Telescopic Rammer for Ordnance. Alfred A. Thresher, Dayton, Ohio. Application filed July 30, 1904.

Combined with the telescopic sections of the apparatus is a mount in which they are supported having an opening extending transversely below the sections. Gearing operates the sections in turn operated by an electric motor.

805,598. Telescopic Rammer Motor. Alfred A. Thresher, Dayton, Ohio. Application filed July 24, 1905.

A motor for telescopic rammers embodies heads, armature, armature shaft journaled in the heads and a field ring connecting the heads, the ring being of substantially uniform section to enter the rammer mount and having an external flange near one end adapted to abut against one of the faces of the rammer frame.

805,619. Electric Signaling System. William S. Aungst and Arthur S. Aungst, Alliance, Ohio; said Arthur S. Aungst assignor to said William S. Aungst. Application filed March 20, 1905.

Combined with a telephone central-office jack are a subscriber's line connected therewith, an alarm-station register having two markers, a circuit from the register to the central office and a plug in the circuit at the central office. A battery at the alarm station is included in the line circuit with one of the magnets of the register, a grounded circuit including the battery and the other magnet of the register. A make-and-brake call mechanism independent of the local telephone circuits is looped on the subscriber's line, and a ground connection is used for the make-and-break call mechanism.

805,650. Panel Board. Hubert Krantz, New York, New York, N. Y. Application filed December 29, 1904.

In a panel board, a fuse plug receptacle, a bus-bar passing through the base, a superposed cross bar entering into and terminating within the receptacle, and a branch-line bar entering from the opposite side compose the apparatus.

805,694. Method of Electrostatic Separation. Philip H. Wynne, Boston, Mass., assignor to Charles Henry Huff, Brockton, Mass. Application filed August 2, 1904.

Separating commingled particles according to their diverse conductivities is done by subjecting them to static electricity on an electrode under conditions favorable to effective contact therewith. The static electricity is applied in recurrent accessions of potential all of one sign, whose durations are adjusted to operate separately upon the particles of better conductivities.

805,714. Visible and Audible Signal. John L. Creveling, New York, N. Y. Application filed October 27, 1900.

As a system of signaling, there are associated a source of energy, means producing by the energy visible or audible signals, and means controlling the signal-producing means. The latter device comprehends a detector responsive to Hertzian waves or oscillations and means of setting up Hertzian waves or oscillations controllable by the operator to whom the signal is visible or audible.

805,724. Wire-cutting Mechanism. Noah S. Harter, Chicago, Ill., assignor of one-half to Charles R. Barrett, Chicago, Ill. Application filed December 30, 1904.

Mechanism adapted to feed a wire coil or the like in a longitudinal direction has a fixed cutter and a reciprocating cutter arranged in the path of the wire coil. An electromagnet is adapted to impart rectilinear movement to the reciprocating cutter, a circuit-closer being arranged in the path of the wire coil passing beyond the cutting mechanism. A source of electromotive force embracing the electromagnetic mechanism is controlled by the circuit-closer. (See cut).

805,725. Controlling Device for Electric Generators. Moritz von Hoor, Friedrich Reinitz and Leopold Stark, Budapest, Austria-Hungary. Application filed April 17, 1901.

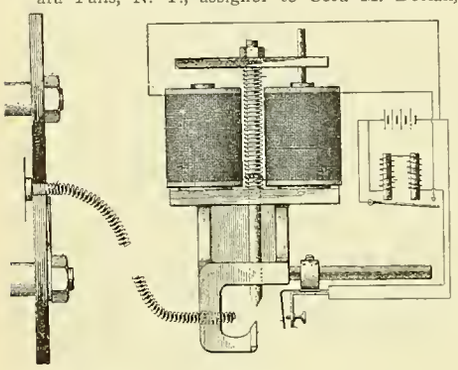
Controlling apparatus for producing a uniform voltage in electric generators embodies a main dynamo running at variable speed and an auxiliary dynamo running at a speed proportional to that of the main dynamo. A circuit of constant potential is supplied by the main dynamo. A single field-magnet winding suffices for the auxiliary dynamo, the winding being connected across the circuit. Main and opposing field windings are supplied for the main dynamo, the main field winding being connected across the circuit and the opposing field winding being connected across the brushes of the auxiliary dynamo. (See cut).

805,735. Rear-end-contact Telegraph Key. Samuel B. Lefley, Florinel, Pa. Application filed August 26, 1903. Renewed July 13, 1905.

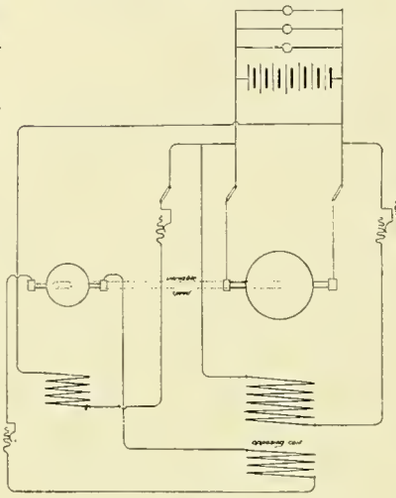
Mechanical features are described.

805,783. Electric Furnace. John S Dorian, Niagara Falls, N. Y., assignor to Cora M. Dorian, Niagara Falls, N. Y. Application filed March 27, 1905.

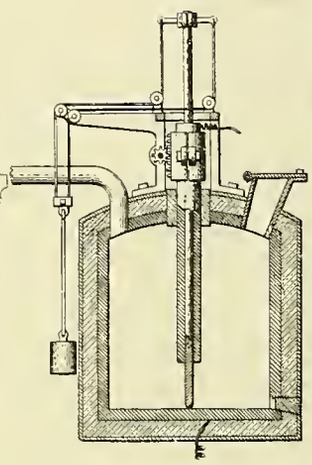
An electric furnace comprises a heating chamber, a pair of electrodes arranged in the chamber, and a resistance member electrically connecting the electrodes. One of the electrodes is moveable lengthwise of the resistance member for varying the extent of its exposure or its heating effect. (See cut).



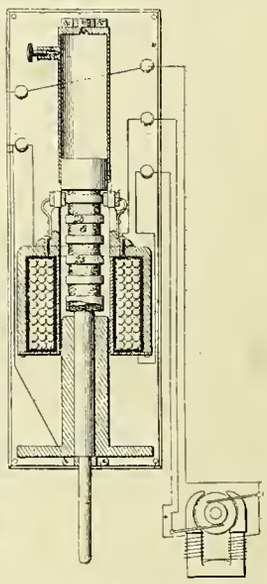
NO. 805,724.—WIRE-CUTTING MECHANISM.



NO. 805,725.—GENERATOR CONTROLLING DEVICE.



NO. 805,783.—ELECTRIC FURNANCE.



NO. 806,009.—AUTOMATIC MOTOR STARTER.

805,788. Electric Strain Insulator. Samuel L. Foster, San Francisco, Cal. Application filed January 16, 1905.

The insulator is made in two parts, one a link like portion with means for attaching the stay cable and the other an insulating body within the link for holding the cable holding the conductor.

805,790. Sparking Device. Benjamin G. Gilbough, Chicago, Ill. Application filed December 30, 1904.

Details are described.

805,795. X-ray Tube. John O. Heinze, Jr., Lowell, Mass. Application filed March 16, 1905.

In an X-ray tube are a cathode and a shield made out of metal and mounted on the end portion of an anode-stem. The shield has two holes, the first hole passing through it, a portion of the hole having a thread. The second hole leads into the first hole to receive the cathode stream. A plug having a hard metal surface is provided with a screw thread, whereby it may be screwed into the thread portion of the second hole to secure the point of bombardment of the anode in the path of the cathode stream.

805,827. Railroad Signal Circuit. Eugene W. Vogel, Chicago, Ill., assignor to the Railroad Supply Company. Application filed September 20, 1901.

Associated with a number of signals are closed track circuits controlling the operation of the signals. An insulated track section is situated between the signals, to the rails of which the circuits are connected, and a source of electricity is directly connected to the rails of the track section. By this arrangement, when the first truck of a train enters the insulated track section the source of electricity is short circuited.

805,854. Magnetic Ore Separator. Eric Hedburg, Joplin, Mo., assignor to the American Reduction Company, Chicago, Ill. Application filed January 15, 1904.

In a compound magnetic ore separator are a vertical shaft and an upper and a lower electromagnet mounted axially thereon. Each magnet is provided with two pole pieces which form a shell inclosing the windings, and with a non-magnetic ring having a central outwardly extended flange upon which the contiguous edges of the pole pieces rest whereby the latter are separated.

805,856. Block System for Railroads. Albert N. Ireland and John T. Reese, Sioux City, Iowa. Application filed April 6, 1905.

The system is designed to ring an electric gong in the engineer's cab when its circuit is closed by the movement of an arm on the locomotive pilot which is moved by blocks on the railroad ties at certain points along the line.

805,874. Automatic Fire-extinguisher System. James G. Nolen, Chicago, Ill., and John D. Nolen, Toledo, Ohio; said John D. Nolen assignor to said James G. Nolen; said James G. Nolen assignor of one-half to Frank B. Cook, Chicago, Ill. Application filed September 11, 1902.

Combined with a valve of a fire-extinguisher system are a transmitter adapted to transmit a plural-impulse signal, a signal-responsive device, suitable circuit connections for the transmitter and responsive device, and means for actuating the signal-transmitter to cause it to transmit a signal and condition it for another signaling operation, the means are controlled by the valve for operation upon the movement of the valve from one position to another.

805,879. Illuminating Device. Adolph Richter, New York, N. Y. Application filed February 24, 1905.

A shaft adapted to be supported vertically, carries motor fields and a revoluble sleeve. A motor armature is attached to the sleeve which also supports an electric lamp, and an electrical circuit in which the lamp and motor are included are the remaining features.

805,901. Telephone-exchange System. Henrik T. Cedergren, Stockholm, Sweden. Application filed January 28, 1902.

Conductors connect the poles of a central battery respectively with the two branches of the line conductors, the connecting points of the conductors with the branches being situated between the respective spring jacks of the line's corresponding substations. Inductive resistances are interposed between the central battery and the line conductors, plug conductors uniting the spring jacks of different subscribers.

805,952. Electrical Muscular Exercising Machine. Robert O. Hammond, Buffalo, N. Y., assignor to Josiah S. Andrews, Buffalo, N. Y. Application filed May 23, 1905.

Combined with a suitable frame are an electric generator movable on the frame and electric conducting and operating cords arranged in circuit and connected to operate the generator and convey the current through the operator when moving the generator on the frame.

805,968. Junction Box. Edwin T. Greenfield, Monticello, N. Y. Application filed October 24, 1904.

A junction box is provided with an internal curvilinear extension in its bottom and one or more pairs of inleading conduit openings surrounding it. A single clamp is provided for each pair of conduits, the clamps being provided with means for effecting lateral pressure between the inner wall of the box, the ends of the conduit and the internal extension.

805,969. Separation of Metals. Noak V. Hybinette, Westfield, N. J. Application filed November 25, 1904.

Separating nickel from copper is done by electrolyzing an anode containing substantially an alloy of copper and nickel in a solution consisting of nickle sulphate and a weak acid, regenerating the solution and returning it.

806,009. Automatic Motor-starting Resistance. Ralph Scott, Wilkesbarre, Pa. Application filed June 15, 1904.

A solenoid having a soft-iron casing or housing contains a core having an enlarged flange that is attracted by the casing or housing when the solenoid is energized. Non-magnetic spacing means prevent contact between the flange and the casing. A resistance bar supported by the core and having spaced contact, a contact carried by the casing and adapted to engage the contacts of the resistance bar, and means for retarding movement of the solenoid core complete the apparatus. (See cut.)

806,017. Ignition Plug. Charles F. Splitdorf, New York, N. Y., assignor to the Electric Vehicle Company, Jersey City, N. J. Application filed March 7, 1903.

An ignition plug for explosive engines is the basis of the patent.

806,018. Electromagnetic Relay or Sounder. Thomas M. St. John, New York, N. Y. Application filed April 12, 1905.

Co-operating with a vibrating core having an appropriate winding, pivotally supported at one end, are front and back stops between which the free end of the core plays, a resilient plate of magnetic material having an upturned end supporting the core adjacent its pivot and means for raising or lowering the upturned end to adjust the spring tension applied to the core.

806,035. Electric Signaling and Electropneumatic Train-control System. John A. Whyte, Toronto, Canada. Application filed September 2, 1904.

A block comprises one insulated section of a conductor which is divided into a series of insulated sections. An insulated section of the first track rail is divided into a series of insulated sections, a second track rail being used as a common conductor for all the blocks. Line wiring connects one end of the section of the conductor with the extreme end of the immediately preceding insulated section of the first track rail, and suitable wiring connects the other end of the immediately preceding insulated section of the first track rail to the second track rail.

806,039. Electric Heater for Oil Wells. James E. Williamson and Charles E. Collins, Allegheny, Pa., assignors of one-third to Amalia S. Connelly, Pittsburg, Pa. Application filed January 23, 1896.

An electric heater for oil wells is associated with the oil pumping tube, the heater being separate and separately removable therefrom. There is a casing and an inner tube surrounding the pumping tube with means connecting the casing and inner tube and forming a closed annular chamber. An electric resistance in the chamber has suitable terminals leading out and means for raising and lowering the heater around the pumping tube whereby different sections of the tube may be heated.

806,052. Receiver for Wireless Telegraphy. Henry S. Blackmore, Mount Vernon, N. Y. Application filed May 8, 1901.

Apparatus for indicating electrical disturbances comprises two electrically conductive terminals and a material of relatively higher resistance. The material is capable of having its resistance lowered when exposed to the action of electrical rays of high frequency and capable of automatically regaining ohmic resistance.

806,067. Electrical Signaling Mechanism. David H. Coker, Piedmont, Ala. Application filed December 13, 1904.

Signalling mechanism is contained in a box or casing. It comprises the circuit controller and arrangement for operating the signal arm.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on December 4, 1905:

393,742. Dynamo-electric Machinery. W. F. Collins, New York, N. Y.
393,744. Indicator for Secondary Batteries. S. C. C. Currie, Philadelphia, Pa.
393,745. Armature for Dynamo-electric Machines. Leo Daft, Plainfield, N. J.
393,749. Trolley. F. E. Fisher, Detroit, Mich.
393,755. Mode of Making Secondary-battery Plates. W. W. Griscom, Haverford College, Pa.
393,756. System of Electric Lighting. William W. Griscom, Haverford College, Pa.
393,757. Train Lighting by Secondary Batteries. William W. Griscom, Haverford College, Pa.
393,814. Galvanic Battery. Peter C. Burns, St. Louis, Mo.
393,823. Submarine and Subterranean Electric Cable. Elias Flotron and Frances B. A. Royer De La Bastie, Paris, France.
393,824. Telephone-exchange Switch Fasteners. William M. Goodridge, Chicago, Ill.
393,828. Electric Water Elevator for Buildings. Albert E. Hall, Plainfield, N. J.
393,849. Dynamo-electric Machinery. Samuel E. Nutting, Chicago, Ill.
393,954. Method of Producing Electrodes for Secondary Batteries. Henry Woodward, Sheperd's Bush, County of Middlessex, England.
393,955. Electrode for Secondary Battery. Henry Woodward, Shepherd's Bush, County of Middlessex, England.
393,998. Electric Bell. James F. McLaughlin, Philadelphia, Pa.
394,035. Electric Motor. Charles J. Vandepoele, Chicago, Ill.
394,036. Duplex Electromotor. Charles J. Vandepoele, Chicago, Ill.
394,037. Constant Upward-pressure Contact for Overhead Conductors. Charles J. Vandepoele, Lynn, Mass.
394,038. Duplex Upward-pressure Contact. Charles J. Vandepoele, Lynn, Mass.
394,039. System of Suspending Electric Conductors. Charles J. Vandepoele, Lynn, Mass.
394,040. Workman's Electric Time Recorder. William K. Brassford and Edwin B. Maynard, New York, N. Y.
394,062. Apparatus for Removing Scale from Electric Conductors. Leo Daft, Plainfield, N. J.
394,075. Electric Motor and Dynamo-electric Machine. Orazio Lugo, New York, N. Y.
394,081. Electric Annunciator Target. Francis J. Fatten and Theodore A. Bingham, U. S. Army.
394,100. Indicator for Secondary Batteries. Stanley C. C. Currie, Philadelphia, Pa.
394,139. Sectional Double-line Electric Railway. Sidney H. Short, Columbus, Ohio.

WESTERN ELECTRICIAN

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LIBRARY OF ELECTRICAL ENG'G

Training of the Telephone Operator.

One need only to visit the operating room in a large telephone exchange and watch for a few minutes the motions of the operators, as their hands fly back and forth from plug to jack and among the various keys of the switchboard, to realize that only extreme skill and a cool head prevent an operator from getting into a hopeless tangle the moment she takes her position at the board. The idea is prevalent among the public at large that an inexperienced operator is put in the operating room at once, with no special training, there to work out her salvation at the expense of the subscribers' service. This conception is erroneous, as many of the large telephone companies now maintain fully equipped telephone schools, entirely apart from the operating department, where new operators are trained daily for from three to five weeks in those things which relate to switchboard manipulation. Here they are taught the "three P's" of telephony—principles, practice and politeness—which are so necessary in rendering satisfactory service to the company's patrons.

Such a school is maintained by the Chicago Telephone Company, and the methods there pursued in preparing competent operators for the service are particularly interesting. The school is located in Main Exchange and is under the immediate charge of a capable instructress, Mrs. Catherine Moore, who is herself, from personal experience, thoroughly familiar with every detail of the work. Upon her, with numerous assistants, devolves the no small task of keeping the ranks of the company's operators filled at all times with those who are in every way comepetent. The applicants from which she chooses are obtained by the company through a regular system of advertising, which must be followed energetically, for, as there are required for the work in Chicago about 2,500 operators, and as a large proportion of the girls marry before they have been long in the service, there is no time when the school is not well filled with new recruits.

Applicants for a position as operator are first required to fill out a detailed application blank and also to give references as to character, age, education, etc. These references the company takes pains to look up, and if they are found satisfactory and the applicant appears to be fitted for the work she is examined as to her hearing, enunciation, sight, quickness and memory. She is then given a physical examination by a medical matron, and if physically qualified she is ready to report for school work, and from that time her name appears on the regular pay-roll of the company.

From 8 a. m. to 5 p. m. every day the school work goes on, with the exception of Saturday, when it closes at one o'clock. The work is taken up in the form of a regular course consisting of 15 lessons. A lesson is first given in the form of a lecture. For this purpose the students meet in a lecture room and are instructed verbally in the principles of operation of the switchboard, the lecture being illustrated by charts showing the board and the apparatus. The students are then taken to the switchboard; not the exchange switchboard, but a 12-position board for the use of the school. Here the instructions are gone over again with the actual apparatus instead of the charts. From the switchboard the students go to the study room, where the verbal instructions are again dictated and taken down by the students in memorandum books. At the same time the instructions are analyzed and explained. Study of the theory of the apparatus then takes up one hour, after which the instructions are put in actual practice at the board. The next day the lesson is reviewed before new work is taken up.

In this manner the whole course of 15 lessons is gone through with. Some students will naturally be found to grasp the work more quickly than others. Those who are slower are given private tutoring to enable them to keep along with their class, but sometimes this does not suffice, and then the experiment is tried of putting them back with a class which began later. Thus some of the students may require four or even five weeks to complete the course, although the average time is about three weeks.

Supplementing the lectures and practical work, voice culture training is given in a separate room.

Application Department and Office.
Operating Room, Showing Monitor's Desk and Practice Switchboard.

Lecture Room in the Telephooe School.
Study Room.

TRAINING OF THE TELEPHONE OPERATOR.

In this room is a round table at which 12 persons may be seated. Jacks are placed around the edge of the table into which the students' instruments are plugged, connecting them with the instructor's desk. The instructor's instrument may be cut in on any of the student's circuits, and from her desk she is able to converse with any one of the 12 and "coach" her in the fundamental rules in answering, which are followed rigidly in actual practice, particularly on the rising inflection, which is carefully cultivated.

Of most interest to the students probably is that portion of the work which has to do with the actual practice at the switchboard. Here the girls are placed at the board and given instructions

ROOM WHERE MEDICAL EXAMINATIONS ARE MADE IN TRAINING SCHOOL FOR TELEPHONE OPERATORS.

covering the use of the apparatus and the methods of handling the various cords, plugs and keys. In the operating room every three students are in charge of two instructors—a monitor and a supervisor. The monitors sit at elevated desks, where they can overlook the students at the board. Each monitor acts as the calling and called subscriber for the three students under her charge. She calls for a certain number, and after the connection has been made she gives the disconnect signal of the called or calling subscriber, everything being carried on as in actual practice.

First, the answering call is taken up and the student must learn to give the familiar "Number, please?" with the proper rising inflection as she has been taught in the voice-culture room. Then follows the handling of this connection to the called number, and so on.

So thorough is the course of training that, after the students are familiar with the handling of ordinary connections, the instructors making the practice calls impersonate the various types of subscribers met with in ordinary practice, making their calls not only in the usual way, but also with various irregularities, so that their students may have

REST ROOM IN TRAINING SCHOOL FOR TELEPHONE OPERATORS.

actual experience in the handling of the various little personalities and idiosyncrasies of the public before meeting it under actual operating conditions.

Back of each three students at the practice switchboard is a supervisor as above mentioned. She helps the beginners with their connections and gives them general directions as to the proper handling of the apparatus. Beginning with the flat-rate service the girls follow through the various classes of service such as measured, dime and nickel, and are finally instructed in toll service. There are also two position of B board in the room, where they are instructed in the trunking service.

The accompanying pictures show the various departments of the school and also the facilities which are provided for the comfort of the students, including ample rest rooms and parlors. The students upon entering the school receive excellent lunches free of charge, as is the case with the regular exchange operators. These lunches are taken in the lunch room of the main operating force and are the only occasions when the students mingle with the regular operators.

Physical lectures are given by a woman physician, there being four lectures in each course. These the students find interesting and valuable, and many of them request to be allowed to hear the lectures the second time with a succeeding class.

After finishing the school work the student is ready to enter upon the exchange work proper. At first she is given a position where the work is of a less responsible and arduous nature than that at one of the big exchanges. For this reason she is at first transferred to evening work at some branch exchange, and is sent whenever possible to the exchange nearest her home. Here she works for five hours daily. As she becomes more proficient she is transferred to more difficult positions.

It will be interesting also to note the various comforts and conveniences that are provided for the operators of all the exchanges of the company. As mentioned before, substantial lunches are furnished the operators without any expense to them. Libraries of good books are provided in each exchange, generally by small contributions from the operators, which are duplicated by the company. At some of the outlying exchanges where space permits gardens are established, where

VOICE TRAINING IN THE SCHOOL FOR TELEPHONE OPERATORS.

the operators may find recreation in the open air during their "off-duty" periods. Parlors for their use are prettily decorated.

All these things are done for the operator to make her work as interesting as possible. At best the things she has to put up with from the unthinking public are annoying enough, and for the short periods each day when she is not at the switchboard it is the aim as far as possible to surround her with all the little comforts and conveniences which will go to lend a more cheerful aspect to the work.

Electric Railway to Summit of Mont Blanc.

Work on the construction of the railway to the summit of Mont Blanc has been begun, says the Geneva (Switzerland) Journal. The line will be built like the Jungfrau line in the Bernese Oberland, Switzerland (system Guyer-Zeller). It will have a total length of 19 kilometers (11 4-5 miles) and may be completed within five or six years. From the Fayet to the last station (via Chamonix, as there is already a railroad between the Fayet and Chamonix) the fare will be 100 francs ($19.30), and the trip will require four hours. The cars will be heated and lighted by electricity, and the train will be composed of an electric locomotive and two cars made to accommodate about 80 people. A special arrangement of the windows will permit all travelers to enjoy the scenery. Three kinds of powerful brakes, independent of each other, will be attached to the cars, thus rendering accidents improbable. A telephone line will be established along the road and will connect any point thereof with the head stations.

The Municipal-ownership Idea to be Combated.

As the results of the efforts of the committee on public policy of the National Electric Light Association, of which Arthur Williams of the New York Edison Company is chairman, the first number of the Bulletin of the Anti-Municipal Ownership League has been issued. It is designed to establish such leagues in each locality to combat the influence of the municipal ownership—M. O. for short—organizations. In a circular letter to the members of the National Electric Light Association Mr. Williams says:

"The result of the election at Chicago, and more recently in New York city, is another indication of a widespread movement in favor of municipal and government ownership of public utilities.

"This movement threatens to take the place of the free-silver movement of some years ago.

"It can be counteracted only by publicity. And with a degree of publicity as comprehensive and equal in scope as that which is now employed by the advocates of public ownership.

"The time to begin is not immediately preceding an election. Rather, we should say, the beginning should be made when the question is not acute—and the medium of publicity must be persistently maintained.

"The companies interested must unite in the same manner that the financial and business interests of the country united in favor of gold as against silver. Their work was effective. Who would now think of raising the question of free silver in this country? In all probability, effectively and rightly handled, municipal ownership as a political question will soon pass into like oblivion.

"The interests of all public-service companies are mutual and identical. In any locality they are alike for the gas as for the electric-light companies; for the telephone as for the railways. All should unite in right effort against this issue."

The Anti-Municipal Bulletin contains arguments against public ownership, with recitals of actual experiences which point in the same direction. Here is an example of the reasoning drawn from experience:

"It is to be proven that municipal ownership and operation are advantageous to the community. Apparently in no single instance, where accurate records are kept, has this as yet been demonstrated. As a rule, municipal bookkeeping is not of a high order. The incentive or motive is usually lacking. Municipal authorities encourage rather than deprecate the omission of many items.

"There are some exceptions. In the United States, Massachusetts offers one. The reports of the municipal authorities must equal in detail those of the private companies. And the reports of the 21 municipalities operating electric-light and power plants fail to make a case in favor of municipal ownership.

"Were these 21 municipalities to purchase electric light from the private company supplying the municipality of Boston at that company's prevailing rates, they would save annually $20,614.06 under a contract running for 10 years, and $45,559.87 annually if the obligations were made for a period of 20 years. In addition there would be an income of approximately $20,000 annually, which the private company would pay in taxes that are not included in the figures of the municipalities.

"The expenditure of the municipalities last year was $245,126.75. The saving in this service purchased from a private company thereupon becomes, under a 10-year contract, 8.4 per cent.; under 20 years, 18.6 per cent.

"It is not unfair to the point at issue to make comparison on the basis of 10 or 20 years, for the investment of the municipalities is made for an equal or much longer period. In some instances

40 or 50-year bonds are issued to pay for the plant, and, almost without exception, sinking funds are adjusted to this period."

Mr. Williams, who may be addressed at 136 Liberty Street, New York city, is anxious to obtain all the data he can on the question and any suggestions that will help the committee in its work.

Simple Rules for Draftsmen.

To the mechanic a drawing is more simple than any amount of verbal explanation. Ideas are expressed to him by a diagram as readily as melodies and harmonies are suggested to the musician by notes on the staff. The mechanical drawing gives all that it is desired to give—form, size, material and quality, if essential—but it is destitute of perspective, light, shadow and color, as a rule, and therefore some conventional method of conveying ideas is essential. Standards for drawings have not been adopted as yet, though there are a great many rules which are generally recognized.

Eugene Ransom, in a recent paper read before the Ohio Society of Electrical, Mechanical and Steam Engineers, presents a few simple and well-established rules for use in drafting rooms, which, if followed, would do away with the friction which so often occurs between the drafting department and the men who finally use the drawings. These rules are more or less familiar, but in many cases they are not adhered to. The rules which follow were taken from Mr. Ransom's paper.

1. Use the fewest possible lines accurately to represent the object.

2. Make these lines smooth and black and heavy enough to show white in a blue print.

3. Make views enough to show the object completely.

4. Where a number of parts are shown on one sheet, endeavor to group them in such a manner as to show their relations one to another. Much time will be gained in finishing, if the workman knows how the parts assemble.

5. Do not obscure a drawing by a lot of notes. Literature looks cheap on a drawing. The drawing should tell its own story without remarks, and the workman has a right to expect it. Besides, notes are a prolific source of error, as they tend to confuse or escape notice entirely.

6. Heavy lines should be used on the dark side of the object, and the light is always supposed to come from the upper left-hand corner at an angle of 45 degrees. This takes a trifle more time in the drafting room, but pays in the hands of the workman on account of greater clearness, especially when the part is complex.

7. Dimension lines should be heavy enough to be seen and their terminals clearly and strongly marked.

8. Enough figures should be on a drawing to give the dimensions completely and no more; more than enough tends to confusion, especially on a small drawing.

9. In giving the dimensions for a shaft, for instance, don't forget to give total length as well as the length of all parts. Someone has to cut it off.

10. Figures and letters should be large enough to be seen without the use of a magnifier and should be strong, perfectly formed and black. The man who works to your drawings may be wearing glasses.

11. Dimensions should be left off the object as much as possible, when they tend to confusion, and near enough to be seen with the object to which they refer.

12. Each sheet of the drawings should have an appropriate title, and each piece an appropriate name, with the number required for one complete machine, and where no section shows the material, that should also be indicated.

The New Engineering Building in New York City.

The joint building committee having in charge the erection of the new United Engineering Building now going up on Thirty-ninth Street, between Fifth Aveue and Sixth Avenue, in New York city, is composed as follows:

American Institute of Electrical Engineers—Charles F. Scott, Bion J. Arnold, S. S. Wheeler.

American Society of Mechanical Engineers—C. W. Hunt, James M. Dodge, F. R. Hutton.

American Institute of Mining Engineers—A. R. Ledoux, Charles Kirchhoff, Theodore Dwight.

This joint committee has just made an interesting report to the governing bodies of the three engineering societies named. Fig. 1 of the accompanying illustrations is a perspective of the new building, looking northwest. Following is the text of the joint committee's report:

FIG. 1. NEW ENGINEERING BUILDING IN NEW YORK CITY.

The public competition instituted by the joint committee for the selection of architects for the planning and erection of the buildings presented by Mr. Andrew Carnegie for the American Institute of Electrical Engineers, American Society of Mechanical Engineers, American Institute of Mining Engineers and the Engineers' Club resulted in the presentation of 26 sets of plans for the buildings. After a careful examination of these plans, the committee appointed Hale & Rogers and Henry G. Morse, associate, as architects for the three engineering societies, and Whitfield & King as architects for the Engineers' Club.

The architects' plans embody a general scheme which is acceptable to the committee which represents the societities. The committee reports these plans herewith to the councils of the three societies named in the letter of gift, and believes that it would be of interest and service if the report should be sent to the members of all the societies.

It will be recalled that the frontage of the Engineering Building on Thirty-ninth Street, between Fifth and Sixth Avenues, covers five city lots, or 125 feet front, and 100 feet deep. The building law of the city of New York requires that a building shall occupy only 85 per cent. of the lot area. Advantage is taken of this requirement to have space on all sides of the building, thus giving the building a monumental appearance. The building utilizes 115 feet of the 125 feet front and 90 feet of the 100 feet depth, the lot numbers being 25 to 33.

The Engineering Building must meet requirements in five directions:

1. It must serve the convenience of each of the individual societies, which enter the building as founders. This has been secured by the proposed arrangement which is represented on the society office floor plan herewith (Fig. 4). The purposes of the rooms assigned will be made clear from their designations. The working offices of the representatives of the society, the reception room, board and committee rooms, important elements of the life of the society, are on the desirable south front and are favored by the windows which look to the eastward.

2. The building must supply to the three national founder societies and also to such other organizations as may be invited to participate in its benefits as associates, such meeting rooms and auditoriums as will be required for the annual meetings, the public reading and discussion of papers and for scientific lectures and demonstrations. In view of the number of participant societies for which provision has been made, the committee has thought it advisable to arrange for a number of assembly rooms suitable for various uses.

One of these, primarily designed for the national societies' meetings and for those of other large bodies, has been made to accommodate 1,000 persons (Fig. 3). This limit is set as being as large a number as can be expected to hear clearly the voice of a speaker. The location of this large auditorium is on the first floor above the street, so as to make elevator service for it unnecessary. Attention is directed to the large foyer and generous corridors, which give ample space for withdrawal from the large assembly hall. The ample provision for exit also at the four corners of this floor is to be specially noticed as a desirable provision for safety. To enable auditors in the back of the audience to see clearly such diagrams and illustrations as may be on the stage, the seats are arranged on a grade conforming to best modern practice in theaters. This parterre arrangement enables coatrooms to be provided, opening from the outer corridors, and special consideration has been given to secure rapid service with large numbers in attendance. It will be noticed, further, that the large auditorium floor is reached from the great central rotunda on the street floor (Fig. 2) by generous stairways, and that it can also be reached from carriages entering the driveway and moving continuously as they receive or discharge their passengers. The room for preparing apparatus and exhibits for the stage is conveniently served by a large freight elevator, so that heavy machinery and apparatus can be easily handled.

On the floor above the large auditorium are two assembly rooms (Fig. 5), occupying the principal portion of the area. These assembly rooms may be used independently for lecture purposes, or one may be made auxiliary to the other and used as a foyer or conversation room. As to the two rooms adjoining they may be used in common when desired, as, for instance, for purposes of general reception or conversazione. Auxiliary smaller rooms on this floor are provided and provision is made for the service necessary for light refreshments or luncheon.

On the floor above (Fig. 6) a number of small

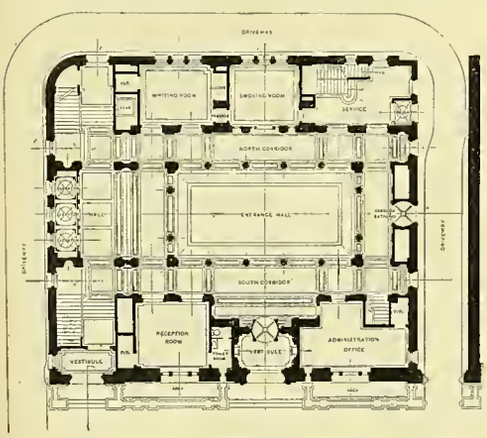


Fig. 2. Entrance or First Floor.

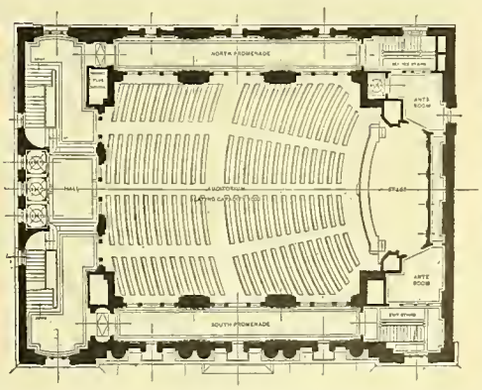


Fig. 3. Third-floor Auditorium.

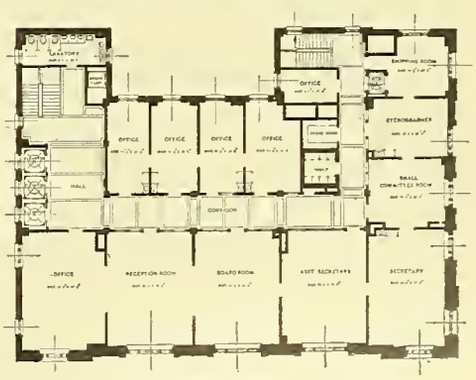


Fig. 4. Offices of Electrical Engineers on Tenth Floor.

FLOOR PLANS OF THE NEW ENGINEERING BUILDING IN NEW YORK CITY.

lecture halls are provided suitable for ordinary meetings of scientific and engineering societies, and for meeting of sections at the time of general conventions of national organizations.

It is expected that there will be a great demand, especially for the small meeting rooms, for scientific purposes. They will be supplied with electric current, with compressed air and with gas and water. The meeting rooms of all sizes will be fitted for the use of the projection lantern and will be unique in their completeness for the purposes

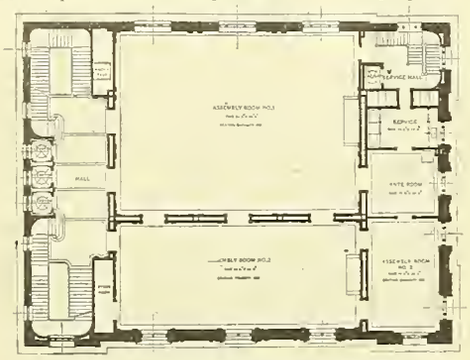


FIG. 5. ASSEMBLY OR FIFTH FLOOR OF NEW ENGINEERING BUILDING.

for which they are intended. The board rooms of the society floors will he large enough for the holding of small professional meetings when occasion may require.

3. A crowning detail in the planning of the building has been the provision on the two upper floors of the libraries of the various societies (Fig. 7). It is the purpose of the societies so to administer the library of each that by bringing them together there shall be created a working and reference library of the highest possible value and completeness as respects engineering science and practice, which shall be unequaled anywhere. The societies have recognized that there is before them an unexampled opportunity, and it is their desire to avail of it to the highest degree. In seeking this end the entire top floor is to be devoted to reading and reference rooms, to working alcoves, to rooms for photographic reproduction and for drawing and similar library work. The roof will be specially constructed to secure the best illumination. The location of the reading rooms at the top of the building will be quiet, cool, airy and free from dust. The floor below the library reading rooms will be devoted to the book stacks, although when first the societies enter the building the alcove construction in the reading and reference rooms will take care of the nucleus of the future library which the societies will bring with them. This will leave the book stack floor for growth, as the library shall increase in size hereafter. It is believed that by the co-operation of the New York Public Library on the adjoining block and with the interest and strength which the societies will furnish, the library in the Engineering Building can be made

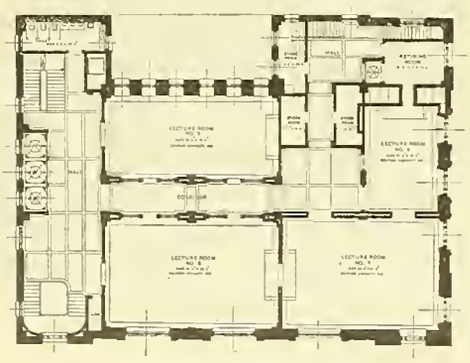


FIG. 6. LECTURE HALLS ON SIXTH FLOOR OF NEW ENGINEERING BUILDING.

the most important engineering library of the country. The Committee has tried to provide ample space to accomplish this end.

4. The building is also to furnish office accommodation for a large and continually increasing number of societies which have engineering or some other department of science as their principal object; such are, for example, the New York Electrical Society, the Society of Naval Architects and Marine Engineers, the Heating and Ventilating Engineers, the American Gas Light Association, the National Electric Light Association, the Society of Chemical Engineers, the Association of Edison Illuminating Companies and many others. For these organizations the building will offer office areas of varying sizes, whose arrangements will be adjusted to the requirements of such participants as shall hereafter be made known. Such participants will have use of the auditoriums of the desired size.

5. The building must also serve as a business office for the founder and the associate societies. Attention is called to the driveway (Fig. 2), whereby access is had on the street level and under cover to the freight elevator both for boxes of books and for other merchandise moving inward and for mail-sacks moving outward. This driveway also serves for carriage access to the auditorium and passenger elevators. It gives facility for unloading by gravity to the coal pockets of the heating plant without handling. The general convenience of the building is also served by the receiving and shipping office at the rear, through which all goods in and out will be handled. There is also the Bureau of Information at the right of the main entrance, where general questions can be answered, visitors directed and some routine business transacted. This office will also be a suitable location for the telephone exchange, the telegraph and the sub-postoffice.

By a business arrangement formed under legal advice and forming part of the deed to the property to the east of the building a restriction has been placed which prevents the erection on that lot of a building more than 60 feet high. This restriction runs with the land and secures light and air for the building on its eastern front above the third floor. The westerly wall is built 10 feet within the property line, so that openings for light and air should always be left on that side and on the rear, even if high buildings should be hereafter

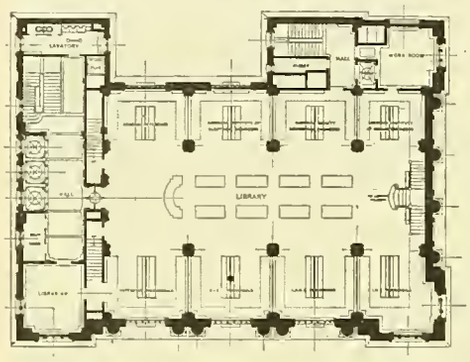


FIG. 7. LIBRARY FLOOR OF NEW ENGINEERING BUILDING

built on adjoining property to the west and the north. The committee contemplates finishing the building on all four sides and not merely on the south facade, in order that its monumental character may be seen and recognized from every point of view.

It may be serviceable to remind members of details which have been presented at various times concerning the organization of the holding corporation which is to administer the building for the founder and associate societies. This corporation was formed by special charter in the state of New York in May, 1904, and is called "United Engineering Society." Its nine trustees are chosen, three each, by the councils of the Electrical, Mechanical and Mining Engineers, and control the building and are responsible for its financial administration. Its charter and by-laws have been the occasion of much careful thought by the societies and by legal counsel, and the title to the land rests in this body corporate. The land passed to these trustees in January, and they are paying the interest and other expenses during construction. It is the unusual character of the trust and its functions which are largely responsible for the delay in beginning construction.

The contract for construction was signed in July, the excavation for the foundations was started at once, and the work of construction has now commenced. The contract limit is 15 months to date of expected completion.

Says Municipal Ownership Is a Failure.

Prof. F. H. Roberts of the University of Denver, Denver, Colo., returned a few days ago from an extended trip in Europe, where he went to study the question of municipal ownership of public utilities. He visited Glasgow, Manchester, Liverpool, London, Brussels, Amsterdam, Antwerp, Hamburg and Berlin. Prof. Roberts stopped at Washington, D. C., on his return and while there was presented to the president, to whom he is said to have expressed the opinion that public ownership of public utilities was a failure in Europe and predicted that in a few years it would have few supporters even in Great Britain, where it has been popular.

Gasoline Motor Cars versus Electric Railways.

The effect which electric interurban railways are having on the steam railroads in the way of diverting both passenger and freight traffic, and the possibilities of the gasoline motor car in meeting the competition of the electrics, are the subject of much discussion among railroad men. A few of the steam roads, in an effort to compete with the frequent service offered by paralleling electric lines, have been experimenting with gasoline motor cars of various types as a possible equipment for their branch and suburban lines. Some success with these gasoline motor cars is reported, but in the opinion of well-informed electrical men in Chicago the time is not near when they will be a serious competitor of the electric railways.

A member of a large electric construction company in Chicago who has given the subject much thought and has inspected a number of gasoline motors now being tried by the steam roads believes that these motors offer so many objections that they will finally be dropped as impracticable. He says that the steam and electric roads are now undergoing an evolution similar to that of the gas and electric-light companies some years ago. And, as in the lighting business, it will be found that the electric interurban railways are a natural development and cannot be put aside. The steam roads, according to the same authority, should themselves accept the opportunity to build electric railways paralleling their lines instead of allowing other interests to step in and build them. Where the interurbans already exist he thinks they would do better to buy the roads instead of trying to meet the competition by the development of gasoline motors.

In the first place the gentleman above referred to points out that the best gasoline motors are not practical for railroad work. Their inefficiency at slight over or underload is one of the objections. A motor car tested on a road near Chicago was incapable of carrying a small overload successfully even on a level track. Again, if loaded below its rated capacity it did not operate economically on account of undue wear and tear and the consumption of as much fuel as if at full load. To operate at the best efficiency gasoline motor cars should carry a stated load, and this, especially if freight is handled, is a difficult matter on railroads. From the viewpoint of economy, the steam roads in adopting the gasoline motor would be compelled to maintain two kinds of equipment and two sets of employes would be necessary.

The gentleman quoted does not think American gasoline engines are equal to imported machines, and unless some unexpected development is brought out within a year or two the interurban men need not fear that they will be put out of business by the gasoline motor.

Chicago Street-railway Situation.

A rumor that Mayor Dunne and some of the Chicago aldermen would make a formal request of Congress to extend the time when the lowering of the street-railway tunnels under the river must be completed until the entire traction problem can be placed before the voters at the spring election has met a strong protest from vessel owners, the Board of Trade, real-estate men and the River Improvement, Shippers' and Lake Carriers' associations. The lowering of the tunnels will bring with it the abandonment of the cables and the substitution of trolleys, and this, it is feared by municipal-ownership advocates, might jeopard the cause of "immediate municipal ownership." The franchise-extension advocates, however, point out that the improvements can be made and the permits so drawn that the traction companies will gain no further rights.

Mayor Johnson of Cleveland, Ohio, has been in Chicago conferring with Mayor Dunne, and while here it developed that he takes all the blame for the Dalrymple incident. In an address at the City Club Mr. Johnson said he suggested sending for Mr. Dalrymple, but thought he was sending for another man; that man apparently was Manager Young, who built up the street-railways of Glasgow.

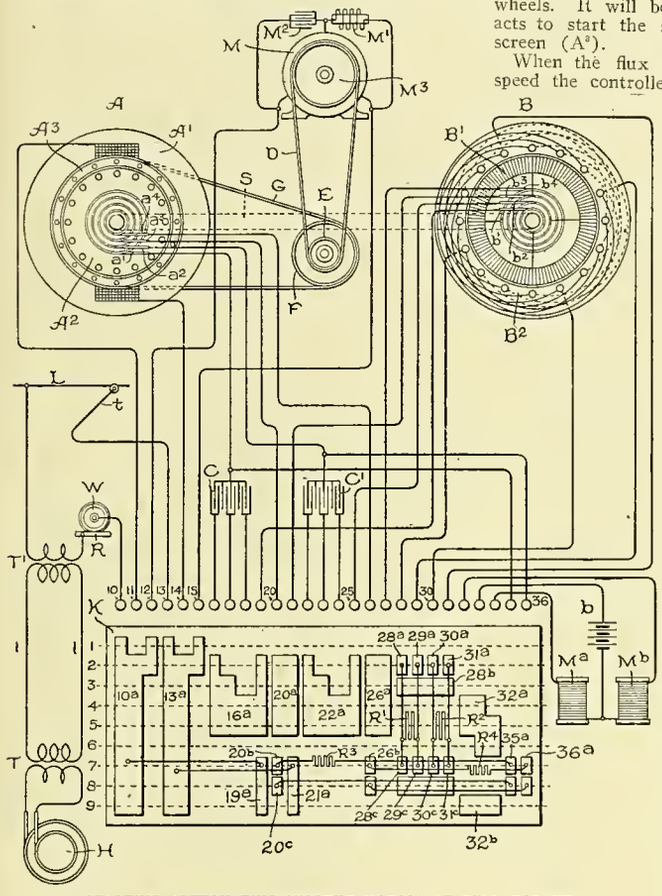
Traction matters were not taken up at the council meeting this week. The expected report of the local transportation committee recommending the passage of the franchise-extension ordinance was held over and may be taken up with other traction matters next week.

Mayor Dunne has appointed M. F. Doty to act as an expert in charge of car heating, their sanitary condition and other requirements for comfort and convenience which the city is endeavoring to enforce.

Starting Alternating-current Motors at Full Torque.

Starting alternating-current motor systems at full torque is a problem upon which considerable study has been expended, particularly in systems of the tandem and tandem-multiple types. The difficulty lies in getting the various motors of the system to start up under full-torque conditions and still run efficiently at various speeds when starting has once been accomplished. Albert G. Davis of Schenectady, N. Y., recently received patents upon a system by which, he declares, the desired result may be accomplished, and his method is of considerable interest.

One important function of the invention consists in connecting in tandem with a single-phase alternating-current motor, actually driving a load, a multiphase alternating-current motor, also driving a load, which may be the same load as that driven by the first motor. For example, both motors may be connected to the same or different axles of a



STARTING ALTERNATING-CURRENT MOTORS AT FULL TORQUE.

street car. Further, the invention contemplates regulating the speed of the system thus formed in various ways and connecting the motors in tandem across the single-phase mains. In this way it is possible to drive a regulable and self-starting motor system possessing the advantages of a multiphase tandem-multiple system from a source of single-phase current, which is particularly valuable in connection with railway work.

In the diagram, (A) (B) are the two motors connected to a common shaft (S). (A′) (B′) are the inducing members, and (A^2) (B^2) are the induced members, the relations of the parts being reversed in the two motors. A generator of single-phase alternating current shown below feeds current through a tension-raising transformer (T), transmission lines (1 1), and a tension-reducing transformer (T′) to the trolley or third rail and the track rail.

Motor (A) is provided with a flux screen (A^3) independently rotable in the air gap and containing a short-circuited winding. If the flux screen be set in rotation it will so distort the flux set up by the current flowing in the primary single-phase circuit, shown on the member (A′), as to produce in the induced member (A^2) a rotary field. This rotary field generates dephased electromotive forces in the winding. Electromotive forces so generated cause multiphase current to flow in the circuits leading from the rings and brushes. These currents are led through condensers to the inducing member (B′) of the motor (B), in which member they produce a rotary field. This rotary field in turn generates current in the induced member, which reacts to create torque. It will thus be seen that both motors produce a rotary effort at the start and tend to run to such a speed that the frequency of the current in the intermediate circuit, in which the phase-advancing devices are preferably interposed, is nearly one-half of the frequency of the current fed to the primary of the first motor (A).

To start the flux screen (A^3) a small auxiliary motor (M) is provided, which, as it is of insignificant output, may be of the split-phase type. That is, it may be wound like an ordinary two-phase or three-phase motor, and provided with a monocyclic starting device consisting of a self-induction (M) and a condenser or resistance (M^2). The armature of this motor drives the flux screen through a belt, pulleys and a second belt. The magnets serve, when energized by the battery or other source of current to reduce the resistance of the induced members of the motors (A) and (B), respectively.

To start the motors the controller is in such a position, shown in development, that the brushes (10) to (36), inclusive, bear upon the line (1). Current then flows from the trolley through brush (13) to contact plate (13^a) and brush (15), to the motor (M), and thence to brush (12), by contact (10^a) to brush (10), and to ground through the wheels. It will be seen that this position simply acts to start the small motor (M) and the flux screen (A^3).

When the flux screen has attained a sufficient speed the controller is moved to the second position (2). Here contacts (13^a) and (10^a) are energized, as before, by the brushes (13) and (10), so that current flows from contact (13^a), through brush (14), to the primary winding (A′), through the brush (11) and to the contact (10^a). This generates an alternating flux in the member (A′), which is converted into a rotary flux by the action of the flux screen (A^3), which, since it drives no appreciable load, runs up to a speed approaching that of synchronism. The rotary field thus induced in the secondary (A^2) causes dephased currents to be generated in the multiphase winding of that member, supposed in this case to be a two-phase winding. Current then flows from the brush (a′) to the condenser (C), and thence, through the first section of the condenser, to the contact (16^a) and brush (19), thence to the brush (b′) of the motor (B) and, through the winding (B′), to the brush (b^3), to brush (21), to the controller contact (20^a) and brush (20), back to the motor (A) at the brush (a^3). The other intermediate circuit is from the brush (a^2) to the condenser (C′), brush (22), contact (22^a), brush (25), motor brush (b^2), through the inducing member (B′), to the brush (b^1), brush (27) and contact (26^a), and thence to the brush (a^4) on the motor (A). The current passing in these paths will create a rotary field in the inducing member (B′), which may be wound, as shown, with a ring winding tapped at four equi-distant points or with two independent circuits or in any other suitable way. This rotary field will produce electromotive forces in the bars of the winding (B^2), which in turn will produce currents in these bars, which bars are arranged in two circuits and constitute an ordinary multiphase secondary. The terminals of these two circuits lead, respectively, to brushes (28), (29) and (30), (31), which brushes are united together in pairs by the resistances (R′) (R^2). It will thus be seen that in this position the motor (M) is energized, the primary (A′) is also energized with single-phase current, and the primary (B′) of the motor (B) is fed with quarter-phase current from the secondary (A^2) of the motor (A) through the condensers (C C′), while the secondary (B^2) of the motor (B) is closed on itself through resistances (R′ R^2).

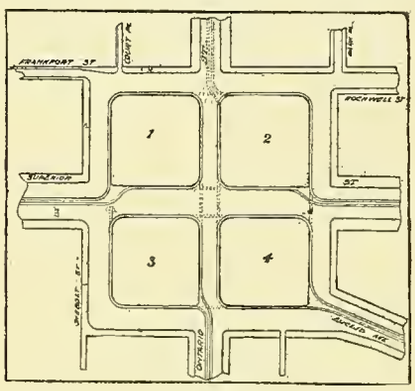
The position above described is the starting position. The current flowing in the intermediate circuits of the tandem system is in general of a frequency equal to the slip of the motor (A), which slip is before the motor starts equal to the frequency of the original current; but as the motor (A) starts the frequency of the current in the intermediate circuit falls.

When a small speed has been attained the controller is moved to the position (3), in which the motor (M) is cut out. This position corresponds to a slightly higher speed in the motor. In the next position, in which the brushes rest upon the line (4), the whole capacity is cut in, since all of the brushes are on the segments (16^a) (22^a), respectively. This position is the full-tandem position, in which the motors will run to nearly half of their synchronous speed. In position (5) the brush (34) also rests upon the segments (32^a), so that the magnet (M^a) is energized. This short-circuits on itself the winding (A^2), which practically cuts off current from the intermediate circuits and from the motor (B), owing to the low resistance of the short circuit. It is now safe to open the intermediate circuits, which is accordingly done in the sixth position.

The seventh position connects the motors in multiple. In the eighth position the connections are the same, except that the resistances (R′) (R^2) (R^3) (R^4) are displaced by short-circuiting leads. The ninth and last position omits the contacts (20^b) (20^c), etc., and short-circuits both secondaries on themselves by means of the magnets (M^a) (M^b), energized from the battery (B) through the contact (32^b). In this position the motors will tend to approach very near to synchronous speed.

Public Square Loops Proposed for Cleveland.

The Board of Public Service of Cleveland, Ohio, has issued a permit for the street-railway company to build loops at the Public Square in order to avoid the congestion resulting from the increased travel of late years. The square is large and is divided into about four equal parts by Superior and Ontario streets, as seen in the diagram. Four different tracks will terminate at the square, if this plan is put in operation. They bring in the cars



PUBLIC SQUARE LOOPS PROPOSED FOR CLEVELAND.

from all lines in the city with the exception of what are known as the cross-town lines. Each of these tracks, under the new plan, will run around one-quarter of the square, so that there will really be four small loops. The tracks will be built inside the curbs, but the sidewalks will be moved back enough to allow this. They will thus cross the walks where they enter the square, but at no other place. At present cars run the entire length of the city on six of the lines, but the new plan will make it necessary to transfer all through passengers at the square. This will probably double the number of transfers issued. The railroad officials opposed the plan, but stated that they were willing to try anything that will afford relief from the congestion. They argued that ultimately the lines in the business portion of the city would have to be placed in a subway, and that it had as well come first as last. Mayor Johnson is also opposed to the plan, and will probably fight it. City Solicitor Baker will decide whether the matter will have to come before the City Council for action.

Interurban Roads Needed in Canada.

Consul Culver of London, Ontario, thinks there is a good field in his district for the sale of material for electric tramways. He writes: "In this active, enterprising, thickly populated part of the Dominion, where factories flourish and where the best of local markets exist, there is an important feature of modern commercial and industrial life which is noticeably lacking, and that is interurban electric roads. The towns and cities are supplied with good electric lines, but there are few interurban lines in Ontario. In this consular district there is one completed road some 12 miles in length between the towns of Woodstock and Ingersoll, and a line some 30 miles in length, under construction, running from this city to Port Stanley, on Lake Erie; but I know of no other lines in western Ontario, except the line from Windsor to Amherstburg; and yet the entire country in every direction is thickly populated and filled with thriving towns and villages. London is the industrial center, the market for all this territory, extending for some 60 to 100 miles in every direction. I know of no better nor more enticing field anywhere for interurban roads than in this consular district."

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DATES AHEAD.

New York Electrical Show, Madison Square Garden, New York city, December 12th to 23d.

Independent Telephone Association of Wisconsin (annual convention), Hotel Pfister, Milwaukee, December 20th and 21st.

Automobile Club of America (annual exhibition), Sixty-ninth Regiment Armory, New York city, January 13th to 20th.

Chicago Electrical Show (first annual exhibition of Electrical Trades Exposition Company), Coliseum, Chicago, January 15th to 27th.

American Electrical Salesmen's Association (first annual meeting), Grand Pacific Hotel, Chicago, January 20th, 9 a. m.

A LIVELY controversy has been stirred up in England over the proposal to transmit electrical power generated at the Victoria Falls of the Zambesi River to Johannesburg, on the Rand, in South Africa, to be used in the mines and for other purposes. The distance of this transmission would be 556 miles in a direct line, or 745 miles if made along a railway through Pietersburg and Gwanda. In either event the distance would be considerably over twice as long as the longest electric power transmission hitherto attempted. The amount of energy to be transmitted is uncertain, but the estimate of power now needed on the Rand, 150,000 horsepower, is taken as the basis of calculation. All authorities agree that the volume and head of water at Victoria Falls will furnish this amount, even during the periods of low water. Thus the transmission, if accomplished, will be the longest and greatest in the world.

But there is grave doubt whether the plan is a practicable one. Prof. W. E. Ayrton has analyzed the project in an article in the London Times Engineering Supplement, and he thinks that while electric transmission of power from Victoria Falls to Johannesburg is feasible from an engineering point of view, it could not be made to pay, owing to the lack of a market for power along the route of transmission, the great expense of construction and maintenance, and the fact that excellent steam coal can be delivered on the Rand at from $2.50 to $3 a ton. Incidentally, Prof. Ayrton favors the Thury direct-current system, if any system is installed, but this preference may be disregarded as simply an academic pronouncement in considering the broader aspects of the question. Curiously enough, however, the promoters of the project favor the Thury system also; but in the light of experience, from the time of the Frankfort-Lauffen test to the present, it can hardly be believed that the transmission of 150,000 horsepower over a distance of between 550 and 750 miles will be attempted with direct current.

Prof. Ayrton points out that it is highly improbable that electric energy can be transmitted 745 miles and sold more cheaply than coal obtained on the spot. He says that one horsepower (steam) costs about $100 a year on the Rand at present. To a 24-hour customer in Buffalo, he figures, Niagara power is transmitted less than 30 miles at about the same price. How, then, he asks, can Zambesi power be commercially transmitted 745 miles and sold at a lower price? He shows that the conditions on the Niagara frontier are radically different than in South Africa and also touches on the great cost of patrolling and maintaining a 745-mile transmission and the possibility of interruption of service, which would be a very serious matter in mines where human life depends on ventilating and pumping machinery.

Mr. H. Wilson Fox, manager of the British South Africa Company, answers Prof. Ayrton. He says that he possesses reports from such authorities as Gisbert Kapp, André Blondel, Edouard Tissot, Ralph D. Mershon and Sir Douglas Fox diametrically opposed to those of Prof. Ayrton. These authorities have assured him that the scheme would be commercially successful. As to price, Mr. Wilson Fox records his deliberate conviction that with coal at from $2.50 to $3.00 a ton at Johannesburg, Zambesi power can be transmitted 745 miles and sold more cheaply than steam power. However, the mines on the Rand actually pay from $125 to $200 per annum per horsepower for steam power. Mr. Mershon's well-known statement that, with present knowledge, 500 miles may be accepted as the maximum distance of practicable power transmission, is explained by the remark that the statement does not apply in special cases, such as the supplying of large amounts of power to gold-mining regions, where it can be sold at high prices. Mr. Mershon, by the way, has been retained as a consulting engineer in connection with the project, and is, we believe, the only American so honored.

To the average disinterested observer it will appear, we think, that Prof. Ayrton cites what seem to be insuperable objections, and that these are not effectively disposed of by Mr. Wilson Fox's communication. With coal available at $2.50 to $3 a ton, it is rather bewildering to be told that hydro-electric power can be transmitted, commercially, 745 miles to compete with it. There must certainly be a new calculation of costs of power plant, copper and line construction, losses in transmission and expense of operation and maintenance to make such an assumption possible. We should be the last to discourage any promising electric power-transmission project, remembering the notable triumphs in this field in our own country; but it would be lamentable to dim the prestige of hydro-electric development with a great fiasco, and therefore we hope that ample publicity will be given to all details of this spectacular proposal, so that, if it be based on sound engineering, the fact may be made clearly apparent. If the proponents of the great project can make out their case theoretically—that is, with detailed figures from the commercial viewpoint—their boldness and energy will be entitled to whatever of reputation and financial reward may thereafter follow on the practical carrying out of the project.

FUTURE novelists should not neglect the tale of the sea which space telegraphy made possible in the case of Lightship No. 58, anchored at Nantucket Shoals, 42 miles out. During a recent severe storm on the Atlantic the ship sprung a leak and began to sink. Its plight soon became very serious; the fireroom was flooded, so that the ship could make no headway, and the 14 men on board were in imminent danger of death. But there was one hope—a chance for life that could not have existed in a like case a dozen years ago and which was due to the modern scientific study and application of electrical phenomena. Lightship No. 58 had been for many years the turning point of steamships on the usual transatlantic route between Liverpool and New York. For the last four years or so it had been equipped with space-telegraph apparatus and included an operator in the ship's company. In addition it happened that three "wireless" operators of the navy were on board at the time of the storm. It was this equipment which furnished a gleam of hope.

Urgent messages were sent out for relief, particularly addressed to the naval station at Newport, R. I., but also appealing for "help from anywhere." "Water gaining; we are helpless," was the burden of the cry heard at all the shore stations. Such a call aroused instant attention, of course, and the lighthouse tender Azalea was dispatched to the rescue from New Bedford, while gunboats from Boston and Newport were also hurried to the disabled ship's station. Owing to the rough weather the task was a difficult one, but the lighthouse tender succeeded in reaching the spot a few hours after setting out. The crew of the foundering lightship were safely transferred and an effort was made to tow the sinking ship to harbor. But after making slow headway for some time the lightship suddenly plunged bow foremost to the bottom, the connecting hawser being cut just in time to protect the rescuing ship. A few hours later the Azalea steamed into New Bedford.

One rescue such as this, due to the use of space telegraphy, is more than a requital for all the effort and money put into the development of this marvelous invention.

THERE HAS always been more or less uncertainty as to the nature of the phenomena which are manifested in the electric arc. Although Davy discovered the action of the electric arc in 1802, the complex physical problems presented by it have not received the attention they deserve, and it is only during the last few years that any very careful study has been made of the subject. According to the most modern view of the physics of the arc, as advanced by Prof. J. J. Thomson of Cambridge University, the positive and negative electrodes emit respectively positively and negatively electrified corpuscles or ions, which, under the influence of electric repulsion, travel across the space occupied by the arc and bombard the electrode opposite to the one from which they have been emitted. It is further supposed that the electric current is itself conveyed by these ions, and that the high temperature of the electrodes is produced by their bombardment. This theory may be tested by deflecting by means of a magnet either the positive or the negative ions into a Faraday cylinder placed with its aperture just touching the center of the arc.

American Society of Mechanical Engineers.

The fifty-second meeting of the American Society of Mechanical Engineers was held in New York on December 5th to 8th, President John R. Freeman of Providence, R. I., presiding. Thirteen hundred were registered, among those from Chicago being John M. Barnay, Joseph G. Prosser, Arthur L. Rice, P. A. Robbins, Oliver S. Shantz and Miss Fanny Crass. Fred W. Taylor of Germantown, Pa., was elected president for 1906.

In the council's report it was stated that Charles H. Haswell, first incumbent of the office of engineer-in-chief of the United States Navy, now in his ninety-sixth year, had been elected honorary member of the society. It was also announced that the society will assist in the coming Franklin bicentenary. At the business session it was decided to allow the formation of sections of the society in any city with local autonomy. Financial conditions are good, and 332 new members were reported for the year.

Among the reports was that of the committee on standard proportions for machine screws. This committee had consulted with manufacturers and recommended a few modifications, among which were that the angle of the thread be 60 degrees and that the diameter be expressed in decimals. The progress report of the committee on the new engineering building was also heard.

Papers read did not touch upon electricity directly, the principal part of the discussion being on bearings. Albert Kingsbury of Pittsburg reported that tests on large shaft bearings showed that rapid acceleration had a tendency to cause binding and that to reach high speeds three hours of gradual increase were required.

C. W. Naylor reported that water is used for lubrication in a large Chicago engine room and has given less trouble in 11 years than had been encountered in one month with oil.

Soft-metal bearings were discussed by Prof. R. C. Carpenter of Ithaca, N. Y. He concluded that all tests are more or less unsatisfactory and differences of opinion are therefore irreconcilable.

Jay M. Whitham of Philadelphia read a paper upon the subject of natural gas under steam boilers (see Western Electrician last week).

Another paper read was by R. J. Durley of Montreal, who took as his subject air flowing through circular orifices. He had collected considerable data upon the circulation of air by the use of ventilating fans.

E. N. Hunting of Pittsburg in a paper on "Reinforced Concrete, Applied to Modern Shop Construction" went at some length into the problems which the engineer has to encounter in shop construction. He gave a large amount of data on the advantages of concrete as a material for shop construction.

Other papers read were "The Realization of Ideals in Industrial Engineering," by H. F. J. Porter of New York, and "Tests of Elevator Plant in Trinity Building, New York City," by Arthur J. Herschmann of New York.

Among the pleasing features of the convention were an inspection of the steamship Amerika and a visit to the lecture and demonstrating rooms of the New York School of Automobile Engineers, organized and under the direction of Prof. Charles E. Lucke of Columbia University.

May Have Located North Magnetic Pole.

Major Glassford, in charge of the government cable office at Seattle, received a message a few days ago from Ronald Amundsen at Fort Egbert, Eagle City, Alaska, addressed to the Norwegian explorer, Nansen. The message is incomplete as to detail, but shows that Amundsen traveled from Greenland to Herschel Island, which indicates that he at last has located the Northwest Passage from the Atlantic to the Pacific for which Arctic explorers have been searching for centuries.

Amundsen left Norway in June, 1903. He made magnetic observations in various localities, and from the message it is taken that he set up his self-registering instruments last summer and located the true north magnetic pole on King Williams Island. He is said to have made a complete and systematic magnetic survey of the region about the magnetic pole, from which an accurate location of the pole is believed to have resulted. The determination of the north magnetic pole by Capt. James Clark Ross in June, 1831, rested on a single determination. Local disturbances may be expected in that region, and it was not believed that his determination was reliable. His position was on Boothia Felix, in north latitude 70 degrees, five minutes and 17 seconds, and west longitude 96 degrees, 45 minutes and 48 seconds. It has been generally believed that the magnetic pole is subject to a fluctuation in its position, and it is hoped that Amundsen's work will throw some light upon the rate and direction of motion.

If Amundsen has located the north magnetic pole, it will be of great value to science, especially if he succeeded, as he purposed, in determining whether the magnetic pole was a fixed point or a circumscribed area. If he found it was an area he proposed to make stations clear around it, so as to completely circle the magnetic pole.

Captain Amundsen left Herschel Island on October 24th, and arrived overland at Fort Egbert, near Eagle City, Alaska, on December 5th. His return trip will be made by the way of Behring Strait, and he proposes to stop at Sitka, and make his final observations there at the United States Coast and Geodetic Survey magnetic observatory for the determination of instrumental constants.

National Conference on Standard Electrical Rules.

A general meeting of the National Conference on Standard Electrical Rules was held on December 4th in the Auditorium of the New York Edison Company under the presidency of Mr. William J. Hammer. This organization was started in 1896 in New York city mainly by the efforts of Mr. Hammer when conditions were such that there were as many as five different electrical-wiring codes in New York city alone and many other different sets of rules in use all over the United States. A second general meeting was held at Boston in April last, but the code committee of the conference had met frequently in the interim, and members of the conference had attended the annual meetings of the Underwriters' National Electric Association. At the Boston meeting it was agreed that the conference should hereafter meet annually.

The bodies represented at the latest conference were as follows: American Institute of Electrical Engineers; American Society of Mechanical Engineers; American Street and Interurban Railway Association; American Institute of Architects; American Institute of Mining Engineers; Associated Factory Mutual Insurance Companies; Association of Edison Illuminating Companies; International Association of Fire Engineers; National Board of Fire Underwriters; National Electric Light Association; Underwriters' National Electric Association; National Contractors' Association and the International Association of Municipal Electricians. The delegates from the above bodies were qualified to vote on matters affecting the code, and there were also present as associate members, but without voting power, representatives of the American Telephone and Telegraph Company; Western Union Telegraph Company; Postal Telegraph Company; General Electric Company; the Westinghouse Electric and Manufacturing Company and other industrial concerns.

This was the last meeting under the presidency of Mr. Hammer, who has been the presiding officer of the conference since it was organized. A special committee was appointed to draw up an appropriate set of resolutions for presentation to the retiring president and he was at the same time elected a life member of the conference.

A new constitution and by-laws were adopted, and it was resolved that in future the conference should meet annually contemporaneously with the meeting of the Underwriters' National Electric Association.

The following-named officers were elected: President, W. H. Blood, Jr., of Seattle, president of the National Electric Light Association; secretary and treasurer, C. J. H. Woodbury of Boston. It was decided that the executive committee should consist of the active members of the conference; and in accordance with a previous resolution this committee also constitutes the code committee.

The conference considered a lengthy paper of recommendations and committee reports on suggested changes in the code, which were subsequently discussed at the meeting of the Underwriters' National Electric Association, as reported in another column.

Following are the resolutions which will be reported to the respective bodies represented at the meeting:

First—That it is the sense of this conference that the grounding of low-tension secondary alternating-current systems be recommended in all cases wherever reliable grounding connections can be secured.

Second—That in cases of three-wire systems the grounded neutral, solid connection, without fuse, be permitted on the neutral wire.

Third—That it is the sense of this conference that the grounding of the secondary of the alternating-current systems inside of buildings on water pipes, provided such connection is made at the nearest point to cellar wall on water pipe and outside of meter, is not only safe but places no additional burden or menace upon such water pipes.

General as Well as Technical Training Needed by Engineers.

Thomas F. Holgate, acting president of Northwestern University, says in the annual report of the university: "In our future developments it should be our immediate aim to enlarge the work of the scientific departments along practical lines, so as to furnish young men more and more with facilities for entering upon commercial pursuits with adequate knowledge.

"It is a well-recognized fact that the engineers of greatest efficiency and originality in all lines, whether civil, mechanical, electrical, sanitary, are men who have had a thorough general training in the principles of their science in addition to the special technical training."

Gas Company Offers 90-cent Gas.

The People's Gas Light and Coke Company of Chicago, by a representative, has offered to sell gas to consumers at 90 cents a thousand cubic feet, net, provided all litigation be "called off" and the city abandon its proposed legislation to regulate the price. Acting on the authority given it by the last Legislature to regulate the price of gas and electricity, the City Council instructed the committee on gas, oil and electric light to investigate the cost of manufacturing gas. Before this committee a lawyer has stated, for the gas company, that the cost of manufacturing gas in Chicago, paying interest on outstanding bonds and a six per cent. dividend on the stock, is 88.53 cents per 1,000 cubic feet. The items he presented as making up this amount are:

Manufacture and distribution	$0.5353
Interest	.17
Dividends	.18
Total	$0.8853

All costs, as office expenses, taxes, legal charges, etc., are put under the head of distribution.

The committee of the council now proposes to call in experts to verify these figures.

The company's counsel submitted figures showing cost of manufacturing gas in other cities, the figures being those sent him by the several companies in answer to a request from him. The cost of manufacture and distribution, exclusive of charges for depreciation, interest and dividends, in the cities answering is as follows: New York, 57.50 cents; St. Paul, 57.50; St. Louis, 53.52; Quincy, 75.96; Peoria, 77.00; Baltimore, 61.00; Brooklyn, 59.32. The Chicago company's figures are 53.53 cents.

Central-station men are watching the Chicago gas situation with some interest. It will be remembered that the enabling legislation which inspired the present investigation also gave the city power to regulate the price of electricity, and its powers to determine what shall be a fair price may be settled in this gas inquiry.

The capitalization of the People's Gas Light and Coke Company reaches the large figure of $68,065,000.

Government Awards Contract for Space-telegraph Apparatus.

Bids were recently opened in the Navy Department for furnishing 10 sets of space-telegraph apparatus for the navy, intended for stations mainly on the Pacific Coast, the following propositions being received: Clark Electrical Engineering Company, $9,468; Massie Wireless Telegraph Company, $15,000; De Forest Wireless Telegraph Company, $25,100; International Telegraph Construction Company, $48,300 Ostheimer Brothers, $67,950; Marconi Wireless Telegraph Company, $175,600; National Electric Signaling Company, $393,500.

The contract was awarded to the Massie Wireless Telegraph Company. The Stone Telephone and Telegraph Company made a proposition for a test of its method, which trial took place recently under the direction of the Bureau of Equipment. It is understood that one of the 10 sets will be installed at the Washington navy yard, and the others will be set upon the Pacific Coast. The Navy Department will purchase the material and make the installation. The Bureau of Equipment regards the price of the successful bidder as entirely reasonable, considering the guarantee of efficiency exacted of bidders.

Underwriters' National Electric Association.

The fourteenth annual meeting of the Underwriters' National Electric Association was held in the rooms of the Board of Fire Underwriters, 32 Nassau Street, New York city, on Wednesday, December 6th, under the presidency of Mr. F. E. Cabot. The meeting was open to all interested in the matter of rules for the installation of electric wiring and apparatus as contained in the National Electrical Code and was well attended.

The meeting received and considered the reports of the committees on car wiring, switches, high-tension motors, cut-outs, rheostats, specifications, fan motors and flexible tubing. A large number of recommendations were considered to effect slight changes of rules, as affecting among other things metal casings for electric heaters, the abolition of single-pole switches, insulated platforms for high-tension motors and the marking of voltages on three-wire system switches.

The association adopted the recommendations which had been adopted earlier in the week by the National Conference on Standard Electrical Rules.

Allis-Chalmers Steam Turbine.

Operation for the first time recently of a steam turbine at the Washington Street power house of the Utica Gas and Electric Company, Utica, N. Y., calls attention to the fact that this is the first turbine to be put into operation by the Allis-Chalmers Company, which recently entered the steam-turbine field. The turbine outfit installed at Utica is shown in Fig. 1. This turbine is rated at 1,500 kilowatts normal load, and runs at a speed of 1,800 revolutions a minute. It is direct-coupled to an Allis-Chalmers two-phase 60-cycle revolving-field alternator, operating at 2,500 volts. The unit has a continuous overload capacity of 25 per cent., with a three-hour 50 per cent. overload capacity without exceeding a safe generator temperature, and is capable of a 100 per cent. safe momentary overload. Artificial ventilation by means of an electrically driven fan blower, will, however, enable the unit to be run safely beyond its rated overload capacity.

The turbine follows the well-known Parsons type,

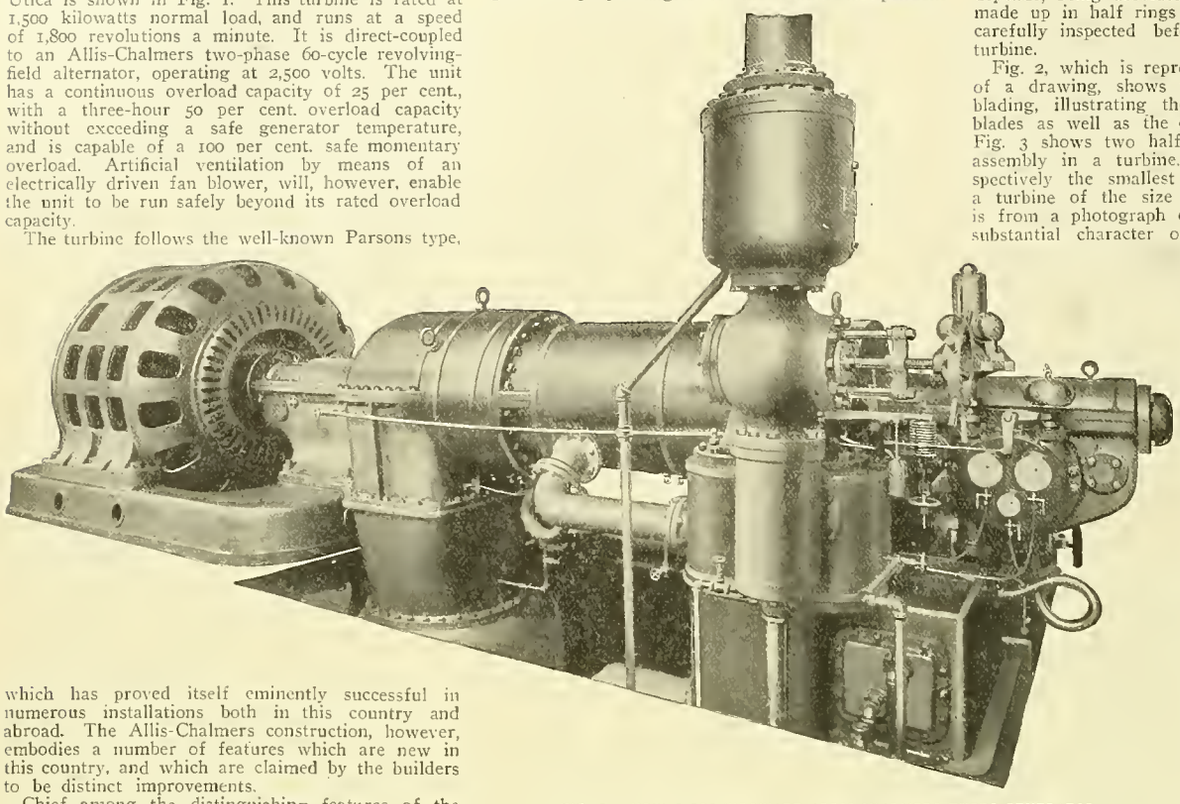


FIG. 1. NEW 1,500-KILOWATT ALLIS-CHALMERS TURBO-GENERATOR.

which has proved itself eminently successful in numerous installations both in this country and abroad. The Allis-Chalmers construction, however, embodies a number of features which are new in this country, and which are claimed by the builders to be distinct improvements.

Chief among the distinguishing features of the construction is the blading, which, while it is of the Parsons reaction type, as regards the principle of operation, differs in mechanical construction in a number of essential details. The roots of the blades are formed in dovetail shape by special machinery, and are inserted in slots cut in foundation or base rings; these slots being formed by special machine tools in such a way as to exactly conform to the shapes of the blade roots. The foundation rings themselves are of dovetail shape in cross-

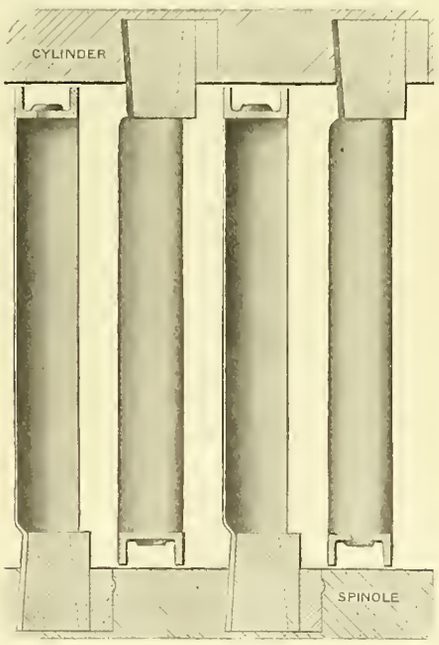


FIG. 2. DIAGRAM SHOWING BLADING AND CHANNEL-SHAPED SHROUD RING.

section and are inserted in dovetailed grooves cut in the turbine cylinder and spindle, respectively, in which they are firmly held by key pieces, much in the same way that the well-known "Lewis bolt" is fastened. In order to further insure the integrity of the construction, the key pieces or rings, after being driven into place, are upset into undercut grooves.

Another noticeable feature of the blading is the method of reinforcing and protecting the tips of the blades. This point in steam-turbine design is one upon which much thought has been expended by various inventors, and the Allis-Chalmers Company asserts that the construction employed by it successfully solves all difficulties. In forming the blades a shouldered projection is left at the tip. This is inserted in a slot punched in a shroud ring, the slots being punched by special machinery in such a way as to produce accurate spacing and at the same time form the slots so that they will give the proper angles to the blades independent of the slots in the base ring. After the blade tips are inserted in the slots in the shroud rings they are riveted over by specially arranged pneumatic machinery.

Shroud rings are made in channel shape, with outwardly projecting flanges, which, after assembly in the turbine, are turned and bored to give the necessary working clearance. The flanges of the channels are made so thin that, although amply sufficient for stiffness, the shroud ring does not have the disadvantage of a solid shroud, which acquires a dangerous temperature by friction in case of an accidental contact of the rotating and stationary parts. It is claimed for this construction that the blades are substantially stiffened against the effect of vibration, while the use of a protecting shroud ring enables the working clearance to be made smaller than in the case of naked blade tips, without danger in case of accidental contact, thus reducing the leakage loss to a minimum. Leakage past the blade tips is the principal source of loss in the steam turbine. As to the safety from damage in case of accidental contact, it is said that this has been proved by experiment with actual blading. This was done by throwing the bearings out of center so as to produce contact, without detrimental results. An incidental advantage claimed for this construction is that, if by chance a blade should prove defective, it is so held in place by the shroud ring that it cannot possibly work loose and produce damage.

By the method of construction described, the entire blading is produced by machinery, thus eliminating the personal equation which enters into blading done by hand work, which depends upon the skill of the individual workmen. Besides insuring that every blade is securely fastened, all blades are necessarily set at exactly the designed angle and pitch; the openings between blades, upon which in great part the economical performance depends, being absolutely uniform. The blading is made up in half rings in the blading shop and is carefully inspected before being inserted in the turbine.

Fig. 2, which is reproduced from the photograph of a drawing, shows the general scheme of the blading, illustrating the method of fastening the blades as well as the channel-shaped shroud ring. Fig. 3 shows two half rings of blades ready for assembly in a turbine. These half rings are respectively the smallest and largest ones, used in a turbine of the size installed at Utica. Fig. 4 is from a photograph of the blading, showing the substantial character of the construction as well as the uniformity of the work. Fig. 5 shows a turbine spindle of the same size as that of the Utica turbine. This is from a photograph taken in the West Allis shops of the Allis-Chalmers Company.

Another special feature of the turbine will be noticed by referring to Fig. 5, viz., the absence of the usual low-pressure "balance piston." The picture shows only two balanced pistons, instead of the three pistons formerly used in this type of turbine, where it is said to have been found difficult to produce a balance piston of the size required for balancing the low-pressure stage of the turbine and at the same time making it sufficiently rigid to run with the necessary small working clearance. In the Allis-Chalmers construction there is, however, a third balance piston, but instead of being at the high-pressure end of the turbine, as formerly arranged, it is at the low-pressure end, and as it is smaller than the large end of the spindle it is hidden from sight in the picture. By making this piston in such a way that its circular area is equal to the annular area of the pistons used in the older construction, the low-pressure balance piston is made much smaller. Instead of reducing the leakage past this piston by means of "dummy packing," as in the high-pressure and intermediate pistons, and as used in the low-pressure pistons of the older construction, a labyrinth packing of radial baffling type has been adopted, thus eliminating small axial clearance in this turbine. A considerable advantage is claimed for this construction in permitting of the use of smaller working clearances in the high-pressure and intermediate balance pistons.

There are a number of other points of improvement claimed for the Allis-Chalmers construction, which include details of spindle construction, governing mechanism, lubrication, and other minor features.

Perhaps the most noticeable feature of the alternating-current generator used in the Utica outfit is the substantial design of the revolving field, providing great strength and at the same time giving the thorough ventilation which is essential. Particular attention has been paid to the insulation, as may be inferred from the fact that the armature (Fig. 6) was subjected to an alternating-current insulation test of 10,000 volts for the period of 15

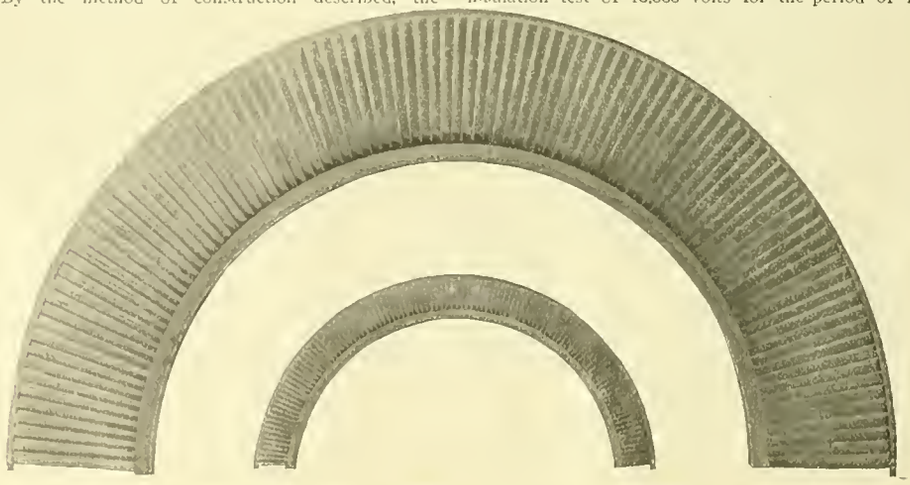


FIG. 3. HALF RINGS OF TURBINE BLADES READY FOR ASSEMBLY.

minutes. This generator was built at the Bullock works of the Allis-Chalmers Company at Cincinnati, where the generators for all of its other turbine outfits are being built.

The Allis-Chalmers Company, in entering the steam-turbine field, effected an alliance with the Turbine Advisory Syndicate of England, thereby securing the co-operation of the firms therein interested, including Willans & Robinson, high-speed engine builders of Rugby; Yarrow & Co., torpedo-boat builders of the Isle of Dogs, London, and the Neptune Shipbuilding Works, Walker-on-Tyne. The Utica turbine, in fact, was built for the Allis-Chalmers Company by Willans & Robinson, to whom a number of turbine contracts were sublet by the Allis-Chalmers Company before the latter had perfected the installation of its special machinery for turbine manufacture.

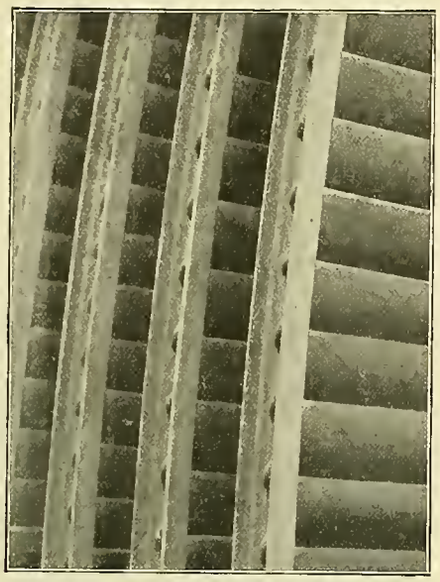


FIG. 4. VIEW SHOWING CONSTRUCTION OF BLADING IN ALLIS-CHALMERS TURBINE.

An agreement was recently effected with Charles A. Parsons, C. B., for interchange of data, thereby giving to the Allis-Chalmers Company the benefit of the vast experience of Mr. Parsons, the original inventor of this type of turbine, and to whose engineering ability and energy the evolution and present state of perfection of this type of steam turbine are principally due. The Allis-Chalmers Company has also secured rights under Mr. Parsons' patents for marine turbines and turbo-compressors and blowers, for which there is a growing demand.

At present the company is building its steam turbines in the engine works at West Allis. The growth of the business, however, has led to a large extension of the works, amounting to a practical doubling of the present plant. A considerable part of the extension will be devoted to the manufacture of steam turbines and the accompanying electric generators, one of the three new manufacturing buildings being given up to the exclusive manufacture of the turbines themselves. The first steam turbine of the Allis-Chalmers Company's own make, of 5,500 kilowatts capacity, was recently shipped, and others are following as fast as the present crowded condition of the shops will permit.

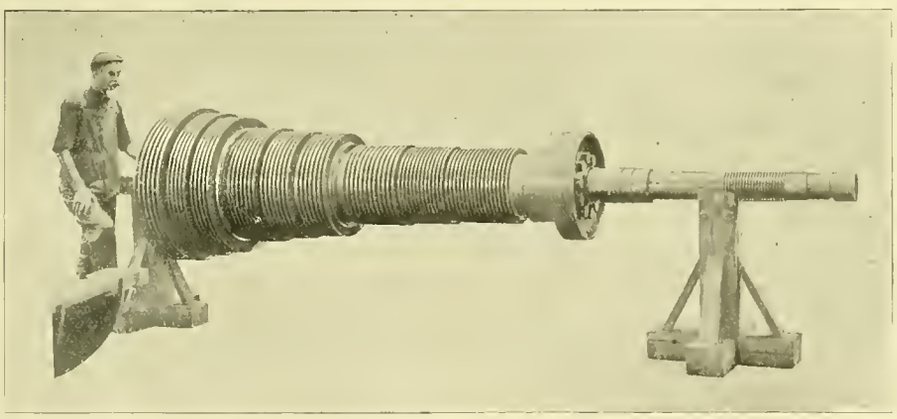


FIG. 5. SPINDLE OF ALLIS-CHALMERS STEAM TURBINE.

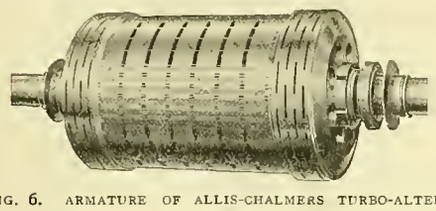


FIG. 6. ARMATURE OF ALLIS-CHALMERS TURBO-ALTERNATOR.

Instructions for Central-station Operating Men.

By W. F. Wells.

Part II.

No employe is to borrow money from any person or agency, giving his position as reference or his wages as security. He must not use the company's credit unless authorized by the proper officer.

If it is necessary for an employe to absent himself from duty he must send word by telephone to the system operator before the hour at which his duties should commence, giving his reason for absence and the probable time of return to duty.

An employe to be relieved by another must not go off duty until so relieved, and he must explain to the employe relieving him all unfinished work in progress and give any other information necessary for his guidance.

Smoking or use of intoxicants by employes while on duty is prohibited. The habitual use of intoxicants is a sufficient cause for dismissal.

All employes will be regarded as in the line of promotion, advancement depending on past record and capacity for increased responsibility.

If in doubt as to the meaning of any rule, or special instructions, application must be made at once to the proper authority for an explanation. Ignorance is no excuse for neglect of duty.

Repeat back all operating orders and messages before you execute them, and insist on the repetition of messages that you may transmit.

Medical supplies may be issued to any employe injured on duty; otherwise only on written order of engineer on duty, or operating foreman.

System operators will record hourly, on the prescribed forms, the output of the generating stations and for each sub-station the current transformed by rotaries, discharged by batteries or charged into batteries. He will plot hourly on regular forms curves showing the total load on the system, the output of the main generating station and the current generated at low tension or discharged by batteries. On the daily report will be noted all engines and equipment out of service in any station, any accident affecting system operation, with full details of conditions in each sub-station before trouble occurs, the amount of output affected, the drop in pressure, and any further information that will assist in ascertaining the cause of trouble and correction to be applied. Battery test discharges will be made by battery department, and the total effective capacity of battery reported. Report is to be made of current furnished unusually to any outside company, with reason for same and meter readings in accordance with instructions. Record is to be kept of starting-up tests, which should be made at least semi-monthly. Record of feeders made alive or cleared, feeders "held off," with the precautions taken, and names of regulators to whom information or instructions are given regarding these are to be kept in a special book provided for the purpose.

The battery department will furnish schedule for discharging batteries periodically in order to maintain them in good condition. These test discharges are to be made at a time when most beneficial for system purposes, and should not be allowed to interfere with system operation in any way. Report of them should be made on daily report and battery-discharge report. Whenever any considerable discharge is taken from a battery it should be charged again as soon as possible and all batteries should be fully charged before 8 a. m.

Discharge each battery to two-thirds of its capacity twice a week and completely discharge each battery once a month at the one or three-hour rate.

On the electrical foremen's daily report is to be noted:

Any accident or occurrence which has any bearing on the service of the station, any accident to person, special tests made, or any special work done or repairs made by the men of the operating or construction department.

Foremen's log book will contain report of work done and repairs made by the operating department, and will include the following reports:

Air-gap measurements of generators, which are to be made semi-annually.

Air-gap measurements of motor generators and exciters, which are to be made monthly.

Record of oil switches cleaned, which work is to be done yearly, or whenever switch has broken heavy current.

The foreman will make out schedules apportioning the cleaning of switches among the three watches, and will see that this schedule is adhered to as nearly as possible.

He will be held responsible for the lighting of the plant during the 24 hours. On all passages, stairways, etc., there must always be sufficient light to prevent possibility of accident, and at same time lamps must be turned off whenever sunlight is sufficient.

Foremen will inspect each morning the following reports, and in case of any irregularity note cause for same: High-tension load sheets; high-tension feeder wattmeter readings; high-tension recording voltmeter chart; low-tension load sheets; low-tension feeder pressure slips; recording voltmeter charts of standard feeders and batteries; battery curves.

All requisitions for supplies or material are to be made on prescribed forms.

Foremen will inspect and initial "hold-off" order book when coming on duty and from time to time when "hold-off" slips are issued.

Before any new or repaired apparatus or cables are connected to the system, carefully inspect same and make the prescribed tests, making sure that all switches, etc., are marked with the proper number of designations. Relays should be tested before feeders are put in service.

Give to the system operator each morning a list of apparatus or equipment out of service, and advise him from time to time as any change is made.

During increasing or heavy load spend as much time as is consistent on the high-tension control board, and keep the system operator continuously informed regarding the load whenever generators are carrying load in excess of schedule.

The regulator will report at once to the foreman any defective gloves, tools, ladders, etc., accidents to apparatus or employe, disturbance of pressure, trouble on system, or any accident or extraordinary occurrence whatever.

The regulator will call attention of foreman to any work in progress near or around electrical apparatus if he thinks such work is being carried on in a manner that may damage the apparatus in question or cause injury to anyone.

The regulators must keep posted as to all changes in feeders or electrical equipment, note same in their log book, and at every change of watch call the incoming regulator's attention to all such changes. No excuse by a regulator that he did not know such changes were being made will be accepted.

Each generator switch is to be tested for operation after cleaning or repairing. Each generator switch not in service shall be tested for operation every morning before 7 a. m. and a report entered in "reports to foremen" of its action.

The feeder switches and transformers will be tested for operation after they have been cleaned or repaired by first cutting in the non-automatic switch, and note that the pilot lamp lights, and when that switch has been cut out, cutting in the automatic switch.

Each week as the underground tester tests the high-tension feeders the regulators will test the direct-current connections of the time-limit relays. The regulator will keep a record in "reports to foremen" as these relays are tested, and observe that the plunger resumes its normal position.

All the details of changing busses should be handled under the direct supervision of the foreman, and, when possible, change should be made just previous to midnight.

The man who is to do the cleaning of oil switches will personally notify the high-tension regulator as to the switch or switches he desires to clean. The high-tension regulator will arrange with the system operator for taking the feeders connected to such switches out of service and properly protecting same in the sub-station.

A safe load for the generator depends altogether upon the absolute temperature of the parts of the generator that will deteriorate with the continued application of heat. For generators of the size and construction of those under consideration (Waterside) we cannot advise subjecting them to higher temperature than 80° C. Consequently the safe load at any time will depend altogether upon the temperature of the surrounding atmosphere. It will, therefore, be possible to operate with an output of say 500 amperes per phase at one time, when it would not be safe to operate with more than 400 amperes per phase at another time, pro-

vided the temperature of the surrounding atmosphere can vary through such limits as 20° C. to 35° C.

Calibrating Battery Bristol Voltmeters.

This must be done after a battery charge each day. When there is no charge this should be done at a certain hour each day. See that the battery is floating on the proper number of cells and adjust the Bristol resistance so that the voltmeter, when connected across 50 cells, reads 104 volts.

After a discharge the battery should be left floating so no current passes to or from the battery. A rise in the Bristol chart curve shows that the battery is charging from the bus, which is not proper.

After a charge the battery should be left floating on the proper number of cells for the bus pressure. Usually this will allow the battery to discharge slightly, but the ammeter needle will soon settle to zero.

When floating the voltage on the battery should be constant and there should be a comparatively straight line during the entire floating period (marked "correct floating"). Notice also where print is marked "incorrect floating."

A variation of two volts is allowed, as regulation cannot be made closer; 104 is the floating voltage.

Anything unusual in the curve should be explained on the chart, and if the Bristol circuit is open for any reason the meter should be calibrated when the circuit is again completed.

Specific gravity and temperature readings of the pilot cells should be taken after a battery charge each day. When there is no charge this should be done at a certain hour each day. The specific gravity and temperature of the pilot cells and the time these readings were taken should be marked on the battery Bristol charts.

To Charge Battery with Booster from the Field Bus.

This should only be done when charging from the system bus would leave the field bus without a battery.

1. See that booster is clear and that the booster generator fields are open.
2. See that the bus to be used for charging is not connected to any other bus.
3. Close the positive and negative booster motor bus switches.
4. Close the starting switch on the pedestal, cutting out the resistance slowly, step by step, until switch is entirely closed.
5. Tie the positive charging bus to the positive field bus with the positive battery switch in use.
6. Close the positive booster generator low leg on the field bus and the high leg on the charging bus.
7. Tie the negative charging bus to the negative field bus with the negative battery switch in use.
8. Close the negative booster generator low leg on the field bus and the high leg on the charging bus.
9. Insert the galvanometer plug in each pedestal and see that the galvanometer indicates zero. Then close the pedestal switch on both booster generators.
10. Disconnect the positive and negative battery switches from the field bus.
11. Put the field rheostats at the "all in" or weakest position and close both booster generator fields.
12. Adjust field of each booster generator until a charge of 600 amperes is obtained. While doing this be careful that field bus voltage is kept normal.

To Start an Auxiliary Direct-current Bus.

1. Tie standard and dead auxiliary bus together with machine bus switches of machine running on standard bus and which is to be changed to auxiliary bus.
2. Change all feeders that are to be run on auxiliary bus to same.
3. Before separating busses see that the total load on all feeders changed to auxiliary equals the load on machine tied to standard and auxiliary bus, then separate the busses by opening both standard bus switches of the machines connected to standard and auxiliary bus, and raise auxiliary bus voltage to get the desired voltage at the end of the feeders.
4. To drop auxiliary bus adjust the auxiliary bus voltage until it is the same as the standard bus voltage, then close machine switch on standard bus.
5. Change all feeders from auxiliary to standard bus.
6. Open machine switches on auxiliary bus.

To separate the field bus from the system bus, notify high-tension switchboard; then bring the field bus voltage to normal very slowly. Add 150 amperes to the total load on all alternating-current generator fields and adjust fields on exciters and machines on system bus until the load on the exciters is equal to the total load on the field bus as above; then separate field system bus at point where they were tied. Under no consideration take field battery off field bus without first changing system battery over in its place.

Operation of Motor-generator.

To start a motor-generator from the direct-current side:

1. See that the motor-generator is clear.
2. Remove clamp from switch blade on the direct-current starting box.
3. Place starting lever on the alternating-current motor in the running position.
4. With the field rheostat at the "all in," or weakest position, close bus switches and field switch and test pole for magnetism.
5. Adjust the field rheostat to the "all out," or strongest position, and close pedestal switch on starting clip.
6. Close switch on the direct-current starting box slowly, step by step, until switch is entirely closed.
7. Close pedestal switch entirely.
8. Bring field rheostat slowly to eighth button from weakest end.
9. Close alternating-current control switch and note that the red "bull's-eye" lights indicate that the oil switch has closed.
10. Place switch blade on the direct-current starting box in the starting position and replace clamp on blade.

To start motor generators from the alternating-current side:

1. See that the motor generator is clear and starting lever at the point nearest the direct-current generator, which is the correct starting position.

Note that the movable contact brush is on the contact nearest the direct-current generator. If not, starting lever must be thrown nearer the direct-current generator.

2. With the field rheostat at the "all in," or weakest point, close bus switches and field switch and test field pole for magnetism.
3. Close oil switch control switch and note red "bull's-eye" lights, indicating that the oil switch has closed; then cut out starting resistance of induction motor, step by step, as machine reaches its maximum speed for each step.
4. When the starting resistance is all cut out, insert galvanometer plug in pedestal receptacle and adjust field to bring galvanometer to zero; then close pedestal switch entirely.

To shut down motor-generator.

1. Adjust generator field until zero current is obtained; then open oil switch control switch, and note that the green "bull's-eye" lights, indicating that the oil switch has opened.
2. Open pedestal switch.
3. Bring field rheostat to weakest point and open field switch.
4. Open bus switches.
5. Place starting lever of induction motor in starting position.

[*The end.*]

The "Dynelectron."

Cheap electricity manufactured direct from heat, water and air is the fond hope of a number of Indiana people who are interested in the project of J. H. Reid of New York, who is the inventer of what he terms the "dynelectron." This device is described as "an engine for the extraction from heat, water and air of unlimited electrical power, without the use of boiler, engine or dynamo, a startling revolution of known methods of development of electricity. By the application of less than 400 degrees of heat to the apparatus and by supplying it with air at 12 pounds pressure, and with water in required quantities to replace that which is evaporated, the dynelectron will go on for an indefinite period creating a current of electricity, which, measured by present devices and tested by known means is found to be identical with that generated by the rotary dynamo."

A local office has been opened on the ground floor of the Fitzgerald Building in Indianapolis, where demonstrations of the dynelectron in operation are given daily. During the first three days the office was open it is said more than 1,000 persons, "largely scientific men and electricians," viewed the invention. The parent company, of which Mr. Reid is president, has headquarters in New York, but it is proposed to turn the affairs of the Indiana concern over to people of Indiana. If this is done, it is said that a large factory will be erected at Indianapolis. I. A. Lewis of Indianapolis is vice-president of the company.

Industrial Advertising Managers Dine.

The Technical Publicity Association, the members of which are the advertising managers of the machinery and electrical manufacturers east of Ohio, dined and held an open meeting at 111 Fifth Avenue, New York city, on December 8th. George H. Gibson, a former secretary of the association, made an address on "Lost Motion in Machinery Advertising," which was followed by an informal discussion. Among the concerns represented at the dinner were the Ingersoll-Rand Drill Company, Niles-Bement-Pond Company, General Electric Company, Crocker-Wheeler Company, Sprague Electric Company, De La Vergne Machine Company, John A. Roebling's Sons Company, M. H. Treadwell Company, Westinghouse Companies, New York Edison Company, Yale & Towne Manufacturing Company, American Wood Working Machinery Company, B. F. Sturtevant Company, H. W. Johns-Manville Company, Holophane Glass Company and Sawyer-Man Electric Company.

Heavy-duty Electric Coal Truck.

Electric trucks for heavy hauling in cities are coming more and more into favor. The cost of operation is moderate, and when the loss of horses, which even with the best of drivers is frequent during slippery going, is taken into consideration, experience has proved the electric truck to be the more economical. Illustrated herewith is a new electric truck which is being operated by a large coal company in Chicago. Some of the results that have been obtained with it are surprising and gratifying to those who hope to see the much-abused horse relieved of the heavier hauling. The truck has been in operation about four weeks and the loads which it carries vary from 10,000 to 11,500 pounds. The service which it performs consists of carrying coal from the yards at the corner of Fourteenth and Clark streets and from the pier at the end of Randolph Street Viaduct to all parts of the city. The hauls are made principally to the "loop" district, however, and the truck will make easily six trips daily to that part of the city, carrying each time a load of over five tons. Three-

HEAVY-DUTY ELECTRIC COAL TRUCK.

horse teams make at best three or four trips, carrying not over 8,500 pounds.

The truck is provided with a motor made by the Synnestvedt Machine Company of Pittsburg, Pa., the Commercial Automobile Company being distributing agent in Chicago. This motor is four-pole and supplies power to the rear wheels. It is substantially a street-car motor, and by being carried on heavy coil springs from a cross-piece on the truck frame it is relieved of all pounding and jarring of the wheels. It is maintained in a fixed position from the rear axle by heavy frame-like strut rods pivoted at the motor, the rods being made so that adjustments of the drive chains can be made. The motor has four forward and two reverse positions. It has practically eight field windings, two for each pole. On the slow-speed the eight windings are connected in series; for second speed the two windings in each pole are united in parallel and the four poles joined in series; for third speed the two poles are joined in parallel with the other two in series, and at top speed all windings are united in parallel. The controller is horizontally placed beneath the seat and is worked by a short lever at the right of the seat. The motor when under load on level streets draws from 75 amperes of current upward and the voltage ranges from 80 when recharged to 68, the latter being the minimum when carrying loads. The speed with full load is from six to seven miles an hour, with a radius of 30 miles on one charge.

Running gear is provided with a very heavy frame of H section, on which rests the carrying platform. The rear axle is a solid piece of square section three inches to the side and front axle is a solid shafting with a diameter of 2½ inches. Yoke steering knuckles work within heavy jaws pinned to the ends of the front axle. Front and rear wheels are 36 inches in diameter, shod with seven-inch Firestone tires and run on Moffatt roller bearings, the motor also running on these bearings. The spring suspension is a platform scheme in front and rear, the rear platform being attached to the frame at the front ends of the side springs and to the center of the rear cross-piece. The cross part of the front platform connecting the rear ends of the front side parts rests against a cross-piece of the frame. The wheel bas is 10 feet. Steering is done through a column, on the bottom of which is a small pinion meshing with an internal toothed quadrant that connects with the tie rod. Current is supplied by a battery consisting of 40 cells of the Universal Storage Battery Company's manufacture.

BOOK TABLE.

HIGH-TENSION TRANSMISSION. New York: McGraw Publishing Company. 1905. Pp. (six by nine inches), 466, with 117 illustrations. Price, $3.

In this book have been collected the results of the work of the high-tension transmission committee of the American Institute of Electrical Engineers. There is nothing new in the material, all the papers and discussions being contained in the Transactions of the Institute. The excuse for the book lies in the fact that the papers and reports of this committee are collected into one volume, where they are more readily accessible to one studying the subject of high-tension transmission.

THE HOW AND WHY OF ELECTRICITY. By Charles Tripler Child. Second edition. New York: Electrical Review Publishing Company. 1905. Pp. (5 by 7½ inches), 138, with 39 diagrams. Price, $1.

This is the second edition of this useful little book, first published just after the death of Mr. Child, three years ago. The type has been reset, some new drawings have been made, and such corrections and amendations supplied as were necessary to bring the book up to date. The subtitle is "A Book of Information for Non-technical Readers," and for this purpose the book may be heartily commended.

PRACTICAL PATTERN MAKING. Edited by Paul N. Hasluck. Philadelphia: David McKay. 1905. Pp. (five by seven inches), 160, with 300 illustrations. Price, $1.

Information on the general principles of pattern making is contained in this book, which is a comprehensive digest of information contributed to an English periodical edited by Mr. Hasluck. What the use of patterns in foundry work is and how they are made is told in the text, and a large number of excellent diagrams illustrate the various steps. There are in all 13 chapters, each treating of some phase of the art which is distinctive, such as, for instance, the making of worm-wheel patterns, slide-rest patterns, valve patterns, core boxes, etc.

THE BUSINESS OF MUNICIPALITIES AND PRIVATE CORPORATIONS COMPARED. By M. J. Francisco. Rutland, Vt: M. J. Francisco & Son. 1905. Pp. (5¾ by nine inches), 136.

The new book by Mr. Francisco entitled "The Business of Municipalities and Private Corporations Compared" is practically a revision of his former book upon "Municipalities versus Private Corporations." It strongly combats municipal ownership of electric-lighting plants and has been carefully compiled as to statistics. Reports from the records of a large number of cities are given, and in cases where positive and reliable figures could not be obtained the city was omitted from the list. Information collected by Mr. Francisco and here presented all goes to show that municipal ownership of lighting plants has proved a failure in almost every instance.

REAL ELECTRIC TOY MAKING FOR BOYS. By Thomas M. St. John. New York: Thomas M. St. John. 1905. Pp. (4⅞ by 7⅜ inches), 140, with 107 illustrations. Price, $1.

Although intended for boys who are handy with tools and interested in electricity, the book will be found useful by those who wish to take up a course in elementary electrical experiments that can be performed with simple homemade apparatus. Most of the experiments and toys which are described may be made by a boy with a mechanical turn of mind with the tools and materials which are usually among his cherished possessions. Some of the devices described may be put to real use, and all are interesting and will instill in the boy's mind a liking for the mysteries of electricity. In the hands of an intelligent youth the book will be found a never-ending source of amusement and show to him many opportunities for exercising his mechanical abilities.

MODERN LOCOMOTIVE ENGINEERING, WITH QUESTIONS AND ANSWERS. By Calvin F. Swingle, M. E. Chicago: Frederick J. Drake & Co. 1905. Pp. (4¾ by 6½ inches), 630, with 265 illustrations.

Locomotive engineering requires a man of more than average mechanical ability, for the locomotive is a complicated machine, subject to many ailments. And then there is always the great responsibility resting on the driver. To make a success of it there must be a great deal of study on the part of the man taking it up as his vocation in life. In order to condense into a form which is readily accessible, and at the same time understandable, as much information on the construction of the locomotive as possible, this book has been prepared.

First, the elementary features are taken up, and here the author is to be commended in making at the start an effort to interest and instruct the fireman as well as the engineer. To help fix in mind the contents of the text a system of questions follows each chapter, which cover all the essential parts of that chapter. The phrase, "With Questions and Answers" of the title page is a little ambiguous, as the answers to the questions are not given, except as they are found in the text, the author believing the catechetical form not so helpful as where the student must dig the answer out for himself. In all there are 903 of these questions. The first 10 chapters take up in detail the various parts of the locomotive, the fireman's duties and what to do in case of breakdown. The eleventh and last chapter deals with that all-important factor in railroading, the air brake.

Aside from the regular illustrations, which are plentifully scattered throughout the book, there are six large plates of different parts of the locomotive and air-brake mechanism, two of these being contained in a pocket in the back, which forms a convenient receptacle for loose sheets of data which the engineer may wish to preserve. The book is bound in leather with a flap similar to the usual pocket or hand book, and it makes a very neat-appearing volume—one to which the engineer may often refer with profit.

MODERN TURBINE PRACTICE AND WATERPOWER PLANTS. By John Wolf Thurso. New York: D. Van Nostrand Company. 1905. Pp. (6⅛ by 9⅛ inches), 244, with 88 illustrations. Price, $4.

Hydraulic-turbine practice from the viewpoint of the installing engineer rather than the designer is made the basis of this book, and the author's experience in connection with engineering work upon nearly 200,000 horsepower in hydraulic installations has given him an excellent opportunity to study the various phases of the subject. American practice varies widely from that in European countries, which is a natural outgrowth of the difference in conditions existing between the waterpowers in this country and abroad. On the whole the author is inclined to the opinion that American turbine practice is inferior to that in Europe, and the first part of the book is devoted to pointing out these deficiencies. One deficiency of the American turbine the author asserts is in the matter of efficiency at heads from say 40 feet up. Instances are cited of American turbines working under a head of over 200 feet in which the efficiency is in the neighborhood of 68 per cent., while it is common for European turbines at similar heads to give an efficiency of 80 per cent. Below 40 feet the American-built turbine seems to have the better of the argument.

The cause for this may be ascribed to the fact that the American turbine has been developed largely through experiment, and the testing flume at Lowell, Mass., may be said to be the cradle of this development. At Lowell the head available was but 18 feet, and turbines perfected for such low heads cannot be expected to perform as creditably at higher heads. Of course, it is not to be supposed that all American turbines are designed for a head of 18 feet, but still the tendency has been, since the first experimental work, according to the present author, to cling to forms of construction first adopted. The shape of the bucket in American types of turbine is not believed to be suitable for high heads.

After pointing out the differences between American and foreign turbines, other chapters in the first part relate to classification of turbines and their construction, turbine accessories, and one chapter upon the steam turbine.

Part two takes up waterpower plants in general and gives much valuable information regarding the development of such powers. Finally, in an appendix, there is a reprint of the paper presented by Allan V. Garratt to the American Institute of Electrical Engineers upon the subject, "Elements of Design Favorable to Speed Regulation in Plants Driven by Waterpower." The book will find a wide field of usefulness, especially in view of the rapid extension of waterpower development.

BOOK RECEIVED.

"Gas, Gasoline and Oil Engines." By Gardner D. Hiscox, M. E. Published by the Norman W. Henley Publishing Company of New York city. (Pages, 438; price, $2.50.)

The Telekino.

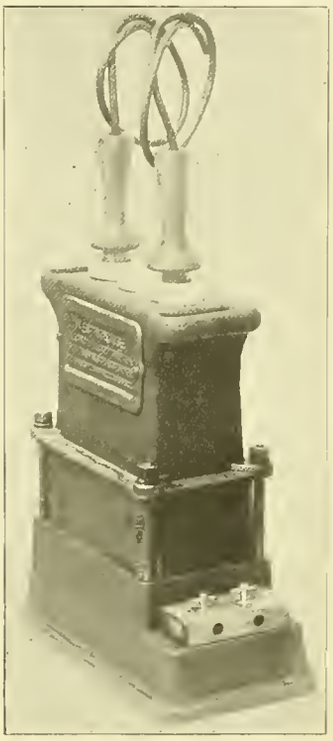
Bernardo Torres Quevedo, a Spanish engineer, has been experimenting with a device he has patented which he calls the "telekino." The device is utilized to control electrical apparatus at a distance by the aid of electric waves sent without wires. Official tests were made at Madrid last month, which are said by a correspondent of the London Times to have been successful, the inventor easily controlling from a shore station the movements of a boat out in the bay. The boat used for the experiment carried a battery of accumulators, a motor for driving the propellor, another for the rudder, and two controlling motors for operating the mechanism of the other motors. The controlling motors were directly connected to the telekino, with which they formed one single apparatus. Hertz waves from the transmitting station on shore were received by the telekino. This controlled the controlling motors, which sent currents either to control the rudder motor or the propeller motor so as to govern both the steering and the propulsion of the boat. It is said that Mr. Quevedo controlled all the movements of the boat without the least difficulty.

The Waldorf Mining Company is to install an electric power plant at Georgetown, Colo.

Westinghouse Pipe-thawing Apparatus.

Electric current as a thermal agent is superior in many ways and its convenience and effectiveness have led to its utilization in the thawing of water pipes, gas mains, telephone conduits, and the like. It is necessary that the apparatus for such purposes shall have a range in capacity adequate to cover all ordinary requirements; easy to connect and moderate in price; portable and light in weight so as to be easily handled; able to withstand rough usage and insure protection from injury to the operator. The Westinghouse Electric and Manufacturing Company has placed on the market two outfits, one for heavy service, comprising a specially designed choke coil used in connection with the primaries of a standard transformer and one for lighter service, consisting of a transformer adapted for suitable secondary voltage adjustments mounted in cast-iron top and bottom frames.

The heavy-duty outfit consists of a choke coil connected in series with the primary of a standard 2,200-volt 60-cycle transformer of from 15 to 25 kilowatts capacity. The choke coil is compactly built and enclosed in a cast-iron case which occupies a floor space of 16 by 16 inches. Five plug receptacles mounted in the upper portion of the case provide a simple means of varying the primary voltage. The various taps give approximately 50, 60, 75, 87 and 95 per cent. of the full line voltage. By changing the position of the plugs any one of these combinations may be used.



ELECTRIC PIPE-THAWING APPARATUS.

The smaller outfit is intended for lighter service, such as thawing house piping. It is compactly built and enclosed in a case with cast-iron top and bottom, the transformer laminations themselves being exposed to the air, thus providing excellent conditions for cooling. Handles are provided on the top casting which will enable one man to carry the transformer, as its weight complete is approximately 100 pounds. It is intended for use on 2,200-volt 60-cycle circuits and has a variation in secondary voltage from 55 to 35 and will maintain a current of 100 amperes for one-half hour without undue heating. No oil is used with this transformer, as the insulation is specially prepared to withstand severe conditions.

In operation the transformer should be placed as near the pipes to be thawed as possible. For dwellings one low-tension lead may be connected to a faucet and the other to a hydrant so as to enclose the frozen section. For thawing street mains two hydrants may be conveniently used. On account of the different conditions met with it is impossible to prescribe the exact voltage or current necessary to do any particular thawing. In general the voltage necessary to force the same amount of current over pipes of the same diameter will vary with the length of pipe. Large pipes require less voltage to force the same current through a given length, but require more current to thaw them.

For pipes up to five inches in diameter approximately 500 amperes is usually sufficient, while 12-inch mains may require 1,000 amperes. As a rule a small current for a long period of time will do the work that a large current will do in a shorter time, and the thawing will be done with less chance of injury to the piping system.

Indianapolis-Cincinnati Single-phase Railway Inspected by Large Party of Traction Men.

Owing to the constantly increasing importance of the electric railway, particularly since the introduction of the single-phase equipment, the operation of such an important single-phase line as that of the Indianapolis and Cincinnati Traction Company is watched with great interest. This interest has been enhanced by the recent decision of the New York, New Haven and Hartford Railroad Company to equip its terminal passenger service into New York city for operation by single-phase electric locomotives supplied by the Westinghouse Electric and Manufacturing Company, which also furnished the electrical equipment for the Indianapolis-Cincinnati electric line. The latter will be 120 miles long when entirely finished, and will be supplied from a single power house. The closing of this year finds a considerable portion of this road in successful operation, and the construction of the remainder well advanced.

With the idea, therefore, of affording a large number of railway and electrical men an opportunity of inspecting the Indianapolis-Cincinnati road, the Westinghouse company, through Mr. T. P. Gaylord, manager of its Chicago office, with the co-operation of Mr. Charles L. Henry, president of the Indianapolis and Cincinnati Traction Company, last week took a party numbering between 90 and 100 on special cars from Indianapolis to inspect the system, which is now in operation between Indianapolis and Rushville, Ind.

On Friday, December 8th, at 8:40 p. m., under the guidance of Mr. Gaylord, the Chicago portion of the party, numbering in the neighborhood of 85, started for Indianapolis via the Panhandle railroad in three special Pullman sleepers.

During the evening the guests were entertained on the train by Mr. Gaylord, Manager H. H. Kerr of Westinghouse, Church, Kerr & Co. and Western Manager W. S. Bartholomew of the Westinghouse Air Brake Company, assisted by a number of other gentlemen connected with the three companies.

The members of the party were breakfasted at the Claypool Hotel, Indianapolis, as guests of the Westinghouse Electric and Manufacturing Company, and at 10 a. m. all were taken in three special interurban cars from the terminal station of the Indianapolis and Cincinnati Traction Company at Indianapolis, over that company's double-track road to Rushville, at which point is located the power house and generating equipment of this fine example of a Westinghouse single-phase alternating system.

After a brief stop at Gwynville, about 29½ miles out from Indianapolis, to inspect the transformer station at that point, the party took the cars again and ran into Rushville to inspect the power plant.

During the ride from Indianapolis to Gwynville, with the train running at an exceedingly high speed, each man in the party was given, individually, an opportunity to inspect the single-phase motor in action beneath the car, particular attention being called to its practically sparkless brushes.

A point of decided interest to the electrical engineer was the fact that the single-phase motors beneath these cars ran out from Indianapolis 2½ miles on a direct-current 550-volt circuit (the city railway system), then, without stopping, ran onto the overhead 3,300-volt alternating-current system that extends to Rushville. An interesting fact to be noted also is that the air-pump motor on the cars also runs either "A. C." or "D. C."

The system of electrical distribution on this road requires transformer stations about 10 or 12 miles apart. The current is sent from the power station to these transformer station at 33,000 volts, single-phase alternating current, where it is reduced and fed into the trolley wire at 3,300 volts. The high-tension current is carried from the central power station to the transformer stations on No. 4 copper wire, two wires to each transformer station, giving a complete circuit and permitting the placing of the circuit-breakers and switches at the central power station, so as to do away with the necessity of attendants at the transformer stations.

The motor equipment consists of four 75-horse-power single-phase alternating-current motors. Train control of the electro-pneumatic type is installed on each of the cars, enabling one motorman to control the operation of a train of any number of cars. The motors operate on alternating current at a voltage of 250, this voltage being derived from an auto-transformer mounted under the car, this transformer deriving its voltage from the 3,300-volt trolley. Both straight and automatic air brakes are provided on each car, the straight air-brake equipment being used when only single cars are operated, and automatic air brakes being used when the cars are operated in trains. The motors on present car equipments are geared for a maximum speed of 45 miles per hour for local service. The motors are all connected in parallel, so that any one of them may be cut out of service if it becomes damaged in any way. The motor and control equipment are so designed that they may be operated on direct or alternating current, and the necessary switches for making the changes and connections are provided underneath the cars. By this provision the cars run equally well on 500-volt direct current. Each of the cars is provided with two trolleys. One is an ordinary wheel trolley for use in running over the Indianapolis city lines, and the other is a sliding contact or "bow" type trolley, held in position by compressed air, to be used on the lines of the company, especially with a view to taking from the trolley wire sufficient current to attain a high speed and carry heavy loads. This will, however, be more important in the equipment of cars for "limited" service and for heavy loads of freight.

The "limited" cars for through service will be like the present cars, except that they will be equipped with four 150-horsepower motors and geared to a maximum speed of at least 80 miles an hour. It is confidently believed that with the high-voltage alternating-current trolley wire and sliding-contact trolley adopted by this company heavy freight can be hauled advantageously without experiencing the difficulties heretofore encountered in the use of direct current on low-voltage trolley wires.

As Westinghouse engineers think that it is safe to assume that the alternating-current system will soon become as pre-eminent in the railway field as it now is in that of general power transmission, it is worth while to note the flexibility and economy attained in single-phase alternating electric-railway construction, and hence the large radius of action from a single station. Besides, there is the elimination of the rotary-converter sub-station and of electrolytic troubles as well, and the economy and exact speed control. In the matter of distribution it is safe to say that no feature in the construction of this road to Cincinnati received more comment than the comparatively small high-voltage cables feeding the system, that are carried on a line of neat, light poles located on the east side of the road's right-of-way. The Westinghouse company believes, apparently, too, in the replacement of the third-rail system by the overhead line; and that this feature is of great importance not only on the main line, where the third rail is expensive and where the difficulties of insulation are hard to overcome, but particularly at terminals, such as at Rushville, where there are complicated networks of tracks and switches.

A detailed description of the many other interesting features of this line and its entire equipment, for which Sargent & Lundy, Chicago, were the electrical and mechanical engineers, can be found in issues of the Western Electrician of February 18 and March 18, 1905.

Under the guidance of President Henry of the railway company and Mr. Gaylord of the Westinghouse company the visitors were allowed to inspect the single-phase system in all its details, beginning with the railway shops. They were then conducted to the Windsor and Scanlon hotels in Rushville for luncheon. In the afternoon the equipment was inspected more in detail, and at 3. p. m. the party left on the return trip to Indianapolis. Exceedingly fast time was made on both runs. On the arrival at the terminal station in Indianapolis "three cheers and a tiger" were proposed for President Henry, the Westinghouse Electric and Manufacturing Company, and particularly enthusiastic were the three cheers and a tiger for Mr. T. B. Gaylord, under whose guidance, along with Mr. Henry, the party was so cleverly instructed and pleasantly entertained.

In the evening the visitors, owing to the arrival of contingents from Pittsburg, Cleveland, Detroit and elsewhere, now numbering in all 91, were entertained by the Westinghouse company at an elaborate banquet. A delicious menu in many courses with wine was served. Although it was given out that the banquet was to be strictly informal, a few toasts were proposed and drunk with much enthusiasm. Irving P. Lord, secretary and general manager of the Waupaca (Wis.) Electric Light and Railway Company, proposed a toast "To the Indianapolis and Cincinnati Traction Company and President Henry and the Westinghouse Electric and Manufacturing Company and Manager Gaylord, our hosts," and this toast was drunk standing, with cheers. Manager Kerr was also publicly thanked for his dispensation of Westinghouse hospitality, as was likewise Western Manager Bartholomew of the Westinghouse Air Brake Company. Vice-president T. P. Bailey of the L. E. Myers Company, Chicago, was most timely, too, in his toast to the "absent one"—Mr. Lamme—whose work in perfecting the single-phase Westinghouse motor is so well known.

After the banquet the entire party was taken to the theater, and at 11:30 the majority of the visitors returned to the sleepers in the Indianapolis Union Station, reaching Chicago about 8 a. m. Sunday morning.

The excursion was not marred by a single unpleasing incident, and Manager Gaylord was repeatedly congratulated on having engineered a trip marking a step in advance in the modern methods of exploitation employed by the more advanced of the larger electrical companies.

Following is a list of the names of those constituting the Westinghouse party visiting Indianapolis for inspection of this single-phase railway system:

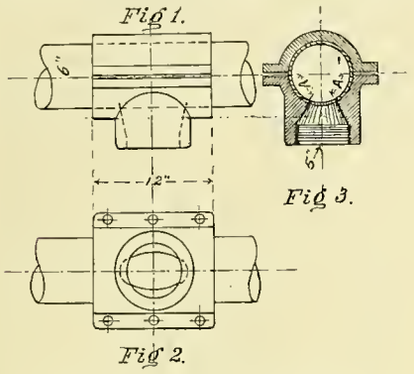
Arnold, W. L., vice-president The Arnold Company, Chicago.
Atkinson, J. M., vice-president Chicago and Southern Traction Company, Chicago.
Austin, M. M., superintendent of transportation Milwaukee Electric Railway and Light Company, Milwaukee.
Auten, A. O., president Alton, Jacksonville and Peoria Railway, Jerseyville, Ill.
Baker, Frank J., Chicago, Ill.
Bartholomew, W. S., manager Westinghouse Air Brake Company, Chicago.
Bailey, T. P., vice-president L. E. Myers Company, Chicago.
Bicknell, Warren, president Lake Shore Electric Railway Company, Cleveland, Ohio.
Bissell, G. W., professor mechanical engineering Iowa State College, Ames, Iowa.
Blackhall, J. R., general manager Chicago and Joliet Electric Railway Company, Joliet, Ill.
Boynton, S. C., Chicago, Ill.
Bridge, J. W., master mechanic West Pennsylvania Railway Company, Connersville, Pa.
Brett, J. A., manager Westinghouse Electric and Manufacturing Company, Cincinnati, Ohio.
Budge, J. W., master mechanic Western Pennsylvania Railways Company, Connellsville, Pa.
Burdick, E. C., Detroit, Mich.
Campbell, C. P., Campbell Investment Company, Chicago.
Cass, C. D., general manager Waterloo, Cedar Falls and Northern Railway, Waterloo, Iowa.
Chapman, C. A., consulting engineer, Chicago, Ill.
Chapman, W. D., consulting engineer, Chicago, Ill.
Clark, C. E. W., with Sargent & Lundy, consulting engineers, Chicago.
Conrad, general manager Chicago and Southern Traction Company, Chicago.
Collins, C. E., with L. E. Myers Company, Chicago, Ill.
Cravath, J. R., western editor Street Railway Journal, Chicago.
Colgrove, George B, electrical engineer Illinois Central Railroad, Chicago.
Cummings, R. F., Marion, Bluffton & Eastern Railway, Bluffton, Ind.
Carrington, M., Westinghouse Electric and Manufacturing Company, Chicago, Ill.
Davis, A. C., electrical engineer Pennsylvania Lines West of Pittsburgh, Fort Wayne, Ind.
Davidson, C. J., Milwaukee Electric Railway and Light Company, Milwaukee, Wis.
Draper, N. C., vice-president and general manager Eastern Wisconsin Railway and Light Company, Fond du Lac, Wis.
Dresser, C. A., Kohler Bros., Chicago, Ill.
Drum, A. L., general manager Chicago-Milwaukee Electric Railway Company, Highwood, Ill.
Emmons, C. D., general manager Fort Wayne and Wabash Valley Traction Company, Fort Wayne, Ind.
Evans, D. J., Continuous Rail Joint Company of America, Chicago, Ill.
Fisher, F. E., president Joliet, Plainfield and Aurora Railroad, Joliet.
Fisher, Lee D., chief engineer Joliet, Plainfield and Aurora Railroad, Joliet, Ill.
Fowler, W. F., manager Pittsburg office Westinghouse Electric and Manufacturing Company, Pittsburg, Pa.
Folds, G. R., general manager South Chicago City Railway Company, South Chicago, Ill.
Freeman, Prof. C. E., Armour Institute, Chicago, Ill.
Froelich, F. H., consulting engineer Patrick Hirsch Company, Toledo, Ohio.
Gaylord, T. P., manager Westinghouse Electric and Manufacturing Company, Chicago.
Gibson, Charles, Jr., director Pittsburg and Butler Street Railway Company, Pittsburg, Pa.
Goldsmith, Leon, engineer, Westinghouse Electric and Manufacturing Company, Pittsburg, Pa.
Gonzenbach, general manager Sheboygan Light, Power and Railway Company, Sheboygan, Wis.
Grover, T. F., 356 Dearborn street, Chicago.
Hemphill, R. W., Jr., manager Washtenaw Electric Light and Power Company, Ann Arbor, Mich.
Hernly, Charles S., Indianapolis, New Castle and Toledo Railway, Indianapolis, Ind.
Heskett, R. M., manager Knox Engineering Company, Green Bay, Wis.
Hess, L. W., general manager Northern Illinois Light and Traction Company, Ottawa, Ill.
Hoagland, H. C., electrical and mechanical engineer Illinois Traction Company, Danville, Ill.
Hopkins, G. H., general foreman South Side Elevated Railway Company, Chicago, Ill.
Horning, J. C., with W. H. Schott, engineer, Chicago, Ill.
Jackson, William B., mechanical engineer, Madison, Wis.
Kenfield, F. S., Street Railway Review, Chicago, Ill.
Kerr, H. H., manager Westinghouse, Church, Kerr & Co., Chicago, Ill.
Kirk, E. L., general manager Sioux City Traction Company, Sioux City, Iowa.
Kirker, G. B., French Westinghouse Company.
Knox, George W., president Knox Engineering Company, Chicago, Ill.
Lake, Edward N., The Arnold Company, Chicago, Ill.
Lardner, James F., general manager Tri-city Railway Company, Davenport, Iowa.
Layton, Hudson F., consulting engineer Pittsburg and Butler Street Railway Company, Pittsburg, Pa.
Lord, I. P., secretary and general manager Waupaca Electric Light and Railway Company, Waupaca, Wis.
Manning, L., Owasso and Cornell Electric Railway.
Marott, George J., president Kokomo, Marion and Western Traction Company, Kokomo, Ind.
McReynolds, T. C., secretary and treasurer Kokomo, Marion and Western Traction Company, Kokomo, Ind.
McMitchell, J. G., president Atlas Railway Supply Company, Chicago, Ill.
McMynn, J. C., R. W. Hunt & Co., engineers, Chicago, Ill.
Medbury, C. F., manager Westinghouse Electric and Manufacturing Company, Detroit, Mich.
Moore, A. R., president Escanaba Electric Street Railway Company, Escanaba, Mich.
Munger, E. T., master mechanic Metropolitan West Side Elevated Railway Company, Chicago, Ill.
Moran, W. M., engineer Chicago and Southern Traction Company, Chicago, Ill.
Olds, E. W., superintendent rolling stock Milwaukee Electric Railway and Lighting Company, Milwaukee, Wis.
Payne, Frank S., president Centerville Light and Traction Company, Centerville, Iowa.
Perry, Frank L., assistant business manager Western Electrician, Chicago, Ill.
Peticolas, S. G., Westinghouse Electric and Manufacturing Company, Chicago, Ill.
Powelson, W. V. N., general manager Union Electric Light and Power Company, St. Louis, Mo.
Roberts, E. P., Roberts & Abbott Company, Cleveland, Ohio.
Rathbone, R. L., Westinghouse Electric and Manufacturing pany, Detroit, Mich.
Renshaw, C., engineer railway department Westinghouse Electric and Manufacturing Company, East Pittsburg, Pa.
Snow, J. E., professor electrical engineering Armour Institute, Chicago, Ill.
Sherwood, I. H., manager Illinois Light and Traction Company. Streator, Ill.
Sloan, H. M., general manager Calumet Electric Street Railway Company, Chicago, Ill.
Seeley, C. A., mechanical engineer Chicago, Rock Island and Pacific Railway Company, Chicago, Ill.
Talbott, Charles, Westinghouse Electric and Manufacturing Company, Chicago, Ill.
Thomas, W. Owen, consulting engineer, Chicago, Ill.
Tschentscher, R., electrical engineer Illinois Steel Company, South Chicago, Ill.
Turkington, W. B., general superintendent Detroit, Monroe and Toledo Short Line Railway, Detroit.
Van Tuyl, F. F., consulting engineer, Detroit.

Wamsley, W. N., Kohler Bros., Chicago, Ill.
Woodmansee, F., Sargent & Lundy, engineers, Chicago, Ill.
Wynn, F. E., engineer Westinghouse Electric and Manufacturing Company, East Pittsburg, Pa.
Zimmerman, W. H., manager De Kalb-Sycamore Electric Company, De Kalb, Ill.

Emergency Steam-pipe Connection.

How a new 150-horsepower engine was connected into a six-inch main steam pipe which was already attached to two boilers and had fittings secured in such a way that it was out of the question to think of disturbing the pipe to cut and insert a tee is told by Lewis F. Lyne in the November issue of Graphite, published in Jersey City, N. J.

Mr. Lyne had a rough pattern made for a clamp connection, shown in Fig. 1 of the accompanying drawing, and consisting of two parts held together by six three-fourths-inch bolts. This clamp was 12 inches long, and bored out to a neat fit upon the six-inch steam pipe, the rough surface of this pipe having been previously smoothed off with a file. The outlet in the side of this clamp was threaded, to receive a five-inch pipe (see Fig. 3), and while this outlet was necessarily round, the opening through the inside of this clamp into the steam pipe was of an oval shape, three by 6½ inches, which would give an area of 19.5 square inches, while



EMERGENCY STEAM-PIPE CONNECTION.

the area of a five-inch pipe is 19.03. The object of making this oval was to secure so far as possible the widest bearing surface at (A). This clamp when completed was put in place upon the main steam pipe, after which the five-inch pipe was cut and connected by a stop valve with the boiler. Nothing now remained to be done but to cut the opening through the side of main steam pipe. Accordingly the five-inch pipe was removed, leaving the clamp in position upon the main steam pipe, when with a scriber reaching in through the five-inch opening, the oval-shaped figure was marked upon the side of main steam pipe. The clamp was then removed, and the following day at the proper time (only two hours were available to make the connection) with a "cape chisel" Mr. Lyne cut out the oval section of the steam pipe. This part of the work only consumed about three-quarters of an hour. The burrs were taken off with a file, and all was then ready to replace the clamp permanently.

Dixon's pure flake graphite mixed with copal varnish to the consistency of paint was put on in a thick coat, both on the six-inch pipe and on the inside surface of the clamp, and in this emergency the mixture was found to be valuable. When this was done the clamp was placed in position and tightened moderately by screwing up the nuts on the bolts. The five-inch pipe was then connected, using the same mixture upon the threads, after which the final adjustments were made by setting up on the nuts fairly tight. The connection was made inside of two hours and when steam was turned on there was no leak, the joint remaining in daily service until a new plant was built five years later.

Electricity for the Port Huron-Sarnia Tunnel.

It is now confidently asserted that the Grand Trunk Railway Company has let the contract for the equipment of the Port Huron-Sarnia tunnel with electric power for the operation of trains. The contract involves the building of a large power house. The total cost is said to be estimated at about $700,000. The third-rail system and powerful electric locomotives will be used, it is said. The adoption of electricity will remove all danger from gas in the tunnel arising from the use of coal. The company has been working on plans for this improvement for the last three years.

Moonlight Schedule for 1906.

The Western Electrician's Lamp Lighting Schedule for 1906 has been issued. This schedule is based on mean local time as given in the calendar for 1905 and applies to a latitude of about 41 degrees. For adjoining states north or south the error may be approximately 10 minutes, to be added or deducted from the time given in the schedule. While seemingly simple, moonlight schedules have caused considerable confusion and a number of lawsuits on account of the rules of the schedule not being clearly understood or followed out specifically. This little book allows of no errors being made, for the time of lighting and extinguishing for every day in the year is contained in tabular form, which is readily accessible.

Indiana Telephone Items.

The Home Telephone Company of Fort Wayne proposes to take over the National Telephone Company of that city. The capital stock of each company is $250,000, and the former has the same amount of bonds. The National owns a long stretch of toll lines, with exchanges at Auburn and Newhaven, and has been doing a good business. The proposed merger under the Home charter is significant of the movement of the merger of the Independent companies in Indiana.

Indianapolis, Muncie, Chicago and Marion capitalists, represented by O. L. Barger, have been granted a franchise by the Board of Public Works to place an automatic telephone system in the city of Marion. The rates to be charged are $1.50 and $2.50 a month, respectively, for residence and business houses, no charges to be made for use of any telephone till 1,000 have been placed. A tax of 66⅔ cents for each telephone will be paid annually into the city treasury. Construction of the plant is to begin the first of April and to be completed in 18 months. It is said that the council will ratify the work of the board, and then will begin strong competition by the Independents to regain the territory recently surrendered to the Central Union through the latter's acquisition of the United Telephone Company, formerly an Independent.

For some time there has been friction between the Citizens' Telephone Company of Kokomo and the city administration. The City Council has refused to amend its charter so it can secure toll-line service through the Central Union company. Now the Board of Police has been presented with a bill from the company for long-distance messages. The department, under the company's franchise, is on the free list, but the company is now asserting that this exemption does not apply to out-of-town talk.

One of the first matters to come before the new city administration of Indianapolis will be a request from the Indianapolis Telephone Company for modifications and alterations in the franchise now existing in order that the company may raise its rates for telephone service. It is proposed to ask for an increase of rates from $24 to $32 a year for house telephones, and from $40 to $54 a year for business telephones, and a franchise which shall run 40 years from the present time. The present franchise was granted for 25 years six years ago. The Toledo and St. Louis capitalists who recently acquired a controlling interest in this company will make these requests on the ground of the greatly increased expenses resulting from the unforeseen proportions reached by the company's business, and the plan to float a bond issue of $500,000 to meet the expense of the extensive improvements contemplated. The petitioners say unless the franchise is extended it will be difficult to secure financial assistance in marketing the bond issue. The present contract requires the company to pay to the city $6,000 annually as well as $2 a year on every telephone in service over 6,000. This exaction is complained of, since the franchise of the Central Union Telephone Company is limited in years only by the statute, that the city fixes no definite rate, and that a bonus on telephones over any certain number is not required. S.

Ohio Telephone Notes.

According to ideas expressed in Cincinnati, the recent Supreme Court decision against the Queen City Telephone Company in its effort to secure a franchise in Cincinnati through the Probate Court will make it all the harder for the Independent people to get a foothold in Cincinnati. However, Harry B. Gates of Indianapolis and his associates in the Queen City Telephone Company state that they will reincorporate, present a new petition to the council and renew the fight for a franchise. There may be a change in sentiment among the new officers of the city by this time and some arrangement made by which the Independents will gain an entrance. President F. S. Dickson of the Cuyahoga Telephone Company, Cleveland, is of the opinion that the decision will not have a widespread effect upon the business, as companies may yet appeal from the decision of city councils where there are differences as to routes or locations and secure a decision. Many of the franchises of both the Bell and the Independent people have been granted through the medium of the Probate Court, and it is not probable that either side will care to test the matter on existing franchises of that kind.

The Union County Telephone Company of Marysville has been organized for the purpose of taking in all the companies operating in Union County, including exchanges at Marysville, Ridgewood and other places, as well as the country lines. Frank L. Beam of Columbus, Dwight E. Sapp of Mt. Vernon and a number of men in Union County are interested in the new company. This is another move toward the plan to bring all the smaller companies into groups in order to make the management more economical and the operation more uniform.

Fire Chief W. S. Aungst and Captain Arthur Aungst of the fire department at Alliance have been granted a patent on a new system of electric signals to be used in connection with established telephone systems. By this system fire alarms may be sent in with an ordinary telephone in a simple and rapid manner.

Miss Jennie L. Pullman, chief operator in the exchange of the Ashtabula Telephone Company of Ashtabula, and Ira B. Bishop, a railroad man, were married a few days ago. C.

Canadian Telephone News.

The property and plant of the Cumberland Telephone Company of Amherst, Nova Scotia, has been sold at auction for the sum of $14,000. The company was organized three years ago with a capital of $50,000, all subscribed by Cumberland County people, of which 20 per cent. was paid up. Over 70 miles of line were in operation and the company had 350 telephones in use at a charge of $12 a year each. After the company had expended $19,000, and while only $10,000 of capital was available, it had to go into liquidation.

Three telephone companies are struggling for a franchise in the city of Brantford, Ont. The Bell company desires to hold what it has, which is an exclusive franchise; while the Canadian Machine Company and the Ontario Telephone Company are looking for competitive franchises. The Canadian company desires a 21-year agreement, with an option for municipal ownership, and prices to be $25 for business and $15 for residence telephones. The Ontario company wants a 20-year franchise at $25 for business and $18 for residence, with certain reductions for party lines.

The recorder of the city of Montreal has rendered a judgment by which the Bell Telephone Company will hereafter be compelled to pay the civic tax of $5 on each of the company's slot-telephone machines. The City Council some time ago levied this tax upon all slot machines, but when the city attempted to collect the tax on the telephone machines the Bell company contended that the machines were not slot machines, under the law, and that therefore the tax did not apply.

Robert Loring of Montreal, who has just returned from Australia and New Zealand, is much impressed by the superiority of the railway, telegraph and telephone systems of this continent to those of the two southern commonwealths. Government ownership of these public utilities, Mr. Loring says, produces results that are not at all satisfactory to people accustomed to the up-to-date methods of American railway, telegraph and telephone systems. The business is often done in a slip-shod manner, and generally the services appear to be conducted as certain government and municipal services are conducted in Canada. W.

The Telephone on the Pacific Slope.

The Automatic Telephone Company, represented by Charles E. Sumner of Portland, has been granted a franchise to operate an automatic telephone system at Olympia, Wash. Rates are to be fixed at $3.25 for business houses and $1.75 for residences.

The Independent Telephone Company has been granted a franchise by the City Council of Tacoma, Wash., to install an automatic telephone system costing $500,000. The Pacific States Telephone and Telegraph Company was recently offered an additional franchise, but has declined to accept it because of certain restrictions.

The Home Telephone Company of Alameda County, Cal., which was the highest bidder for the franchise in Oakland, Cal., has deposited with the city clerk the balance of its $35,000 bid. The City Council at its last meeting approved the company's $100,000 bond. The ordinance necessary to grant the franchise was then introduced. The matter must lay over for 30 days in the regular course, the ordinance being referred to the proper committee. The officers of the company are making preparations to begin construction of the new system as soon as permission is granted by the city authorities.

The Automatic Telephone Company has been granted a franchise in Salem, Oregon. A.

Telephone News from the Northwest.

The Northwestern Telephone Exchange Company has started work on a separate toll line between Thief River Falls, Minn., and Crookston. It has been rumored that the Twin City Telephone Company would build into Thief River Falls.

The Tri-state Telephone Company at Albert Lea, Minn., has selected William Wohlhutter as local superintendent.

The Grant County Telephone Company of Milbank, S. D., will extend its lines 35 miles, to South Shore and to Summit.

The Knox (Iowa) Mutual Telephone Company has been organized with C. F. Morse as president and A. D. Benson as secretary.

A new switchboard has been installed for the

toll service at the local exchange in St. Peter, Minn.

W. N. Smoot and associates have incorporated the Madison County Mutual Telephone Company at Macksburg, Iowa.

The Bell Telephone Company is building a line from Swisher to Cedar Rapids, Iowa.

Charles Whitmore and others are organizing a rural telephone company near Oskaloosa, Iowa.

The Turkey River Farmers' Telephone Company has been organized at Elgin, Iowa. R.

Michigan Telephone Matters.

The Citizens' Telephone Company started the month of December with 7,007 telephones in the local exchange and with over 100 orders to fill. During the month of November 136 orders for new telephones were taken by the company.

There is trouble between the Village Board of Holley and the Peninsular Telephone Company of Detroit. The company set poles in Maple Street after notice was served to cease the work. Maple Street was considered already badly congested, and the poles were cut off at the ground and now lay along the street. The officers of the company threaten to take the matter into court.

The Bell company is offering inducements to the business men and residents in Plymouth, but the Independent system is owned by Plymouth people and its telephones are in most of the homes in town, as well as numerous surrounding towns.

A telephone line from Gladwin to the S. A. Price farm is nearly completed. It is an Independent line, projected by 12 farmers on the route. Probabilities are that the line will be extended some six miles farther, and connect with a line running to Claire. An Independent line from Gladwin to Skeels is also being projected. This will make three rural telephone lines centering in Gladwin, besides the railroad line to Rhodes and Estey. B.

Team Work by Telephone Operators.

At a dinner of the Commercial Club in Boston at the New Algonquin Club, Frederick P. Fish, president of the American Telephone and Telegraph Company, told some things about the system of that company. He gave an idea of the growth of the telephone system and business and incidentally described the operations of a Boston exchange, asking his hearers to appreciate what it meant when he said that the ordinary run of the connections were made in two to five seconds, in view of the fact that there were 9,600 lines going out from the exchange.

Mr. Fish is further quoted as follows: "We try to make the service of the public as perfect as possible, though the conditions dealt with are not always the same. When several calls are made, we find the only practicable way is to take each in its turn. It often happens that the subscriber blames the company, when the fault is his own. As for the girls, their team work—and they help one another when necessary—is better generally than that of the Harvard football players.

"The work is made as automatic as possible, and that is why there is such quick service. The girls are carefully trained in the work, and I cannot express myself too strongly when I say that a more loyal, a more efficient, and a more capable set of employes you will not find anywhere. Once in a while there may be a girl who is ill-mannered, but that is an exception. We give them comfortable quarters and everything to make them satisfied."

NEW COMPANIES.

W. H. Davis, R. Z. Linney, J. M. Rambo and associates of Hopeton, Texas, have incorporated as the Hopeton Telephone Company.

The Gilead Home Telephone Company has been incorporated at Gilead, Neb., with a capital of $6,000 by J. W. Deaver and others.

The Hopeton Telephone Company of Hopeton, Okla., has been incorporated with a capital of $10,000 by W. H. Davis and others.

The Niobe (N. Y.) Telephone Company has been incorporated with a capital of $1,000 by L. L. Warner, L. C. Way and C. L. Rexford.

Telephone service in Forreston, Ill., is proposed by the Forreston Mutual Telephone Company, which has been incorporated with a capital of $5,000. Henry Zumhall, Henry Radner and Joseph Duetzman are the incorporators.

The Springfield Home Telephone Company, recently incorporated to construct a telephone system in Springfield, Tenn., has elected Thomas Pitt, president; John McMurray, vice-president; A. L. Dorsey, secretary, and H. T. Stratton, Jr., treasurer.

The Central Home Telephone Company of Louisville, Ky., is reported as having been incorporated with a capital stock of $5,000,000, to operate in Western Kentucky and Tennessee. Among those interested in the new company are J. D. Powers of Louisville, John C. Monteleith of Bloomington, Ind., Edwin L. Barber of Wauseon, Ohio, and James E. Bergen of Nanticoke, Pa.

GENERAL TELEPHONE NEWS.

The Automatic Telephone Company has been granted a franchise at Walla Walla, Wash.

The Bell Telephone Company is building new telephone lines from Independence, Mo., to Atherton.

A telephone line from Wentworth to Madison, N. C., may be constructed by J. V. Price and Samuel Ellington of Wentworth.

The South Dakota Independent Telephone Association will meet in the Cataract House in Sioux Falls on January 10th and 11th.

The Southern New England Telephone Company of Danbury, Conn., is going to erect a new office building at the corner of West Street and Terrace Place.

H. R. McKenzie of St. Cloud, Minn., has been appointed manager of the Minnesota Central Telephone Company at Sleepy Eye, Minn., succeeding T. A. Butler.

W. A. Stanton, local manager at Owatonna, Minn., for the Northwestern Telephone Exchange Company, has been made district manager, in charge of four counties.

The Miami (Fla.) Telephone Company contemplates extending its system to West Palm Beach. About $12,000 is to be expended at present, and later the line may be extended to Jacksonville.

A private telephone line 123 miles long has just been completed from Winston, N. C., to the Washington Cotton Mills, at Fries, Va., the line having connection with the long-distance Bell lines to New York.

The Washington, Whitman and Brenham (Texas) Telephone Company has begun the construction of a telephone line from Washington to Brenham, via Whitman. The company was recently reorganized with C. W. Bohne, president; W. L. Knolle, secretary, and H. C. Lehde, treasurer.

It is reported from Lockport, N. Y., that a telephone line will be constructed by the Niagara, Lockport and Ontario Power Company along the route of its power-transmission line from Niagara Falls to Syracuse. William Gibbony of Buffalo has charge of the telephone work, and has opened offices in Lockport.

In the Munn Avenue Presbyterian Church, East Orange, N. J., small telephone receivers have been placed in the pews most remote from the pulpit. A small switch connects the receivers with wires leading to a large transmitter in the pulpit directly in front of the minister, thus making it possible to hear the speaker more plainly if desired.

The first Independent telephone connection with Burlington, Iowa, from the west has been made by the Jefferson County Telephone Company of Fairfield, Iowa, which has built a full metallic No. 10 copper line into the office of the Mississippi Telephone Company. Connection is also made at Mt. Pleasant, and another copper line is to be built from Fairfield to Ottumwa.

It is reported that interesting experiments in wireless telephoning are being carried out near Swansea, Wales. The instruments are placed in two huts, 1,000 feet apart, with hedges, trees and buildings intervening. It is stated that voices can be heard distinctly, but that they are fainter than over the ordinary telephone. The instruments can be tuned to prevent the interception of messages.

The new directory of the Chicago Telephone Company, now being delivered, will show several changes of considerable importance to all telephone users. First, there is a great increase in the number of telephones. The total is over 100,000 in the city exchange system and exceeds 35,000 in the suburban district. A new office called Humboldt has been opened on the northwest side of the city. About 2,800 West, Ashland, Ogden and Seeley subscribers have been transferred to the new exchange. On the South Side the office names South, Brown and Green have been abolished and the single name "Calumet" is used, creating less confusion.

Proposed Power Development on Pacific Slope.

The Western Development Company, or the Western Power Company, is said to be the name proposed under which a chain of electric power plants extending through Oregon and California is to be established, according to the plans of a corporation in process of formation by western promoters and eastern capitalists. The project involves ultimately the acquisition of developed and undeveloped water-power sites for the production of electric energy, aggregating 500,000 horsepower. A capitalization of $50,000,000 is proposed for the corporation, which hopes ultimately to control the electric power plants from British Columbia down to Lower California, and to engage extensively in electric traction.

CORRESPONDENCE.

Great Britain.

London, November 28.—The period for which the London County Council has hitherto been in the habit of granting loans to borough councils for electric-lighting purposes has aroused the criticism from many persons who may fairly claim to have no prejudice against municipal trading. Up to the present it has been the custom to loan sums of money for electrical machinery to be repaid in 42 years, and it is well known that the life of the machinery is far short of this. The matter cropped up again last week and the finance committee has reported that it has this matter under serious consideration, as it regarded the matter now as one of great importance.

The first installation of the Griffiths-Bedell surface-contact system in this country has just been put into operation at Lincoln, a city where there are many steep gradients. I believe the system at Lincoln, which is only a small one, is being worked as an experiment by the contractors, much in the same way that the Lorain system was experimentally run for 12 months at Wolverhampton. If successful the undertaking will be taken over by the corporation. At Torquay the Dolter system has been adopted, but in this case the whole of the powers are in the hands of a company, the corporation only having the right of purchase after a long term of years.

Now that the official obstruction to the use of bare overhead mains for electric transmission purposes is fast being broken down, every new scheme carried out in this manner attracts considerable attention. I have before mentioned that overhead transmission mains will be made use of to a considerable extent in connection with the North Wales electric power scheme, but another undertaking has recently been put into operation, the North Wales works at present being only in the constructive stage. Although not a public-supply scheme, the one in question is extremely interesting, for it is an application of electricity toward improving the sanitary condition of our cities. The particular locality is in the neighborhood of Birmingham and the electric power transmission for working the sewage pumps, etc., is carried on over a distance of six miles and for which overhead mains are employed. The generating pressure is 2,250 volts at a periodicity of 50 cycles, and a refuse destructor has been combined with the generating station.

Advocates of municipal tramways will read with interest a report which will shortly be presented by the chairman of the tramways committee of the Darlington corporation. Many municipal tramway authorities have been associating themselves with half-penny fares only to abandon the idea, and although such fares are being charged in London with satisfactory results, it needs a very exceptional service to make them remunerative. The five miles of track at Darlington have cost nearly $350,000, aside from the expenses incurred in acquiring the original horse tramways, and after six months' working the estimates for the coming winter show a loss of something like $7,500, without depreciation, a too-frequent habit of municipal authorities in this country. The half-penny fares are apparently responsible for the larger part of the loss at Darlington, the decision to adopt which was carried by the casting vote of the gentleman who was mayor last year. The whole matter will come up for discussion shortly, and it is of more than ordinary interest in that it bears most closely upon the management of small tramway undertaking, of which there are a very large number in Great Britain.

A paper on electric driving in the Royal Gun Factory, Woolwich, was read last week before the Institution of Electrical Engineers, but it is impossible to go into details here. One point struck me in listening to the paper, and that is the difficulty encountered by the workmen in adopting any new methods, a fact which may or may not have some connection with the comparatively small amount of electric driving here, although it is fast increasing. Col. Holden was one of the pioneers in this country of electric driving, but he remarked that when the motors were first installed the switch regulating the speed had to be enclosed in a wire cage and only the foreman had the key. Thus the foreman started the motors at a given speed and the men could not lessen it. This prejudice, or whatever it was on the part of the men, has now quite disappeared.

After much negotiation and litigation the exchanges of the Swansea corporation and the National Telephone Company in that town have been connected up, and the subscribers now have the benefit of intercommunication as provided for under the Telegraph Act of 1899. G.

New York.

New York city, December 9.—A contract for 25,000 tons of steel and the necessary erection work for the new Pennsylvania railroad passenger station in this city has been awarded to Milliken Bros., amounting to $1,500,000.

Further progress is reported on the construction of the new depot of the New York Central railroad. Plans for a large new building have been filed.

President Hudson of the Central Hudson railroad announces that when the electrification of that line is complete there will be a revision of the schedule of fares between New York and Yonkers.

The New York Chamber of Commerce met yesterday and awarded commemorative medals relating to the completion and opening of the subway to a number of men who had been associated with the enterprise, which, it may be remembered, was originally suggested by the chamber. Among the recipients were Alexander E. Orr, president of the Board of Rapid Transit, and ex-Mayor Seth Low. Congratulatory speeches were in in order.

The Board of Estimate and Apportionment is still waiting to hear the decision of the courts as to the constitutionality of its jurisdiction in transit matters, but in the meanwhile continues to hear applications. Various requests for the extension of lines in the Bronx borough are being discussed. The board will also receive a delegation from the Bath Beach district of Brooklyn, which is demanding a subway extension spur.

Plans for the million-dollar subway loop for the Manhattan terminal of the Williamsburg Bridge have reached the Art Commission, which will pass upon their artistic merits. Details of the other bridge-terminal plans divulged this week show that they propose to have a three-story building at the Manhattan end of the Manhattan Bridge, with 10 trolley loops on the second floor and at least four elevated loops on the upper story. Plans for the Brooklyn end of the Brooklyn Bridge provide for five new trolley loops.

The workmen engaged in the under-river tunnels now being constructed around this city are preparing an ultimatum and are expected to strike if their demands are not granted. They complain that bad ventilation and a 12-hour day are slowly killing the men, who altogether number 5,000. Rapid progress is reported on all these tunnels.

Thomas M. Carter, president of the Public Service Corporation of New Jersey, has told the aldermen of Newark, N. J., that if the existing method of computing the five per cent. tax on the company's property is found after investigation to be unfair he is entirely in favor of having it adjusted equitably. The tax amounts to $30,000 a year.

The State Lighting Investigation Commission is sitting regularly, but so far has dealt only with gas-lighting matters.

The Board of Aldermen of Paterson, N. J., with one dissenting vote, has refused the offer of the Paterson Electric Light, Heat and Power Company, which was willing to pay $3,000 a year for a franchise and grant a reduction of 15 per cent. on present prices for current.

The Luzerne Light, Heat and Power Company of Jersey City has been incorporated with a capital of $200,000.

The Washington Irving apartment house on West One-hundred-and-twelfth Street and the Cameron apartment house on St. Nicholas Avenue are recent instances of the supercession of private plants by the service of the Edison company's mains.

The New York Edison Company announces that it made contracts during the month of October for current equivalent to 222,491 16-candlepower lamps on 2,810 contracts. Since January last the total equivalents contracted for are 1,297,058.

The Atlantic Telephone Company has increased its offer to the city in return for a franchise and now is willing to pay $7,750,000 in cash in 25 yearly instalments and to provide 1,000 free telephones for municipal office use. The various claims of this company are to be analyzed.

D. W. W.

Dominion of Canada.

Ottawa, Ont., December 9.—Mayor Ellis of the city of Ottawa, Ont., has prepared a detailed statement of the working of the civic electric plant since it was taken over on July 1st. On its business since then a gross profit of $3,253 was made, which leaves a deficit of $1,200 when the interest and sinking fund on the $200,000 invested is provided for. As the most profitable portions of the year are yet to come, the mayor thinks that at the end of the first year's operation a net profit will be shown.

Mexican Power stock will be listed on the Montreal Stock Exchange. Power has been successfully transmitted from Necaxa to the City of Mexico; consequently the Mexican Light, Heat and Power Company people are pleased over the news which they have been expecting for some time. The Montreal promoters, on December 6th, received a telegram stating that power had been transmitted to Mexico City, and the first unit was now available for commercial purposes. This means that the Necaxa proposition has been successfully worked out and that 5,000 horsepower is at the disposal of the company in the capital of the Mexican republic. In a short time a second unit will be available, and in three or four weeks the third unit, or 15,000 horsepower.

The Ontario Electric Railway Company, which has secured a franchise from Cornwall to Toronto and from Cornwall to Ottawa, has made an official offer to the city of Toronto to bring a radial road into that city on a franchise absolutely terminable in 1921, when the Toronto Railway Company franchise expires. It desires no renewal clause, and the city may purchase that part of the road, within its limits, at the expiration of the franchise.

The development of electric power at a central station in Sydney, N. S., sufficient to operate all the collieries of the Dominion Coal Company, is the latest move in the forward policy of the directorate. With this object in view, Mr. H. F. Parshall of London, England, a noted electrical engineer, was invited to come to Sydney and make a thorough investigation into conditions around the collieries. Mr. Parshall, together with Vice-president Wanklyn of Montreal, has been busy for the last week making the investigations, with the result that they have agreed upon the scheme of installing, at some central point, an electrical plant capable of furnishing the power necessary to operate all the collieries. As a preliminary installment, three electrical machines of 650 horsepower each, have been ordered, and it is expected that these will be in operation in the early spring.

The minister of public works for Canada has been asked to grant a privilege, on the Niagara River, which is the first acknowledgment of this kind that has been made of Federal control of the Niagara. The applicant is the Canadian Niagara Power Company, which wants to suspend a wire from Fort Erie, on the Ontario side, to Buffalo, N. Y. The company has also applied to the War Department at Washington for the privilege on the American side. There are at present three power companies in Canada and two in the United States, which have erected dams, piers and other works in the river in contravention, it is said, of the Dominion statutes. The recent investigations of the International Waterways Commission have brought the situation to light. In the application just received by the Canadian authorities the intention is to convey electrical energy from Ontario to the state of New York.

The Dominion De Forest Wireless Telegraph Company of Montreal is building a high-power station at Toronto Junction, and it is the purpose of the company to push this station to completion and be ready for commercial business by the coming new year. This company proposes to build and operate stations at all important points in the Dominion of Canada, and do a general telegraphic business between its own stations, as well as between stations in the United States, or elsewhere, owned or controlled by the American De Forest company, or any of its subsidiary companies. It will also build and operate stations on both the Atlantic and Pacific coasts, for transmission of messages abroad.

W.

Indiana.

Indianapolis, December 9.—The Indianapolis and Frankfort Traction Company has been incorporated to build from Carmel to Frankfort. The company also proposes to furnish electricity for heat, light and power. The principal office will be in Indianapolis. The incorporators are Albert C. Pierson, Frank E. Gavin and Theodore Davis.

The Northwestern Indiana Electric Railway Company has been organized to construct an electric railway between East Chicago, Hammond, Crownpoint, Cedar Lake and Lowell. The directors are Frank L. Knight, Edwin Knight and W. B. Ray.

The Fort Wayne and Wabash Valley Traction Company has decided upon yellow and white as its colors and the new cars for the through Fort Wayne and Indianapolis service are being painted accordingly. The company has completed reballasting its track and a great improvement in speed and service is expected.

The Dolan-Morgan-McGowan merger interests are building an electric railway from Terre Haute to Mattoon, Ill., proposing eventually to reach St. Louis. This syndicate now owns the Indianapolis and Eastern and has made arrangements for the transfer of cars over the Dayton and Western, with the object of ultimately reaching Pittsburg, thus completing a through line from Pittsburg to St. Louis.

P. M. Dunn of Indianapolis, representing capitalists of Frankfort, Crawfordsville, Kokomo, Indianapolis and Terre Haute, is promoting a traction line from Terre Haute to Toledo, the ultimate object being to connect Toledo and St. Louis by trolley.

Indiana electric-railway companies are demonstrating their ability to handle long-distance freight shipments. The Indianapolis and Eastern Traction Company delivered a car of paper from Dayton, Ohio, to the Bobbs-Merrill Company in Indianapolis within 20 hours after receiving the order. The shipment weighed 15 tons.

The Indianapolis and Martinsville Rapid Transit Company has been merged with the Indianapolis and Northwestern Traction Company. It is possible that cars will be run through from Lafayette to Martinsville.

The surveyors have reached Otwell in the resurvey and permanent location of an interurban line to be built by the Vincennes, West Baden and Louisville Traction Company. The offices of the company are in Vincennes and the contracts will be let soon, work to commence early in the spring.

James DeHaven, a veteran millwright, has renewed his efforts to construct a dam in Wildcat Creek to secure electric power and light for the city of Kokomo. Mr. DeHaven is the patentee of a waterwheel which is proving very satisfactory in Indiana and Ohio. He says his wheel will produce power for Kokomo at a minimum cost. The business men are giving the proposition considerable attention.

The Michigan City street-car system has become the property of the Northern Indiana Railway Company. The price paid for the property and franchises was $200,000.

J. M. Studebaker, president of the Studebaker Bros. Manufacturing Company, will soon ask for bids for the construction of a magnificent electric fountain in Howard Park, South Bend. The fountain is to be presented to the city.

At a meeting held December 6th the City Council of Terre Haute ignored a remonstrance against the construction of a municipal lighting plant and took steps to build such a plant at once.

The report of the Richmond municipal electric-light plant for November shows that the receipts were $2,108.81 in excess of the operating expenses.

S. S.

Ohio.

Cleveland, December 9.—Rumors are still in circulation to the effect that Randall Morgan and his associates are contemplating the purchase of the Cleveland city street-railway lines.

It is said that the large stockholders of the Lake Shore Electric Railway Company have decided upon E. W. Moore of the Everett-Moore syndicate as president to succeed Warren Bicknell, who will retire the first of the year to take up the construction business. H. A. Everett is now at the head of the Northern Ohio Traction and Light Company, the London Street Railway Company, the Toledo Railways and Light Company and the Detroit United, all syndicate properties, so that it would naturally fall to Mr. Moore to become the head of the Lake Shore Electric.

P. W. Ward, member of the Cleveland Board of Health, has presented a resolution to that body providing for rules regulating the number of passengers that may be carried on street cars, the allegation being made that overcrowding is a menace to health. The resolution provides that the number of passengers shall be limited to those who can be seated and half as many again. The conductor of the car shall be held responsible for the enforcement of this rule, and each car shall have posted in it the number of passengers that may be taken at one time. The officials of the street railway say that it is impossible to enforce any rule regarding the number of persons getting on cars.

School Director Orr of Cleveland has announced that the plan of generating lighting current in some of the school buildings has proved a success, and that in all probability all of them will be equipped at an early date. The plan has been tried in three or four of the buildings, and plants will be put in the new ones as they are completed. In most of the buildings an engine is used to operate a blower for ventilating purposes, and it is said that in most cases there is sufficient power to operate a dynamo also. Where this is not the case, such changes may be made as to accommodate the additional power that will be needed.

Randall Morgan, before leaving for the Pacific Coast, said, among other things, that interurban roads, properly considered, are those so constructed that cars may attain a speed of 40 or 50 miles an hour with comfort to passengers and without the suggestion of danger. All others are cross-country trolley lines. He was of the opinion that the interurbans will not injure the through-freight or traffic business of the steam roads, but will add to it.

On condition that the franchise is amended to allow the higher rate of fare recently attempted to be put into force, the Tuscarawas Traction Company has agreed to strengthen bridges, rebuild much of its road and furnish new cars on the line between New Philadelphia and Uhrichsville. The six weeks' fight has thus been settled, and the company has put cars on between the two points again. The original fare will be charged until the improvements have been completed.

The Cincinnati Gas and Electric Company has presented an ordinance to the City Council, being a franchise to supply natural gas through its present pipe system for light, heat and power purposes at the rate of 30 cents a thousand. Another ordinance makes the price 40 cents, with a rebate of 10 cents for prompt payment. This would do away with the artificial gas, it is thought, but the company would have the right to supply the artificial, should the supply of natural gas give out. This would necessitate a long pipe line, as there is no gas at present near Cincinnati.

Clifton P. Grant has been appointed receiver of the Commercial Transit Company, operating an automobile line between Springfield and Jamestown. The line has been in operation but a few weeks.

Preliminary surveys are being made from Mansfield to Chippewa Lake for a line to connect the Cleveland and Southwestern and the Ohio Central.

Directors of the Lake Shore Electric are considering the construction of a line from Sandusky to Clyde, 16 miles in length.

The Youngstown and Ohio River Railroad Company of Leetonia has been incorporated with a

capital stock of $10,000 by T. W. Hill, C. H. Howland, Max P. Goodman, C. S. Thrasher and Warren Bicknell. Mr. Goodman has heretofore been interested in the electric-railway business in that section.

Projectors of the Ohio Central Traction Company, who propose to build a line from Columbus to New Lexington, are having the preliminary surveys made, C. D. Hood being in charge of the work. The plans not only include this line, but several laterals and a line connecting Lancaster and Newark.

It is said that two more companies will soon be formed at Cleveland for the manufacture of electric automobiles, in addition to the Raush & Lang Company, which has entered the field. The latter is a carriage company. O. M. C.

Michigan.

Grand Rapids, December 9.—It is expected that the Grand Rapids-Muskegon Water Power Company will this month ask the Common Council for a franchise to deliver electric power within the city limits. The work of setting poles and the erection of a power house has so far advanced that the company, it is said, will be able to deliver power by February 1st. Commissioner of Public Works Freshney is strongly in favor, in case the franchise is granted, of having a provision in the grant which will require the company to furnish the city with power at the lowest possible figure.

City Attorney Taggart has ruled that the Common Council of Grand Rapids has full power and jurisdiction for placing street-light extensions. It was claimed by some of the members of the Board of Public Works that, according to the new city charter, this privilege rightly belonged to them.

Because the Thornapple Electric Company does not see its way clear to accept the amendments which the ordinance committee of the Common Council of Grand Rapids has attached to the franchise granted to that company a year ago, there is now danger of serious legal complications arising. The amendments require that the company shall pay an annual fee to an ultimate maximum of $500, and that current shall be delivered in the city within two years from May 1, 1906.

An injunction which sought to restrain the Toledo, Ann Arbor and Detroit electric road from going on with its work at the River Raisin near Petersburg has been dissolved.

The promoters of the Sault Ste. Marie and Les Cheneaux interurban railroad have recently secured a good portion of the right-of-way. Portions of the line have been surveyed.

The Grand Rapids Edison Company is installing a pressure regulator in the basement of its office in the Houseman Building. The machine is of the rotary type.

President Griffin of the proposed Coldwater-Battle Creek electric line is firm in his belief that his road will be the one which will unite Coldwater and Battle Creek. A prolonged illness has kept him back for several months.

The ordinance granting to W. L. Haag the use of the streets of Lansing for the purpose of installing poles and wires for furnishing electric power has been passed by the council. A section provides that the city shall have a right to purchase all of the rights and privileges at the expiration of the franchise. Conduits as well as poles and wires are included. The ordinance provides that the grantee shall pay to the city one per cent. a year on the gross receipts from power furnished in the city. The power used by the grantee in his own business was excepted, except where the power used is transmitted through the streets or alleys on poles or conduits.

Eastern capitalists have an option on the property of the Muskegon Traction and Lighting Company, which gives them the right to purchase the bonds of the company at par and accrued dividend, and the common stock at $75 a share. The company is now bonded for $600,000 and has an issue of $600,000 common stock. The properties of the company comprise the street railway, electric-lighting and gas plants. An investigation of the franchises of the company by the prospective purchasers revealed that there was no statement of the time for which the franchise for the street-railway system was granted. To settle the question the council has passed an amendment making the franchise run 25 years from January 1, 1906. At the request of the council the company has in return for the amendment granted a reduction of 22½ per cent. in the gas rates and 20 per cent. for electric lighting. It is said that under the new owners provisions will at once be made for an extension of the street-railway lines and the gas and electric-lighting systems. B.

Southeastern States.

Charlotte, N. C., December 9.—The Gravity Company of Asheville, N. C., has been chartered to build a road from the Craggy Mountain Railway to a point near the top of Sunset Mountain.

The General Electric Supply Company of Fayetteville, N. C., has put in an electric-light system for the Cumberland Cotton Mills.

The electric railways of the state of Virginia pay the state annually the sum of $48,165, the largest contributor being the Virginia Passenger and Power Company.

The Standard Gas and Electric Company of Raleigh, N. C., is installing a large addition to its gas-manufacturing facilities.

The Augusta (Ga.) council has decided to investigate the matter of a municipal electric-light plant for the city, which, it is estimated, would cost about $75,000. The present contract between the city and the electric-light company expires in August, 1907.

James U. Jackson, and the syndicate which he represents, has taken over the properties of the Augusta (Ga.) electric-railway system and the Augusta-Aiken electric railway from the hands of the Williams-Middendorf interests, the deal involving $5,000,000. The Aiken line, it is said, will be extended to Columbia, S. C., and it is further reported that considerable sums will be expended by the new owners of the properties.

Electric pumps and motors are being installed in the city water and light plant of Albany, Ga., to supplant steam.

The Catawba Power Company of Charlotte, N. C., has completed a survey for a power line to Gastonia, 21 miles away. Other lines are also to be built, and it is said that power will certainly be carried to Columbia, S. C.

Grading contracts have been let for a portion of the Richmond-Ashland (Va.) electric line of the Richmond and Chesapeake Bay railway, the work to be finished by early summer.

J. C. Chaplin, vice-president of the Colonial Trust Company of Pittsburg, and others, have recently visited a number of southern points inspecting waterpowers, etc., with a view to purchasing and developing them. Spartansburg, S. C., is mentioned as one of the points under consideration.

It is understood that current from the Great Falls powers development of the Southern Power Company, Charlotte, N. C., will be available in that city by the summer of 1907. The work will cost at the falls about $3,000,000.

Richland, Ga., has voted $15,000 bonds for water and lighting systems.

Edgefield, S. C., is considering the advisability of putting in a water and electric-light plant for the town. L.

Northwestern States.

Minneapolis, December 9.—An ordinance has been introduced in the council at St. Cloud, Minn., providing for granting a new 30-year franchise to the Public Service Company. Should the franchise be granted, the company will expend about $70,000 in improvements.

The contract for incandescent street lighting in Minneapolis in 1906 has been let to the Patterson Street Lighting Company.

A dam will probably be built at Luverne, Minn., across Rock River, to furnish auxiliary power for the electric-light plant at that place.

The Des Moines (Iowa), Winterset and Creston Electric Railway Company has filed articles of incorporation with a capitalization of $100,000.

The Centerville Light and Traction Company is making a survey for a trolley line from Centerville to Mystic, Iowa.

Business men at Columbus Junction, Iowa, are furthering a project for building a trolley line from that place to Mt. Pleasant, a distance of about 25 miles.

Work has been started at Perry, Iowa, on a new depot by the Interurban company.

J. Vickerman has been given the contract to put in a concrete wheel-pit and foundation for a power plant at Rushford, Minn.

There is talk of establishing an electric-light and waterworks system at Farmington, Minn.

No bids were submitted for a franchise at Belle Plaine, Minn., for an electric-light system, and all plans will be postponed until spring at least. R.

Pacific Slope.

San Francisco, December 8.—The proposed municipal street railway in Geary Street, under the plans recently filed, will cost $346,104. The sum of $350,000 has been set aside this year for the work. Deducting $3,500, fee of consulting engineer, there will be only $396 remaining available for the purchase of the site at the corner of Geary and Baker streets, selected for the power house.

The United Railroads of San Francisco has petitioned the Board of Supervisors for permission to change the motive power of its Sutter, Larkin and Polk Street lines from a cable system to an overhead trolley. The property owners along the line insist on an underground-conduit system. The joint committee on finance and streets will report on the matter.

The California Gas and Electric Corporation will construct a new electric transmission plant on Deer Creek near Nevada City, Cal., which will be ready for operation early next year, supplementing the Colgate and De Sabla plants by a connecting line. Contracts have been closed for a 5,500-kilowatt three-phase generator, and a direct-connected impulse wheel. The company has also ordered two other 5,500-kilowatt generating units, which are to be installed at other plants on the system.

The San Bernardino Gas and Electric Company's electric power house on Mill Street, San Bernardino, Cal., has been destroyed by fire. Manager Charles Grow estimated the loss at $55,000, partially covered by insurance. The company has several other plants.

The contract for constructing the municipal electric-light plant for the town of Gilroy, Cal., has been awarded to the Tracy Engineering Company of San Francisco, which offers to erect a plant complete for $7,943. A contract was closed with the California Electrical Works for the material needed for wiring the city.

The Vancouver Power Company of Vancouver, B. C., has closed contracts with the Pelton Water Wheel Company for another wheel for the transmission plant. The 3,000-horsepower double overhung wheel will be direct-connected to a Canadian Westinghouse three-phase generator. This fourth unit in the power house will be operated under a head of 390 feet, making 200 revolutions per minute. The steel pipe line, varying from 48 inches to 42 inches in diameter, will be built and installed by the Pelton Water Wheel Company.

The Tacoma Railway and Power Company has decided upon plans for extending its Point Defiance electric railway through the business section at an estimated cost of $60,000. W. S. Dimmick is manager.

The city trustees of Vallejo, Cal., are dicussing the holding of a special election to decide the question of a municipal electric-light plant. The estimates submitted by City Engineer Karsberg were as follows: Power plant, $44,500: pole line, $11,400; pole transformers, $4,100; arc lamps, $4,800; contingencies, $2,000.

The Umatilla Electric Power Company has been given a right-of-way by the Forestry Bureau in the Wenaha Forest Reserve in Oregon. The company can now carry out its plans, which provide for developing power on the north fork of the Umatilla River and building transmission lines.

The Willamette Valley Electric Railway Company has been granted a franchise by the City Council of Salem, Ore., for the use of the streets. A.

PERSONAL

Manager L. P. Sawyer of the Buckeye Electric Company passed though Chicago last week. Mr. Sawyer will spend Christmas at his old home in Lincoln, Neb.

Julius T. Hannah, president of the Boardman River Electric Light and Power Company, and one of the leading merchants of Traverse City, Mich., died on November 29th.

James A. McCrea will succeed C. L. Addison as general superintendent of the Long Island Railroad. Mr. McCrea has been superintendent of the Cincinnati, Lebanon and Northern railway. He is but 35 years of age.

Charles T. Yerkes, who is at the Waldorf-Astoria, in New York city, was reported earlier in the week as being seriously ill, and in a critical condition. At the time of writing, however, he is said to be much better.

N. C. Draper has been chosen general manager of the Eastern Wisconsin Railway and Light Company of Fond du Lac, Wis., to fill the vacancy caused by the resignation of T. F. Grover, who moved to Chicago recently.

Thomas R. Mercein, general manager of the Chicago Electrical Trades Exposition, is on a trip which will include Cincinnati, Cleveland, Buffalo and New York. He expects to return with the contracts of many exhibitors at the Madison Square Garden Electrical Show.

Lord Kelvin, it is reported, has fully recovered from his recent illness. He was present, with Sir John Wolfe Barry, Sir William Preece and other members at the opening of the recent meeting in London of the Society of Arts to hear Sir Owen Roberts deliver his presidential address. Lord Kelvin proposed a vote of thanks to the president.

Daniel Simon, chief electrician and assistant manager of the Paducah City Railway Company of Paducah, Ky., has resigned after 15 years' service with the company. When the company was sold recently Mr. Simon resigned, but was induced to remain with the new owners until December 1st. It is reported that he may engage in the electrical supply business in Paducah.

J. J. Myer, for several years representative of the Columbia Incandescent Lamp Company in Indiana and who recently represented the Sawyer-Man company in the eastern territory, has returned to the Columbia company and now has charge of the business of that company in the state of Texas. Mr. Myer will make his headquarters in Dallas and will look after the company's interests in Louisiana as well as Texas.

The Nobel prizes were awarded this year as follows: Dr. Philip Lenard of the University of Kiel, for researches in cathode rays; Adolph von Boeyer of the University of Munich, for researches leading to the evolution of organic chemistry and the development of the chemical industry; Prof. Robert Koch of Berlin, for researches looking to the prevention of tuberculosis; literature, Henryk Sienkiewicz, the Polish novelist. The Baroness von Sutt-

ner of Austria was adjudged winner of the Nobel peace prize.

S. E. Wolff, manager of the gas company at Jackson, Mich., assumed the position of general manager of the Saginaw-Bay City Traction and Light Company upon the resignation of B. C. Cobb. Mr. Cobb retains the position of vice-president of the combined companies. He is to continue with the Hodenpyl-Walbridge syndicate, which controls the valley companies, and will be located at its New York office after January 1st.

Harry C. Goldrick has accepted a position with the Kellogg Switchboard and Supply Company of Chicago as sales representative in the middle southern states, including Kentucky, Tennessee, Alabama and Mississippi. Mr. Goldrick comes from Indianapolis, where he was identified with the purchasing department of the Indianapolis Telephone Company. He is a practical electrician, having been with the Independent telephone interests of Indianapolis for over seven years, where he gained wide experience in the construction, installation, maintenance and operating departments of telephone properties. Mr. Goldrick has a large acquaintance in the electrical trade, and especially among the telephone interests. He is an associate member of the American Institution of Electrical Engineers and is well qualified for his new position with the Kellogg company.

Great regret is felt at the death of G. A. Grindle, late general manager of the Chloride Electrical Power Storage Company of London. Mr. Grindle was drowned in the wreck of the steamship Hilda, a vessel on the cross-channel service between England and France, when nearly 100 other passengers were drowned. Mr. Grindle was one of the early members of the Institution of Electrical Engineers and was much liked. He had charge of the first lighting of London by the Brush company in 1881, subsequently he went to India to take charge of the Eastern Electric Light and Power Company. On his return he went into business on his own account for a while, and undertook several important electrical installations. In 1889 he accepted the post of resident engineer for the electrical portion of the work of the City and South London Railway and in 1893 he transferred his services to the Chloride company and became manager of its works. He was appointed general manager in 1896, which position he held until 1903, and on his resigning he was retained by the company as consulting manager. He leaves a widow and three children.

ELECTRIC LIGHTING.

Ira Steele contemplates putting in a new electric-light plant at Hartley, Iowa.

Coats Bros. & Barton have purchased the Greenfield electric-light and water plant at Greenfield, Tenn.

The Tracy Engineering Company has the contract to construct an electric-lighting plant in Gilroy, Cal.

Nichols & Thornton have been granted a franchise to establish an electric-light and waterworks plant in Andrews, Ind.

Work has been commenced in Streator, Ill., on the construction of the new power house for the Illinois Light and Traction Company.

The Portland Lighting and Power Company has practicaly completed its plans for the construction of a large power house in Portland, Me.

The city of Anadarko, Okla., is considering the advisability of voting $5,000 additional bonds for the extension of the electric-light service.

The Brillion (Wis.) Electric Light Company has been incorporated with a capital stock of $20,000 by C. W. Behnke, O. C. Behnke and others.

S. C. Dowell of Walnut Ridge, Ark., is said to have completed arrangements for the construction of an electric-light plant in Pocahontas, Ark.

The city of Fort Morgan, Colo., will soon hold a special election to vote on the question of issuing bonds for the purpose of building a municipal light plant.

The city of Tallapoosa, Ga., which recently authorized a bond issue for the purpose, will receive bids until January 2d for the construction of an electric-light plant.

The Consolidated Light, Power and Ice Company of Joplin, Mo., has been incorporated with a capital stock of $1,000,000. George Moore of New York city is interested

The citizens of Thomasville, Ga., have approved the proposed $30,000 bond issue for the purchase of the Thomasville Electric Light Company's plant, and improvements are to be made to the system.

The Louisville and Northern Railway and Lighting Company of Louisville, Ky., has been incorporated by J. C. Henderson, R. W. Waite, C. D. Kelso and others of New Albany, Ind. The capital stock is $5,000,000.

G. W. Early, W. P. Callahan and H. B. Early of Marceline, Mo., have incorporated as the Marceline Electric Light Company, and will operate an electric-light plant in Marceline. The company is capitalized at $20,000.

The El Reno Gas and Electric Company has been granted a charter and will operate an electric-light and gas plant in El Reno, Texas. G. J. Hockcok and F. N. Howell of El Reno and several Michigan men are interested in the project.

The Jackson County Light, Heat and Power Company of Independence, Mo., has been incorporated with a capital stock of $300,000. Thomas A. Rockwell of Evanston, Ill., George F. Goodnow of Waukegan, Ill., and Farlin N. Ball of Oak Park, Ill., are the incorporators.

The California Gas and Electric Corporation, which operates in the Sacramento Valley, and the San Francisco Gas and Electric Company are reported to have been merged into the Pacific Gas and Electric Company. A result of the combination will be the distribution in San Francisco of electricity from the waterpower plants of the first-named company in the deep valleys of the Sierras.

ELECTRIC RAILWAYS

The United Railways and Electric Company of Baltimore, Md., has let the contract for a modern car barn, to be 138 by 200 feet and to cost about $70,000.

Car barns adjoining the power house of the Federal District Electric Street Railway Company in the City of Mexico were destroyed by fire recently and 70 fine electric cars are said to have been burned or badly damaged.

The Tennessee-Georgia Interurban Electric Railway Company, which is to build from the central portion of Chattanooga through Walker and Catoosa counties, Georgia, to Spring Place, has applied for an increase in its capital stock from $300,000 to $450,000.

It is understood that the London, Brighton and South Coast Railway Company in England is preparing to go ahead with the electrification of its South London line on the single-phase system. It is believed the contract will be undertaken by the Allgemeine Elektricitäts Gesellschaft.

The London and Northwestern (steam) railroad is contemplating, it is said, the electrification of its line from Manchester to Patricroft, in order to compete more successfully with the electric-car service through Ordsall Lane, Cross Lane, Seedley, Weaste, Eccles and Patricroft, to Peel Green.

The Kentucky and Ohio River Interurban Railway Company of Paducah has filed a deed to secure bonds which will be issued to build an electric railway 35 miles in length, between Paducah and Cairo. It is said that the sale of the bonds is assured, but that no work on the line will be done until spring.

The Chicago, Lake Shore and South Bend Railway Company, promoted by Edwin Hanna and other Cleveland capitalists, has announced the letting of the contract for the building of an interurban electric railway from South Bend, Ind., through Laporte and Porter counties. It will connect with that portion of the road between Indiana Harbor and South Chicago, already in operation. Entrance to Chicago may be secured over the Illinois Central tracks from Kensington to Randolph Street.

The electric street-railway system of Independence, Iowa, ceased operation on December 1st on account of insufficient patronage. The line was built in 1895, but has never been very profitable. Some time ago the Gedney Company of Independence took over the property and at the time some of the stockholders felt that operation should be abandoned, but out of patriotism for the town, which claims the distinction of being probably the smallest in the country with a complete electric street-railway system, the cars were kept running. Last winter was an especially bad one, which resulted in the decision to abandon operation, at least for this winter. Independence has a population something over 3,000.

Representatives of the Rockford, Beloit and Janesville electric railway were in Janesville recently and looked over the routes of the proposed extension to Madison, Wis., as far as Stoughton. President Montgomery of the Madison street railway, it is said, is ready to build to Stoughton in the spring. The line which is to be built from Elgin, Ill., to Marengo during the coming season, and the Janesville-Madison extension will be two links which will complete a through electric line from Madison to Chicago, then, it is said, dining cars and other innovations which have been successfully tried in Ohio and the East may be introduced to accommodate and foster through traffic.

The Consolidated Railway Company, the holding corporation for the street railways and interurban lines controlled by the New York, New Haven and Hartford Railroad Company, is considering an important proposition to centralize the electrical generating plants for the four divisions in Southeastern Connecticut, comprising the Norwich and Willimantic, the Norwich street railway, the Montville street railway and the New London street-railway systems. The plan is to convert the four separate power stations into sub-stations and substitute for them one big central generating station at Thamesville, Conn. The change is estimated to be in the interests not only of centralization, but also of economy.

The Andrews-Vanderbilt syndicate has closed a deal that puts it in control of the Rochester Railway and Light Company of Rochester, N. Y.; the consideration, it is said, will be something like $10,000,000. The properties included in the transaction are the local street-railway lines and all the gas and electric-light plants in the city. This system will form another link for a cross-state line from Buffalo to New York city. The United Railway property at Albany, the lines at Schenectady and those of the Utica and Mohawk Valley are other possessions of this syndicate. The plan, apparently, is to purchase properties at convenient points and connect them up. The West Shore line will probably be used for this purpose. It is said that a short section of the West Shore will be completed as to electrical equipment within a short time and used as a test of what can be done in operating steam and electric trains over the same track.

Guy Mallon of Cincinnati has been in Philadelphia for a few days looking after the details of the incorporation of the Lexington and Interurban Railway Company, which was chartered in New Jersey with a capital stock of $4,000,000. This is a holding company, which will take over the properties recently purchased by a syndicate in central Kentucky. J. Levering Jones of Philadelphia has been chosen president, and Louis Des Cognets of Frankfort, Ky., vice-president. Mr. Mallon is one of the directors. The companies that will be included in the deal are the Lexington Street Railway Company, including electric-light, ice and gas plants; Blue Grass Traction Company; the Frankfort and Versailles Traction Company, and the Kentucky Traction Company. It is expected that a large amount of money will be expended for improvements and developments, and it is said that the proposed northern line connecting with Cincinnati will ot be built soon, because of the poor territory through which it would run.

POWER TRANSMISSION.

The La Crosse (Wis.) Hydro-electric Light and Power Company has been organized and incorporated for the purpose of transmitting electric power from a waterpower plant to be erected near Black River Falls to La Crosse. The plant will be built at Mormon Riffles, 55 miles from La Crosse, and the minimum power developed will, it is said, be 12,000 horsepower. The plant will cost about $750,000 and the preparatory work has already been started, the work of construction to begin early in the spring. The company is capitalized at $1,000,000, with E. G. Boynton as the principal promoter.

AUTOMOBILES.

The Drake Electric Company of Chicago, capitalized at $10,000, has been incorporated to manufacture automobiles and electrical appliances. The incorporators are J. M. Wilson, William Herrick and Frank E. Drake.

The leading automobile manufacturers of France, England, Italy, Belgium, Austria and Holland are reported to have secured spaces to show their cars at the annual automobile show of Berlin, which will be held February 3 to 18, 1906. The commercial and industrial motor-car section promises to be especially large and representative.

PUBLICATIONS.

The Indiana Rubber and Insulated Wire Company of Jonesboro, Ind., is sending out a fine wall calendar for 1906. The calendar is attractive and serviceable.

A tasteful little booklet issued by the Sterling Electric Company of Troy, N. Y., relates to Sterling flexible steel conduit and fittings. The conduit is made of the highest grade of galvanized steel. Its flexibility makes it possible to install this conduit with the minimum amount of expense. Conduit couplings are also described in the booklet.

Electromagnets, solenoids, induction coils and coil windings, as manufactured by Charles R. Underhill of New York, are described in a recent pamphlet. Various styles of these devices are illustrated in the pamphlet, showing the nature of the product turned out by Mr. Underhill. A specialty is made of the calculation, design and construction of electromagnets and solenoids to perform a given duty.

Conduit boxes, bushings and insulators are described in a small pamphlet distributed by the Bossert Electric Construction Company of Utica, N. Y. The pamphlet is intended primarily to call attention to the company's plugged-steel outlet boxes in connection with Erickson insulators or Monarch bushings as an ideal arrangement for conduit out-

lets, and one which is in strict accordance with the Underwriters' requirements.

One of the numerous pleasing and instructive bulletins which are issued at intervals by the Allis-Chalmers Company of Milwaukee is devoted to Bullock oil-insulated transformers. The transformers described in the bulletin are for indoor use and are made in two types, according to the method of cooling. The self-cooling type is built in sizes up to 300 kilowatts. The water-cooled transformers are built from 100 kilowatts up. Both types are fully described and illustrated in an interesting manner.

The Illinois Valley Railway Company of La Salle, Ill., has issued a tasteful booklet, daintily illustrated, under the title, "The Illini Trail: Descriptive of the Valley of the Illinois, Points of Scenic Beauty and Historical Interest, Including the Story of Starved Rock." The publication consists of 42 pages and is almost entirely devoted to a well-written account of the history and attractions of the valley of the upper reaches of the Illinois River. The Illinois Valley Railway Company, of which Mr. H. E. Chubbuck is general manager, may well take credit for this excellent piece of work.

Five new bulletins have been issued by the General Electric Company of Schenectady, N. Y.; they are numbered from 4423 to 4427, inclusive, and take up, respectively, 1,150 and 2,300-volt alternating-current switchboard panels; Edison incandescent lamps for stereopticons, magic lanterns, projectors, headlights, etc.; 4,500-volt oil-break switches, type F, form K-3; CL-B slow and moderate-speed belt-driven generators, and type MC governors for electrically driven air compressors. There are also being distributed by the company two interesting leaflets. One of these describes the isotherm, which is the electrical substitute for a hot-water bag. The other leaflet is devoted to electric decorative lighting outfits for Christmas trees, etc.

The Central Electric Company of Chicago is to be commended for the fine catalogue which it has just issued. The book contains 805 pages, 7¼ by 10 inches, and is strongly bound in cloth. It is probably the most complete and valuable book yet published by the company. It contains much valuable information of the latest inventions and devices in the field of electricity. The cipher code enables correspondence to be carried on completely by telegraph. Every article listed has a number and code word, and the weight of the article and of standard package are also given. This is a new feature and it enables the customer to estimate the cost of material laid down in his own city, which is of importance where freight rates are high, as in the West. It may be said in general that included in this catalogue are all material and appliances that are useful in the construction and operation of electrical installations. The number of the catalogue is 24.

Strikingly unique in design, convenient and serviceable, the new catalogue just issued by the Holophane Glass Company of New York will be much appreciated by those fortunate in receiving a copy. The catalogue contains, besides price lists, engineering data concerning the holophane system of illumination comprising Holophane globes and Holophane Pagoda reflectors. It is arranged on the loose-leaf principle, the leaves being 4 by 7¾ inches in dimensions. These are inserted in a fine leather cover which is just the right size to carry in the inside breast pocket. Upon the outside of the cover in gilt letters is printed the name of the holder of the book. Those who are not conversant with the Holophane system will find in the pages of the catalogue a complete description of the principle upon which this system of illumination is based, the process of manufacture, care of the globes, etc. All the various shapes of globes are illustrated and described, and photometric curves of most of the types of globes, made by the Electrical Testing Laboratories of New York, are also contained. The catalogue will be found very useful by contractors and illuminating engineers, and the information contained may be relied upon for absolute accuracy.

SOCIETIES AND SCHOOLS.

Wisconsin members of the National Electrical Contractors' Association met recently in Oshkosh, Wis., and adopted plans for strengthening the electrical trade and for getting rid of irresponsible and unreliable contractors. Besides W. J. Gray of Minneapolis, vice-president of the association, the following-named gentlemen were present: George Rohn, A. R. Schmidt, Frank Marowitz and Peter Keelyn of Milwaukee, John Warden of Sheboygan, Mr. Buerstatte of Manitowoc, A. C. Langstadt and W. W. Root of Appleton, H. L. Wallach and F. Briggs of Fond du Lac, and Charles S. Thompson and William F. Meter of Oshkosh.

MISCELLANEOUS.

A prominent Canadian, Mr. Lafamme of Ottawa, has prepared a report showing divergence of opinion as to retrocession of Niagara Falls. "The computations made as to the rate of retrocession of the falls," he says, "show wide divergence. As retrocession advances the limestone beds increase, and therefore the wearing away process will be slower. Grabau says that in 3,000 years Niagara will disappear."

Alexander Russell, in a paper recently read before the Physical Society in London, concluded that the dielectric strength of air at ordinary atmospheric pressure is between 38 and 39 kilovolts per centimeter, or about 30 per cent. greater than the value ordinarily given.

Tantalum is entirely nonmagnetic and fuses at about 2,300° C. In the form of wire it has a tensile strength of about 128,000 pounds per square inch. It is said that tantalum has great possibilities when used for tool-making, its toughness and hardness rivaling the diamond.

The Newport Mining Company has decided to equip its mines at Ironton, Mich., with both surface and underground electric haulage. It will use electric locomotives the year round in the various levels underground for bringing the ore to the bottom of the shaft, and after the transportation season has closed will use electric locomotives on the surface for hauling ore from the top of the shaft to the various stock piles for storage. For these purposes it has ordered six four-ton mine locomotives from the Westinghouse company, which will also furnish electrical apparatus for the equipment of the necessary power station, consisting of a 150-kilowatt 250-volt generator, direct connected to a Corliss engine of 130 revolutions per minute, and a three-panel switchboard besides other auxiliary apparatus.

TRADE NEWS.

The Manhattan Electrical Supply Company has purchased a lot containing 14 acres at Ravenna, Ohio, and will build a large plant. Reports are to the effect that 500 people will be employed.

The Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y., announces that it is now carrying a large stock of standard telephones at its Chicago branch and can make immediate delivery from this stock.

The Sampson Cordage Works announces the removal of the Boston office to 88 Broad Street (Broad Exchange Building, corner of Franklin Street). Here it will have better facilities for taking care of its increasing business.

F. J. Green, T. H. Stevens and T. H. Kolderup have incorporated in Illinois as the St. Louis Motor Car company, with headquarters in Chicago. The capital is $10,000 and the object, as stated in the incorporation papers, is to manufacture electrical supplies.

The constructing quartermaster at Vancouver Barracks, Wash., is inviting sealed proposals until December 30th, for furnishing electric-light fixtures, wattmeters and transformers for three buildings at that post. Full information will be furnished on application.

Reports from Oklahoma City, Okla., say that Frank H. Henley of Wabash, Ind., has been in the city looking over the prospects for establishing a wholesale electric supply house in Oklahoma City. As a distributing center it is said that Oklahoma City is becoming of more importance every day and the business and social features of the city are excellent. While in Oklahoma Mr. Henley was the guest of his brother, C. L. Henley, of the Farmers' State Bank.

The Westinghouse Electric and Manufacturing Company has perfected a new line of three-phase core-type transformers for 60-cycle circuits. One of these transformers may be used where three-phase transformation is to be made, instead of two or three of the single-phase type. They are self-contained units of compact construction and are said to be generally easier to install, and reduce the complexity of wiring between the transformer and the apparatus which it is to supply.

George L. Lindsley, the former president of the Lindsley Brothers Company of Chicago, which has been reorganized under the name of the Lindsley-Bauman Company, will hereafter devote most of his time to the interests of Lindsley Brothers Company of Spokane, Wash., and Portland, Ore., in which he is a heavy stockholder. This company makes a specialty of western poles, and is now making arrangements to manufacture cross-arms. Mr. Lindsley's headquarters will be at Portland.

In the campaign for business for central stations —creating new business and extending old business—the C. W. Lee Company of the Scheuer Building, Newark, N. J., offers its services, as an expert, to electric-light and power companies. The company was organized by C. W. Lee, who created the very successful advertising department for the Public Service Corporation of Newark, N. J., and associated with him are other experienced electrical business promoters. The new company is prepared to take up the entire business-getting proposition, down to the solicitors, for central stations. In relation to newspaper advertising alone, it issues a circular, "Getting Rid of Detail," which tells the central-station manager how not to "waste high-salaried energy on low-salaried detail."

The Columbia Dry Battery Company, which was incorporated recently, has its headquarters at 69-75 Wells Street, Chicago. It is said that this company was formed in order that the leading French carbon makers might be enabled to introduce their product into this country. A new process is asserted to have been introduced with great success in the manufacture of dry batteries. Alfred Landau, who has supervision of the new establishment, gained his knowledge of the details of the battery business by years of study and practice in Europe. The company is said to be backed by several leading French manufacturers.

Lindsley Brothers Company, the well-known producer of cedar poles and ties of Menominee, Mich., whose head office has been located in Chicago, has been reorganized. Mr. H. A. Bauman of Menominee has bought an interest in the company, and its name has been changed to the Lindsley-Bauman Company. Mr. Bauman is the president. George L. Lindsley, vice-president, and E. A. Lindsley, secretary and treasurer. The head office of the company will hereafter be located at Menominee, and the mill and yards at Alfred, Mich., where the company has bought a tract of about 25,000 acres of fine cedar land near Lake Superior. The new company will continue in the pole, post and tie business and the change will enable it to produce more poles than heretofore and to fill contracts of any size.

The Navy Department, through the Bureau of Supplies and Accounts, is inviting sealed proposals until December 26th for furnishing certain eastern navy yards with the following electrical material: Schedule 269, motor-generator sets, conduit and fittings, wire and miscellaneous electrical supplies; schedule 270, electric heaters; schedule 272, electric soldering irons. On January 9, 1906, the bureau will open bids for furnishing eastern navy yards with machine tools as follows: Schedule 281, electric hoist and runway; schedule 282, electric driven motor outfit. Blank proposals and detailed information can be obtained at the navy pay office in New York or upon application to the bureau at Washington. On January 9, 1906, the bureau will also open bids for furnishing western yards with motors, cable, circuit-breakers and electrical supplies, embraced in schedule 276, which can be obtained at the navy pay office in San Francisco or of the bureau.

The manufacturers of this country continue to increase their share in both the imports and the exports of the United States. In the 10 months ended with October, 1905, their importations of materials for use in manufacturing formed 47.8 per cent. of the imports of the country, against 45.8 per cent. in the corresponding period of last year, and their exports of manufactures formed 38.2 per cent. of the total domestic exportations, against 36.7 per cent. in the corresponding months of 1904. The increase in the importation of manufacturers' materials in the 10 months ended with October, 1905, amounts to $81,000,000, an increase of 21 per cent. over the corresponding period of last year, while the increase in all other imports amounts to but $54,000,000, an increase of 12 per cent. over the corresponding months of last year. In exports the increase of manufactures is $58,000,000, or 14 per cent., while the gain of all other exports is but $49,000,000, an increase of seven per cent. over the corresponding months of 1904.

BUSINESS.

The Western Display Company of St. Paul, Minn., announces that it has unrivaled facilities for manufacturing signs of all kinds. It has a force of competent workmen turning out a product upon which closest inspection is invited.

A new material for treating armature and field coils has been put on the market by the Macon-Evans Varnish Company of Pittsburg, Pa. It is called "paraffine insulating compound." It is an air-drying and baking substance and possesses the characteristic of being a good heat conductor, allowing armatures treated with it to dissipate their heat and operate under heavy overloads without undue heating.

The Duntley air-cooled electric drills, manufactured by the Chicago Pneumatic Tool Company of Chicago, are meeting with well-deserved success. Over 3,000 of these drills were sold during the month of May and the demand apparently is constantly increasing. These drills are made in various sizes and are valuable for machine and repair shops where electric current can be obtained. They are wound for 110 and 220 volts direct current. Full particulars will be mailed on request.

The Westinghouse Electric and Manufacturing Company has recently placed on the market a storage-battery-charging receptacle having many advantageous features, among the more important being a swivel attachment which conforms the receptacle to standard steam-railway practice, and allows the car or vehicle to start and pull out the cables without danger of breaking them or the contacts. The apparatus is adapted to both railway and automo-

bile service, and has been adopted by the Pennsylvania Railroad for charging the batteries on its cars.

The Chicago House Wrecking Company is placing on the market a large quantity of excellent electrical material secured through the purchase of the St. Louis World's Fair. Among other material are sockets, receptacles, wiring knobs, porcelain knobs, cleats, cut-outs, plugs, tubes, glass insulators, as well as switches and instruments for various purposes. The company will be pleased to mail its complete catalogue to those interested.

Because of the fact that the Westinghouse Electric and Manufacturing Company makes the largest units required for the production and transmission of electricity the company says that comparatively few people know that in the same works at East Pittsburg are manufactured also the smallest units to meet the needs of printing establishments and similar lines of industry. It is a matter of considerable gratification to the company to see the favor with which its motors for the printing industry have been received. There have recently been closed three contracts aggregating in the neighborhood of 400 motors, and the company is in position to undertake the equipment of printing establishments from the smallest to the largest machines required in this industry.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) December 5, 1905.

806,107. Combined Socket and Rosette. Walter A. Church, Binghamton, N. Y., assignor to the Bristol Brass and Clock Company, Bristol, Conn. Application filed December 6, 1902.

Contacts for the conductors are secured to an insulating base. A cap fits over the base. Contacts in the cap, which carries the socket, engage the contacts of the insulating base.

806,150. Electric and Pneumatic Governor. Thomas F. Kelly, Philadelphia, assignor to John E. Reyburn, Philadelphia, Pa. Application filed November 11, 1904.

A stem and a lever are operated by a diaphragm, a contact-wheel being carried by the lever. The pole plate of the device carries a contact plate and a latch plate, a latch lever being fulcrumed on the solenoid case and carrying a spring latch adapted to engage the latch plate. A connection from the diaphragm lever to the latch lever has means for its longitudinal expansion and contraction.

806,152. Third-rail Protector. William H. Kober and Charles E. Watier, Lancaster, Ohio. Application filed March 6, 1905.

A shield member is formed of transversely curved metallic strips, each having an insulating lining, the ends of the strips and the linings overlapping. The lining of the outer strip serves to insulate the strips from each other, insulated securing-bolts connecting the strips. Supporting brackets extend over the strips and are rigidly secured thereto to form strengthening braces for the shield. (See cut.)

806,173. Electric Furnace. Romaine W. Myers, Fruitvale, Cal. Application filed February 14, 1905.

An electric furnace comprising a heat-resisting shell is provided with several pyro-electrolytic bars within the shell, conducting supports sustaining the ends of the bars. Means are supplied for electrically connecting the supports in parallel circuits with a source of electrical currents. Resistance wires are placed in the parallel circuits and a variable rheostat in the lead wire to the parallel circuits.

806,204. Pile-fabric Cutting Machine. Edward Stansfield, New York Mills, N. Y., assignor to the New York Mills, New York Mills, N. Y. Application filed June 18, 1902.

In a device for pile-fabric cutting there are a base plate and a top plate in electric contact with the base plate, the plates being adapted to permit the interpassage of the cloth to the knives. A stop-finger support carries an armature, an electric circuit being completed on contact of a knife guide with the base of the top plate.

806,217. Dynamo-electric Machine. Henry H. Wait, Chicago, Ill. Application filed April 24, 1905.

In a unipolar dynamo-electric machine, there are combined with a field magnet establishing a substantially uniform field, an armature arranged to move in the field and inductors carried by the armature inclined to the direction of their motion through the field.

806,238. Signal Apparatus. Clarence W. Coleman, Westfield, N. J., assignor to the Hall Signal Company. Application filed July 1, 1905.

Stationary-magnet controlling means control a latch mechanism which holds the reciprocating and thrust member of the signal in conjunction during the operation of the signal.

806,248. Trolley. George R. Fletcher, Cambridge, Ohio. Application filed May 31, 1905.

Secured to the pole is a barp provided with a longitudinally disposed ear. The trolley wheel is journaled in the harp, a scraper being pivotally supported on the journal of the trolley-wheel. A spring is interposed between the scraper and ear for yieldably supporting the former in contact with the conductor.

806,276. Trick Telephone Toy. Edward G. Myers, Lincoln, Ill. Application filed January 31, 1905.

A trick device which is operated electrically is described. It is similar in appearance to a wall telephone. Upon using the telephone as usual, however, an electromagnetic device releases a hellows device which expands a long rubber sack in the telephone mouth piece.

806,284. Mouthpiece Attachment for Telephones. Metta F. H. Phillips and William B. Hubbard, Boston, Mass. Application filed March 6, 1905.

A hygienic mouth piece for telephones is described in the patent.

806,310. Trolley Wire Holder. Frank M. Zimmerman, Aurora, Ill. Application filed March 21, 1905.

A socket with cylindrical bore, contracted at its mouth and provided with ledges in its enlarged chamber, carries a wire-holder stem having an enlarged lower part fitted to the mouth and an upper and flanged portion connected to the ledges.

806,318. Automatic Paralleling Device for Alternating-current Generators. George A. Burnham, Willimantic, Conn. Application filed January 14, 1904.

Means for paralleling alternating-current generators comprise transformers supplied by the generators to be connected, a circuit including the secondary winding of the transformers and an electromagnetic switch, a normally closed shunt around the switch and paralleling circuits controlled by the switch.

806,325. Automatic Pressure Control. John H. Crawford, Camden, N. J., and Charles F. Schaeffer, Philadelphia, Pa. Application filed December 8, 1904.

An electric switch controlling an air compressor motor is provided with a pivoted switch member, spring-controlled latches acting directly upon the switch member to lock the switch in the open or closed position. A spring is connected directly with the switch member, a reciprocating member being actuated in one direction by the fluid pressure and spring-actuated in the other direction. The member is provided with lugs for operating the switch, spring and latches.

806,332. Electric Clock System. Martin Fischer, Zurich, Switzerland, assignor to Actiengesellschaft "Magnet," Zurich, Switzerland. Application filed July 5, 1900.

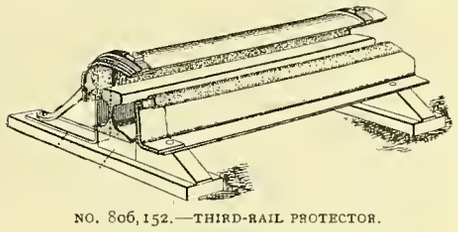
A permanent magnet is arranged to form an open magnetic circuit, a stationary induction coil being in the field of the magnet. A soft-iron bar movable relatively to the magnetic poles and coil closes the circuit through the coil. A permanently closed metallic electric circuit free from moving elements and including the coil and translating devices is adapated to operate secondary clocks through the agency of a master clock.

806,339. Telephone Shelf. Joseph S. Gold, Jackson, Ohio. Application filed May 20, 1904.

Secured to the telephone is a slotted base for holding the telephone receiver when off the hook waiting for a person to be called to the telephone. The slot is provided with a hinged cover to prevent the accidental placing of the receiver in the slot instead of on the hook.

806,348. Insulating Electric Conductor. Isidor Kitsen, Philadelphia, Pa. Application filed April 17, 1902.

Insulated wires are produced by this process by first carrying the wire to be insulated and a strip or strips of amorphous cellulose through a bath adapted to moisten the wire and the strips with a solvent for the cellulose. The wire and the strip are then carried through compressing rollers, thereby inclosing the wire in the strip.



NO. 806,152.—THIRD-RAIL PROTECTOR.

806,363. Magnetic Tachometer. Edwin H. Porter and Burleigh Currier, Philadelphia, Pa. Application filed June 17, 1905.

Permanent magnets form part of the tachometer, between which is a revolving armature carried by a shaft which revolves with the apparatus whose speed is to be taken. As the armature revolves electromotive force is generated in proportion to the speed, which electromotive force actuates a pointer on a properly calibrated scale.

806,372. Telephone Attachment. Joseph Silverman, San Francisco, Cal. Application filed May 26, 1905.

A device for holding the receiver of a desk set in a position near the car is described in the patent.

806,409. Portable Electric Lamp. John H. Goehst, Chicago, Ill., assignor to the Federal Electric Company, Chicago, Ill. Application filed February 16, 1905.

A fixture for incandescent lamps which may he carried about from place to place is described.

806,412. Telegraph Repeater. Francis W. Jones, New York, N. Y. Application filed September 21, 1905.

Combined with one circuit of a main-line relay and an electromagnetic transmitter are main-line breaking points operated by the transmitter and three controlling coils for the transmitter. One of these is in a local circuit with the break points of the relay, the second is differential and in a permanently closed circuit, the third is in a local circuit with break points controlled by the other main circuit. (See cut.)

806,413. Electrode for Electrolyzers Used in the Manufacture of Bleaching Liquors. Richard Kother, Cunewalde, Germany, assignor of one-half to Charles Edward Waithman, Gaddum, Montford, county of Chester, England. Application filed September 7, 1905.

An electrode for use in electrolyzers for producing bleaching liquids is the basis of the patent. It consists of a plate of non-conducting material having very thin platinum laid on the surface and over the edges. Means are supplied for pressing the cathode against the turned edges of the anode at the back of the insulating plate.

806,430. Trolley Signal. Benjamin H. Roberts, Haverhill, Mass. Application filed October 5, 1905.

The device comprises a trolley signal, a signal-setting magnet, its armature, a step-by-step locking device for the armature, an actuating-magnet and a releasing-magnet for the step-by-step device, a circuit for the signal-setting and the actuating magnet, a circuit for the releasing magnet and a trolley-operated switch at each end of the block for one of the circuits.

806,442. Electric Switch Operating Device. Ira J. Stouffer, Altoona, Pa. Application filed July 10, 1905.

An electromagnet having an armature, the opposite ends of which are recessed, has means for connecting the armature to the switch-point. A pair of pivotally mounted locking arms are arranged to enter the recesses after the armature has been moved and thus locking the switch tongue in position. A second electromagnet and armature and links connecting the armature to the pivoted locking-arms are the other parts.

806,462. Automatic Controller for Electrically Actuated Compressors. Niels A. Christensen, Milwaukee, Wis. Application filed May 13, 1898.

A switch located in the circuit of the electric motor is operated by a fluid motor, a valve controlling the admission and release of the actuating fluid to and from the motor.

806,509. Composite Insulator. Louis Steinberger, New York, N. Y. Application filed November 26, 1904.

A composite insulator comprises a hood provided with a depending portion and with a ring disposed adjacent to the depending portion and encircling it. Another hood is provided with a portion extending intermediate of the depending portion and the ring. A member is disposed intermediate of the depending portion and the ring and engaging the last-mentioned hood. (See cut on next page.)

806,516. Electric-light Hanger. Hugh R. Berry, Greenville, Miss. Application filed July 20, 1905.

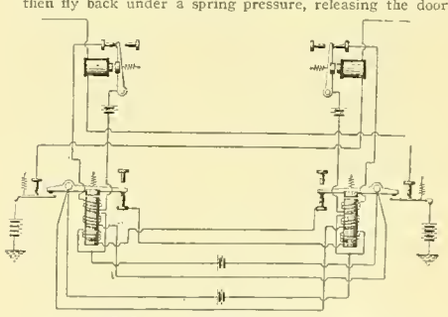
An electric-light hanger consists of an upper tube having a securing cap at one end and a tubular section arranged on its other end. A socket is provided in the tubular section, a tube having one end made spherical being adapted to seat in the socket. A tube telescopes in the latter tube, a spring holding the spherical tube end yieldingly.

806,538. Electric Signal for Railways. John B. Gorrell and Hiram V. Gorrell, Laotto, Ind. Application filed June 21, 1905.

Associated with an electrically operated switch mounted in a containing casing under the control of the station operator and energized by means of a normally open line-circuit is a semaphore pivotally connected with the switch and adapted to be actuated thereby. A normally open lamp circuit in the casing has an independent source which is closed by the switch.

806,542. Locking or Bolting Doors and the Like. Claude E. Hensley, Elreno, Okla., assignor of one-third to John S. Thompson, Chicago, Ill. Application filed May 13, 1904.

Upon the energization of an electromagnet a lever is moved which disengages a catch holding the bolts, which then fly back under a spring pressure, releasing the door.



NO 806,412.—TELEGRAPH REPEATER.

806,560. Electrical Measuring Instrument. Edwin F. Northrup, Philadelphia, assignor to the Leeds & Northrup Company, Philadelphia, Pa. Application filed May 12, 1905.

Two conductors both adapted to carry electric currents extend longitudinally of a supporting frame and insulated one from the other. Clamping means holding the ends of the conductors rigidly near the ends of the frame and indicating means operatively connected to both conductors show the relative heating effects of the currents on the conductors.

806,568. Electric Switch for Street Railways. James A. Posey, Midlothian, Texas, assignor to the Posey Automatic Switching Company. Application filed January 21, 1905.

An electric switch for railways comprising an actuating bar parallel with the railway tracks has mechanical means for effecting longitudinal motion of the bar. A vibratory hook is carried by the bar, a lever being adapted for placing the switch tongue for the line. A lever for placing the switch tongue for a branch line and electric controlling means to cause the hook to engage either one of the levers are the other features.

806,574. Process of Making Insulated Wires. George H. Rupley, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 16, 1902.

The process of insulating an electrical conductor consists in coating it with a film of oil which has been substantially freed from the glycerin of combination, and then hardening the coating.

806,575. Insulated Wire. George H. Rupley, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Original application filed December 16, 1902. Divided and this application filed January 15, 1904.

An electrical conductor is provided with an insulating coating of infusible residuum of destructively distilled oil.

806,573. Means for Ascertaining the Power Factor in Alternating-current Systems. Joseph L. Routin, Lyon, France. Application filed November 21, 1904.

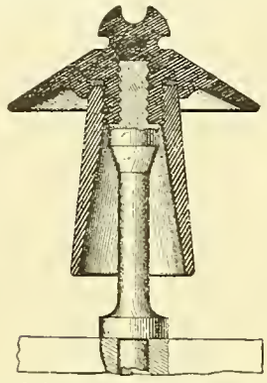
Means for ascertaining the voltage factor of power in an alternating-current system comprises two mains, a transformer excited by the mains, means for controlling the potential on the terminals of the secondary transformer coil independently from the mains, and means for measuring the potential, the potential on the mains and the resultant of the potential differences in parallel and in series.

806,576. Process of Insulating Electric Conductors. George H. Rupley, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 1, 1905.

The process of insulating an electric conductor consists in applying thereto successive layers of enamel having different rates of hardening to produce a homogeneous insulation.

806,588. Electrical Insulator. Herbert Sinclair, Trenton, N. J. Application filed May 5, 1905.

A body part and cap with a central opening through them for the passage of the securing screw are embodied in the device. Corresponding notches in the adjacent faces of body and cap form a cross groove for the wire, the body of the insulator being of oval cross section, with the long axis of the oval in a plane perpendicular to the length of the wire-groove



NO. 806,509.—COMPOSITE INSULATOR.

806,600. Process of Sterilizing Milk and Other Liquids. Robert C. Turner, Columbus, Ohio. Application filed January 25, 1904.

The milk is caused to flow from one vessel to another arranged electrically in series with the first. Simultaneously a current of electricity is passed through the milk in both vessels upwardly through one and downwardly through the other, the stream of milk flowing from one to the other completing the electrical circuit between the vessels.

806,601. Apparatus for Sterilizing Milk and Other Liquids. Robert C. Turner, Columbus, Ohio. Application filed March 16, 1904.

The apparatus consists of a number of liquid-receiving and delivering vessels arranged one above the other in series and each having an imperforate bottom wall and a directing spout adapted to direct liquid overflowing through it in a reduced stream to the next vessel in the series. The vessels are arranged electrically in pairs, a source of electric power, and means connecting each of the pairs of vessels in multiple arc with the source of power being supplied.

806,608. Manufacture of Materials Suitable for Insulating and Other Purposes. Willis R. Whitney, Boston, Mass., and Ralph C. Robinson, Schenectady, N. Y., assignors to the General Electric Company, Schenectady, N. Y. Application filed April 13, 1903.

The method consists in mixing together calcium hydrate and a fibrous binding material, and then treating the mixture at ordinary atmospheric temperatures with a soluble carbonate to convert the calcium hydrate into calcium carbonate.

806,635. Motor-control System. Eugene R. Carichoff, East Orange, N. J., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 4, 1904.

A reversing switch, a controlling switch, two devices controlling from a distance and operatively connected to both switches and means for rendering one of the devices inoperative with respect to the reversing switch when the other device is energized are the patentable features.

806,636. Electromagnetic Vibrator. Ragnar Carlstedt, Jersey City, N. J. Application filed August 22, 1904. Renewed May 16, 1905.

Details are described.

806,664. Sparking Device for Explosive Engines. William B. Hayden, New York, N. Y. Application filed January 9, 1905.

A hollow plug carries the fixed electrode of the sparking device.

806,666. Automatic Circuit-breaker. Edward M. Hewlett, Schenectady, N Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 11, 1897.

Combined with a number of circuit mains, are a circuit breaker comprising coils connected severally in the mains, a tripping device controlled by any of the coils, a magnetic blow-out common to all the coils, independent break-points for each main and separate blow-out chutes for the several break points.

806,667. System of Electric Generation and Distribution. Edward M. Hewlett, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 5, 1901.

Electric generating and distributing apparatus comprises generator units, power-operating switches between them and the distributing bus-bars, each separately insulated, an operating board containing operating devices, an instrument board grouped at a common point distant from the switches and means for controlling the power to operate the switches at the operating board. (See cut.)

806,690. Electrical Ring Furnace. Karl Meiser, Nuremberg, Germany. Application filed April 26, 1904.

Mechanical features are described.

806,696. Method of Insulating. Walter S. Moody, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed April 26, 1902.

A method of insulating the conductors of an electrical apparatus provided with an inclosing casing consists in maintaining a vacuum in the casing and introducing a normally fluid insulating material.

806,709. Switch-operating Mechanism. Jesse S. Pevear, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 27, 1905.

Combined with a supply conductor are a pair of normally open switches, electromagnetic actuating means for the switches normally connected to the supply conductor and arranged to actuate the switches selectively according as the current supplied is alternating or direct and means associated with one of the switches for controlling the other. (See cut.)

806,717. High-voltage Insulator. George W. Thomas, East Liverpool, Ohio, assignor to the R. Thomas & Sons Company, East Liverpool, Ohio. Application filed September 7, 1904.

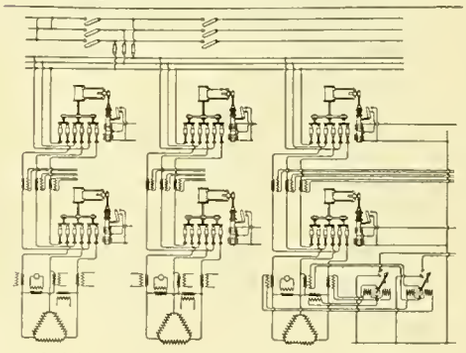
A petticoated body portion has a supporting post, the insulator and post of vitreous material, the supporting post being cemented to the body portion and having at its lower end a broad base, adapted to rest on the cross-arm. A metallic bolt passes through the post and has a shouldered head bearing on the upper end.

806,722. Prepayment Meter. James J. Wood, Fort Wayne, Ind. Application filed December 3, 1904.

A coin-actuated mechanism advances the indicator in one direction, and means controlled by the meter determines its movement in the contrary direction. The means comprise a movable part moved by the meter and adjustable to vary the rate of payment.

806,723. Incandescent Electric Lamp. James C. Wormley, New York, N. Y. Application filed January 15, 1904.

The lamp filament has a series of convolutions consisting of substantially parallel bars connected by curves lying substantially in the plane of the straight bars, the ends of the filament converging and being connected to and integral with the convolutions.



NO. 806,667.—ELECTRIC GENERATING AND DISTRIBUTING SYSTEM.

806,725. Warp Stop Motion for Looms. Horace Wyman, Worcester, Mass., assignor to the Crompton & Knowles Loom Works, Worcester, Mass. Application filed December 2, 1903.

An electric indicator in connection with the loom mechanism is part of the patent.

806,728. Device for Preventing the Overcharging of Electric Cables. Georg Zapf, Cologne-Nippes, Germany. Application filed March 28, 1905.

A safety appliance for preventing the overcharging of electric cables embodies two electrodes disposed in intimate relation to form a spark gap, a holding means for the electrodes containing oil and a layer of insulating material separating the electrodes and capable of being fused by heat and having a higher conductivity than the oil.

806,733. Magnetic Blow-out Switch. Charles E. Carpenter, New York, N. Y., assignor to the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. Application filed January 9, 1904.

A pair of co-operating contacts, one of which is movable to and from the other contact, co-operate with a blow-out magnet the poles of which are so placed as to produce lines of force which intercept the spark gap formed by the separation of the contacts. One of the poles is electrically insulated from both contacts and the other magnetic pole.

806,734. Apparatus for Stopping Electric Motors. Charles E. Carpenter, New York, N. Y., assignor to the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. Application filed April 29, 1904.

Combined with an electric motor are a brake circuit containing a highly inductive resistance in series with the armature of the motor and means for maintaining the field for the armature in a circuit independent of the resistance, and thereby checking the speed of the motor.

806,735. Electric Controlling and Reversing Switch. Charles E. Carpenter, New York, N. Y., assignor to the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. Application filed February 3, 1905.

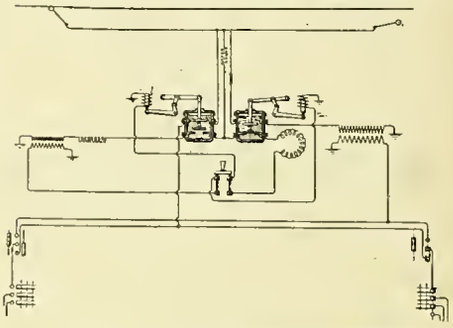
An electric motor controller and reverser has a fixed member and a movable member for effecting motor reversal and control. A stop carried by the fixed member engages with the other member only at an intermediate position in which there is substantially no current flow. Means are provided for retracting the stop when the movable member of the controller is at the intermediate position to permit the movable member to pass the intermediate position.

806,745. Elevator System. George A. Le Fevre, Orangeburg, N. Y. Application filed December 2, 1904.

An electric elevator system comprises a car, an electric motor, a rheostat in the circuit of the motor, a pole changer and a safety clutch for locking the car. The rheostat, pole changer and safety clutch are automatically operated by the making and breaking of the controller circuit.

806,749. Transforming Device for Electric Currents. Jacob E. Noeggerath, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed May 26, 1904.

Transforming apparatus employs a tube, a conducting substance adapted to move freely in the tube, means for subjecting two or more portions of the tube to magnetic fields, means for conducting a current through one of the portions and means for collecting the current induced in another portion by the motion of the substance.



NO. 806,709.—SWITCH-OPERATING MECHANISM.

806,751. Switch-controlling Mechanism. Jesse S. Pevear, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 27, 1905.

Details are described.

806,752. Combined Alternating and Direct-current Control Apparatus. Jesse S. Pevear, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed May 8, 1905.

A motor adapted for operation on either alternating current or on direct current is provided with a variable resistance, a variable transformer element, a controller and a switch device arranged to alternately connect the resistance and the transformer element in operative relation to the controller and the motor. The controller thus operates to vary the amount of resistance in the motor circuit when operating on direct current and to vary the terminal voltage of the motor when operating on alternating current.

806,758. Resistance for Electrical Apparatus. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed January 21, 1901.

A self-reducing starting resistance consists of a substance connected in a circuit with one of the windings of the motor, which at starting permits the flow of normal starting current only through the winding and when heated by the flow becomes a practically negligible resistance.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on December 11, 1905:

394,164. Electric Contact Maker. James S. Farmer, Salford, County of Lancaster, England.
394,171. Signaling Dynamo-electric Machine. Elisha Gray, Highland Park, Chicago.
394,180. Cut-out for Electric Lamps. Charles Heisler, St. Louis, Mo.
394,192. Electrical Fuse. James Macheth, Brooklyn, N. Y.
394,195. Bridge for Cutting in New Loops in Telephone Systems. George S. Maxwell, Louisville, Ky.
394,203. Electromagnetic Air-compressing Rock Drill. Richard G. G. Moldenke, New York, N. Y.
394,207. Electric Underground Conduit. David O. Paige, Detroit, Mich.
394,220. Electric Valve-operating Device. Frank M. Sparrow, Mattapoisett, Mass.
394,230. Telephone Central-station Apparatus. Theodore N. Vail, Boston, Mass., and John A. Seely, New York, N. Y.
394,302. Printing Telegraph. George V. Sheffield, Schenectady, N. Y.
394,307. Thermo-electric Valve Controller. Frank M. Sparrow, Mattapoisett, Mass.
394,332. Electromechanical Movement. Bassett Cadwallader, Chicago, Ill.
394,417. Safety Device for Electric Motors. Charles J. Vandepoele, Chicago, Ill.
394,471. Secondary Battery. Louis Duncan, Baltimore, Md.
394,472. Method of Making Secondary-battery Plates. Louis Duncan, Baltimore, Md.
394,473. Method of Making Secondary-battery Plates. Louis Duncan, Baltimore, Md.
394,474. Secondary Battery. Louis Duncan, Baltimore, Md.
394,485. Electromagnetic Switch. William W. Griscom, Haverford College, Pa.
394,491. Electric Alarm and Water Gage. John H. Johns, National Military Home, Kans.
394,525. Safety Device and Signal for Electric Motors or Generators. Charles J. Vandepoele, Chicago, Ill.
394,541. Electric Distribution by Secondary Batteries. Zach Latshaw, McKeesport, Pa.

WESTERN ELECTRICIAN

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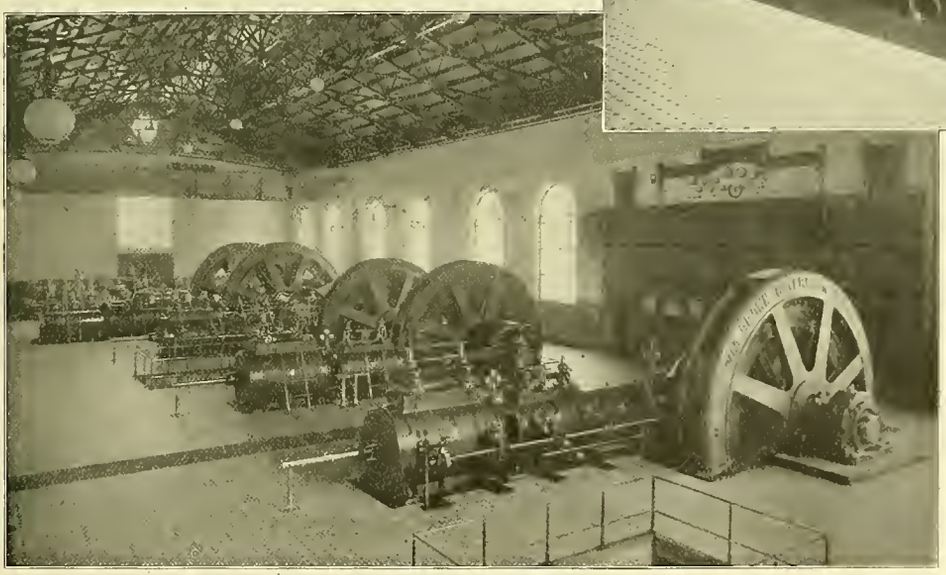
Central Station at Frankfort-on-the-Main.

By C. Smith.

Among the more important German central stations utilizing steam turbines and reciprocating engines combined, that of Frankfort-on-the-Main is the largest and most interesting. The present plant has an actual generating capacity of 17,000 horsepower. This includes four 750-horsepower steam-driven generators, four 1,500-horsepower sets and two 4,000-horsepower steam turbines. The engine room measures 23 by 97 meters and is 10.5 meters in height. It is served by a 25-ton traveling crane. The steam collectors, piping, cables, oil-purifying installation and step-down transformers for the light and power circuits are all contained in the basement.

The boiler house, which is 18 meters in width by 118 meters in length, contains 12 internal-flue boilers with Galloway tubes, transverse drums and Tenbrink grates, as well as six automatically fired water-tube boilers. The internal-flue boilers each have 1.98 square meters grate surface and 86 square meters heating surface. They are 8.78 meters long and 2.5 meters in diameter. The safety and stop valves are placed in the steam dome, with which each boiler is provided, this dome being 1.2 meters high and one meter in diameter. A transverse drum is arranged in front of the grate, causing the flame to return and mix again with air, this facilitating a good smoke consumption. The internal flue is 1.4 meters in diameter and is strengthened by four Galloway tubes, which also provide for the



General View in the Engine Room.

CENTRAL STATION AT FRANKFORT-ON-THE-MAIN.

required circulation of water. These boilers furnish a maximum of 27.5 kilograms of dry steam at 135 pounds pressure per square meter of heating surface. In normal working, however, but 17.5 kilograms of steam are supplied. The water-tube boilers have a grate surface of 4.56 square meters and a heating surface of 310 square meters, the ratio being 1:68, as contrasted with 1:43.4 in the case of the internal-flue boilers.

Coal is delivered automatically by electrically driven apparatus to a plate, from whence it is thrown uniformly over the grate by means of shovels. These boilers are also supplemented by six water-tube boilers with a heating surface of 311.5 square meters, each working with a superheater of 72 square meters, which can be cut in and out during working. Automatic fuel-feeding apparatus has been provided for these boilers, which are constructed for 150 pounds pressure and give nine kilograms of steam at 300° C. per square meter per hour.

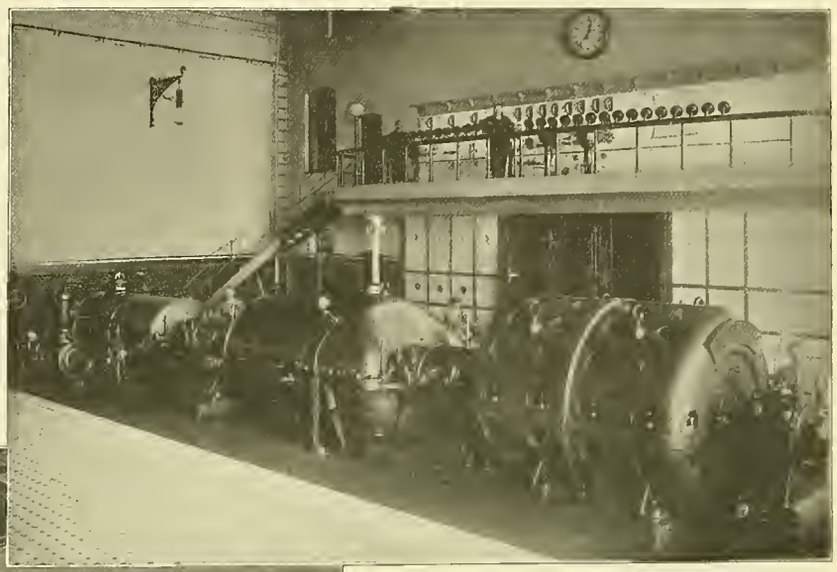
Connected with the internal-flue boilers mentioned above is a steam collector 630 millimeters in diameter, which is placed below the engine room. A circular pipe is used for the water-tube boilers, connecting with the collector at two places. Steam drying apparatus is inserted in the pipes leading to each engine, and by the use of valves each boiler and engine can be separately shut off from the main steam pipe.

Under the coal bunker, which is 11.5 meters wide and 120 meters in length, has been placed a masonry tank for feed water. It is supplied by the city waterworks and has a capacity of 130 cubic meters. Eight hot-water tanks having a capacity of 20 cubic meters each, are fed from this tank by means of an injector. The exhaust steam from the pumping engines, passing through coils, is utilized to heat the water in these tanks to 90° C. They can also be heated with live steam.

Four 750-horsepower tandem compound engines installed were manufactured by G. Kuhn of Stuttgart, and have a normal rated capacity of 560 brake horsepower at 120 pounds initial pressure and a speed of 85 revolutions per minute. They can be run either as condensing or non-condensing engines. The cylinders are 620 and 960 millimeters in diameter, the stroke being 1,200 millimeters. The flywheel weighs 28 tons and has a diameter of 4.8 meters. When developing their maximum capacity of 760 brake horsepower they have a steam consumption of 7.16 kilograms per indicated horsepower per hour.

The 1,500-horsepower engines, of which there are four, were constructed by Sülzer Bros. At the same speed and initial pressure as the 750-horsepower engines they have a steam consumption of 6.54 kilograms per indicated horsepower per hour, developing their maximum power. The cylinders are 1,250 millimeters and 975 millimeters in diameter, respectively, with a stroke of 1,500 millimeters. The flywheels each have a weight of 50 tons.

Alternators for these engines are direct-connected and supply single-phase current at a pressure of 3,000 volts and with a frequency of 45 cycles per second. Their outputs are 522 and 1,032 kilowatts, respectively. The field, which is built directly on the flywheel, consists of 64 poles. Two slip rings with double sets of brushes collect the exciting current. The armature wheel is built around the flywheel and is in four sections. It rests on two supports cast on the main bearings. There are 16 segments of four spools each to the armature, these spools being insulated from the frame by thick paper tubes. Two contact blades fixed to the armature wheel take the current by engaging with cop-



One of the 4,000 Horsepower Turbo-Generators.

per springs fastened to the foundation of the alternator. Series dynamos of 80 volts supplying a current of 180 amperes are used for exciters for the smaller alternators and are mounted direct on the main shaft. For the larger machines shunt dynamos of 90 volts and 280 amperes are used.

Two 3,000-kilowatt steam turbines constructed by Brown, Boveri & Co., have been recently installed, being directly coupled to 2,600-kilowatt alternators supplying current at 3,000 volts pressure. The turbines have a normal speed of 1,360 revolutions per minute and work with superheated steam at 300° C. with a pressure of 135 pounds. Under these conditions the guaranteed steam consumption was to be 7.2 kilograms per kilowatt-hour. Comparing this consumption with that of the 750-horsepower engines, it is noted that there is a considerable difference.

In the case of the steam engines, the steam consumption under normal conditions is 11.5 kilograms per kilowatt-hour. The steam turbines have developed 2,995 kilowatts, utilizing superheated steam at 312° C., with a consumption of but 6.7 kilograms per kilowatt-hour. The second of the two turbines was installed in October of this year, after exhaustive tests on the first had conclusively shown the advantages to be derived.

Cables leading the current to the switchboard are placed in the basement below the alternators. The switchboard, which is of white marble, has all high-tension connections on the back. One set of bus-bars are used for lighting and one for power. Space has been reserved in the rear, so that all repairs can be made quickly and safely.

Step-down transformers have been installed in various parts of the city to reduce the pressure to 125 volts. At Schillerplatz a street-railway motor-generator plant has been installed and is connected with the central station by two high-pressure feeders of 210 square millimeters cross-section. The motor-generators installed are four in number and were designed for a working load of 500 kilowatts each, at 550 volts, the speed being 340 revolutions per minute. They have a full-load efficiency of 91 per cent.

To run the motor-generators up to sped from the direct-current side for synchronizing, a storage bat-

tery has been installed. It can be used as a reserve also, and is able to replace one of the motor-generators for one hour as well as act as a buffer to equalize the street-railway load. The installation consists of 276 Pollak cells, having a normal capacity of 920 ampere-hours at a one-hour discharge.

Novel Starting Resistance for Motors.

Charles P. Steinmetz of Schenectady, N. Y., has devised a novel resistance device which is applicable especially to the starting of motors. It is automatic in its action and is designed to take the place of hand-operated rheostats. The device, upon which Mr. Steinmetz has received a patent, might be termed a "pyro-electrolytic motor starter," for it embodies in its construction the use of a material which has high initial resistance but becomes more and more conductive as the temperature is increased, the resistance finally becoming so small as to enable the material to pass the full current to the motor with a practically negligible ohmic drop through the resistance, whereas at starting the full-line voltage may be required at the terminals

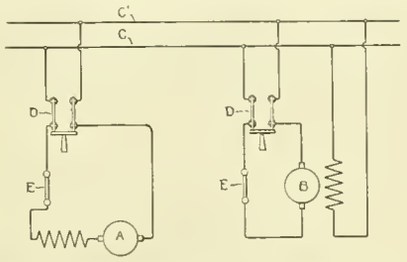


FIG. 1. CONNECTIONS FOR NOVEL MDTOR-STARTING DEVICE.

of the resistance to force the same current through, this action being identical with that of the usual hand-operated rheostats.

Among the various substances which are conductive at ordinary temperatures and become more conductive as the temperature increases Mr. Steinmetz has found that the tetroxide of iron or magnetite is especially suitable for the purpose, or a mixture of magnetite and chromite of iron, the latter having a higher initial resistance than the former, but being equally conductive at high temperatures, may be used. These substances are chemically stable and structurally solid even at a red heat, while the resistance of magnetite is about 100 times less at red heat than at ordinary temperatures. By mixing with it the chromite of iron the initial resistance can be made even higher.

Fig. 1 shows a series motor and a shunt motor provided with the self-reducing starting resistance. Fig. 2 is a diagram showing the invention applied to an induction motor. Fig. 3 is a sectional end view of a portion of the squirrel-cage armature of an induction motor, showing another mode of applying the invention. Fig. 4 is a sectional side elevation of the last.

The series motor (A) and the shunt motor (B) are shown connected across the positive and negative mains (C C'), and the circuit is controlled by a double-pole switch (D). The self-reducing resistance is shown at (E), being simply a stick of magnetite or other material having the characteristics above specified suitably mounted in series with the armature of the motor. When the switch is first closed, the stick (E) being cold, offers a high resistance to the passage of the current; but as the current heats it up it becomes more conductive until finally when at a red heat it offers practically no obstacle to the passage of the current. The length of time required to reach this point depends upon the size of the stick (E) and the voltage to which it is subjected.

Fig. 2 shows in diagram the connections of the armature of an induction motor, the armature coils being in three sets (F) (F') (F²), all connected at one end to a short-circuiting ring (G) and each at the other end to a segment of a short-circuiting ring (H). The gaps in the ring (H) are bridged by resistances (E), and the effect of this construction is to check at first any rush of induced current in the armature, but gradually allow it to increase as the speed of the motor increases and the current heats up the resistance.

Another mode of applying the invention to induction motors is sbown in Figs. (3) and (4). The armature bars (I) of the squirrel-cage armature are usually secured at each end to a short-circuiting ring (K). Between one or more of the bars and the ring are placed washers (L) of magnetite or the like, preferably separated from the bar and ring and from each other by washers (M) of copper or other good conducting material. The fastening bolt (N) is insulated from the washers and the ring to compel the current to pass through the washers. When the motor starts the magnetite washers are cold and offer considerable resistance to the otherwise heavy rush of secondary current; but as the continual flow of current heats the washers they become more conductive and finally permit current to pass freely. When the motor stops, the heat of the washers is quickly conducted away and dissipated by the ring (K), which has considerable radiating surface.

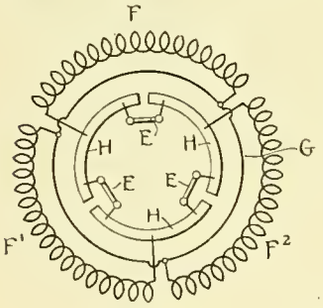


Fig. 2.

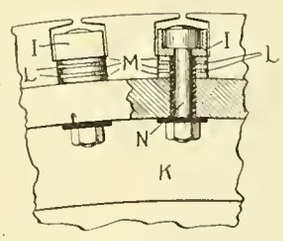


Fig. 3.

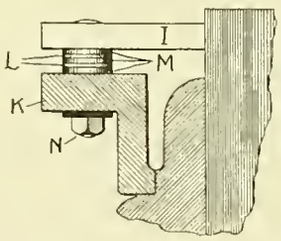


Fig. 4.

DETAILS OF NOVEL MOTOR-STARTING DEVICE.

Routin's Power-factor Meter.

In the operation of alternating-current systems a power-factor meter for obtaining the factor by which the apparent power must be multiplied to obtain the actual power in watts is a convenient instrument. The accompanying diagrams illustrate an improved power-factor meter which was recently patented by Joseph Louis Routin of Lyon, France.

Inspection of Fig. 1 will show that the apparatus embodies a transformer having three coils (b_2), (b_2) and (b_3). The coil (b_1) carries the main current, the coil (b_2), consisting of a small number of turns of thick wire, is connected to a rheostat of adjustable resistance and free from self-induction and the coil (b_3) is connected to one of the mains and to one terminal of a voltmeter, the other terminal of which is connected to the other main; but these connections to the mains are interchangeable at will by means of a switch (C).

Two keys (f_1) and (f_2) allow of using the voltmeter for measuring the potential between the mains, or the potential between the terminals of the coil (b_3).

The method for making a measurement is as follows: The key (f_1) is moved into the position indicated in Fig. 1 by dotted lines. and the potential between the mains, which shall be called e_1, is read off the voltmeter. The key (f_1) is thereupon moved back to its original position and the key (f_2) is moved into the position indicated by dotted lines. The rheostat is then adjusted until the potential between the terminals of the coil (b_3), which shall be called ϵ_1, is equal to e_1. The transformer is so constructed that under these conditions the potential on the coil (b_3) is substantially in phase with the current on the mains and that the potential is also at all times proportional to the current. The key (f_2) is then moved back to its original position, and the potential m_1 resulting from the opposition of ϵ_1 to e_1 is noted. Then

$$\cos.\ \Phi = 1 - \frac{m_1^2}{2\,e_1^2},$$

as will be demonstrated. Since e_1 is in practice a constant, a special scale can be traced on the voltmeter to directly indicate Φ or the power factor $\left(1 - \frac{m_1^2}{2\,e_1^2}\right)$. To obtain a closer approximation the potential m_2 resulting from the addition of ϵ_1 to e_1 can be ascertained. To do this the switch (C) is operated. The angle Φ will then be given by the equation $\tan.\ \frac{\Phi}{2} = \frac{m_1}{m_2}$, as will be seen from Fig. 2.

To demonstrate the first equation cited: Let e be the instantaneous potential on the terminals, e_1 the effective potential on the terminals, i the instantaneous tension, i_1 the effective tension, T the inverse frequency, W the power in watts,

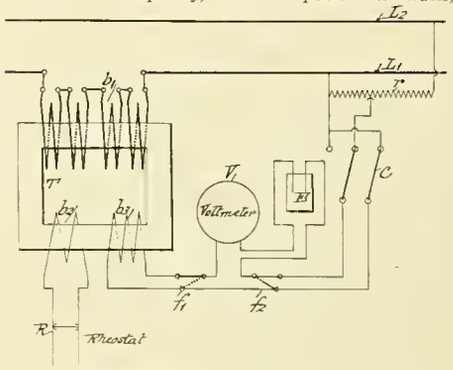


FIG. 1. CONNECTIONS OF POWER-FACTOR METER.

ϵ the auxiliary electromotive force supplied by the transformer, ϵ_1 the effective value of ϵ and m_1 the effective value of the resultant of e and ϵ. The value to be ascertained is

$$W = \frac{1}{T}\int e\,i\,dt,$$

now

$$i = \frac{\epsilon}{K}.$$

$$\therefore \quad W = \frac{1}{K}\,\frac{1}{T}\int e\,\epsilon\,dt,$$

The reading on the voltmeter gives

$$m_1^2 = \frac{1}{T}\int (e-\epsilon)^2\,dt,$$

$$\frac{1}{T}\int e\,\epsilon\,dt = \frac{e_1^2 + \epsilon_1^2 - m_1^2}{2}$$

$$W = \frac{1}{K}\,\frac{e^2 + \epsilon_1^2 - m_1^2}{2}.$$

If the resistance in the secondary circuit is so regulated that $\epsilon_1 = e_1$, then

$$W = \frac{1}{K}\,e_1^2\left(1 - \frac{m_1^2}{2\,e_1^2}\right) = \frac{1}{K}\,e^2\cos.\,\Phi.$$

$$\cos.\,\Phi = 1 - \frac{m_1^2}{2\,e_1^2}.$$

The voltmeter must have sufficient resistance to render the consumption of power therein immaterial to the measurements, for this purpose a direct-current voltmeter is preferably used in series with a small electrolytic cell (E).

If the coil (b_2) were dispensed with and the rheostat connected to the terminals of the coil (b_3), the rheostat must have a very much higher resistance and must comprise a long thin wire instead of massive bars. This would render it difficult to obtain a continuous variation of its resistance by means of a sliding contact. It is solely for this reason that the auxiliary coil (b_2) is used for regulating the resultant flux. If it is desired to obtain low-tension readings with the same approximation as for the full load, the coil (b_3) is preferably divided into sections, as indicated in Fig. 1, adapted to be placed in series or in parallel with each other in order to allow of using approximately the same number of ampere-turns.

To avoid the necessity of using a too large number of turns in the coil (b_3), lower tension than e_1 can be used for exciting the coil (b_3). For this purpose an ordinary transformer can be used or a resistance (r), (Fig. 1), free from self-induction placed between the mains (L_1) (L_2), one terminal of the coil (b_1) being connected to a suitable point on this resistance and the other terminal being connected to the main. These arrangements allow of regulating at will the fraction of e_1 to be used and of keeping this fraction of a constant value in order that the special sale on the voltmeter can be used for ascertaining the power factor.

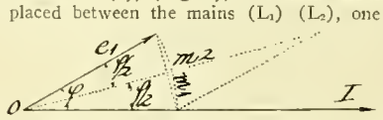


FIG. 2. VECTOR DIAGRAM FOR POWER-FACTOR EQUATIONS.

Work on the construction of a new electrical laboratory at Union College, Schenectady, N. Y., has been begun. The college has an unusual amount of apparatus for electrical work, no characteristic machine, it is said, being absent. The plans for the new building provide every facility and convenience for instruction in electricity.

Gasoline Motor Car for Interurban Traffic.

Gasoline motor cars, while they are not considered seriously by engineers as a strong competitor of electricity in interurban traffic, are nevertheless the subject of considerable discussion, especially since a few of the steam roads are experimenting with them in an effort to compete with paralleling electric lines. As stated in the Western Electrician last week, there are a number of objections to the gasoline motor car which detract from its usefulness.

It is interesting, however, to study the developments which are taking place in this line, and illustrated herewith is a gasoline car which is now operated by the Union Pacific railroad. The two views show the interior and exterior of the car and indicate that in appointment, at least, and in graceful lines of construction the car possesses features which recommend it as a transportation medium.

Car No. 2 is the one here illustrated, and is the second one built by the railroad company. The inside finish of the car is antique mahogany, the ceiling being cream white, with decorations in gold and sepia. Seats are finished in leather, with a semi-circular tufted seat at the rear. The exterior is finished in maroon and striped in gold, while the trucks are painted olive green.

This car has two four-wheel all-steel trucks and is 55 feet long, with seating capacity of 57.

With its steel sills and bracing, the steel carlins and ribs and the angle bracing and outside steel shell, the new car is one of great strength, which is due particularly to its structural design. In spite of its strength the total weight is but 56,000 pounds. The driving wheels are 42 inches in diameter; other wheels 34 inches.

Hot-water circulation coils serve the double purpose of cooling the engine and heating the interior of the car and are located and housed in the pilot. Twenty-five opalescent panel lights, burning acetylene gas, provide illumination.

The car is driven with a 100-horsepower six-cylinder gasoline engine, built after special railroad patterns, designed to meet regular railroad car-service requirements. It has a make-and-break spark ignition, with a primary battery to start on and a magneto for regular running service.

The metal clutch for starting is operated by air pressure, controlled by a specially designed operating valve. The car is started at low speed, engine disconnected, or thrown into high speed at will simply by means of the operating valve.

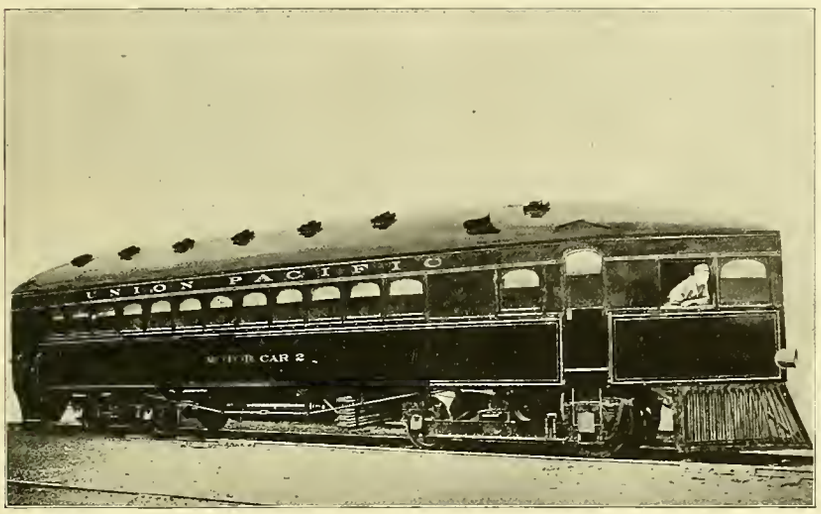
Motor car No. 2 made its initial trial trip September 14, 1905, when the car ran from Omaha to Valley, Neb., on the main line of the Union Pacific, a distance of 34.8 miles. On the west-bound trip no effort was made to make a fast run, the car being put through various evolutions demonstrating its practicability in regular service. However, the distance, deducting stops, was covered in one hour and 11 minutes, actual running time. Especially noteworthy was the performance of the car ascending Elkhorn Hill, where the grade is 42 feet per mile. This hill was ascended at the rate of 32½ miles per hour.

On the return from Valley the run was made without stop, and deducting eight minutes for slow-ups the run was made in 57 minutes, or an average of 37 miles per hour, with a maximum speed on the run of 52 miles per hour.

Facilities for the comfort of the passengers are provided generously. To provide good ventilation the old-style ventilators are done away with and roof ventilators are supplied, which exhaust the air from the car by suction, fresh air being taken from the front of the roof. The floor is water-tight and can be cleaned by flushing with hot water.

Heating water is run around the sides of the car so that in cold weather the heat is circulated in the interior; in warm weather the water is piped to coils below the floor. These two systems of piping serve to regulate the temperature admirably.

Air is supplied at 110 pounds pressure to two reservoirs of 13 cubic feet capacity each for supplying the air brakes and also for starting the engine. W. R. McKeen, Jr., superintendent of motive power, supervised the design of the car.



Exterior of Motor Car No. 2 of the Union Pacific Railroad.

Interior of Car, Showing Lighting and Ventilating Arrangement.

THE GASOLINE MOTOR CAR FOR INTERURBAN TRAFFIC.

New York Electrical Show.

The New York Electrical Show was opened at Madison Square Garden on the evening of December 12th, when the lighting and power circuits were turned on by President Roosevelt by operating a golden key at the White House, Washington. At the New York end of the wire Professor Seaver of Columbia University delivered an address, and when he had finished, the proper signal was sent to Washington, and the president responded.

Exhibits occupied the main floor of the building, but did not overflow very much into the galleries above. Looking down the main floor, the exhibit of the New York Telephone Company was prominent on the left. This exhibit was the most conspicuous in the show, and was generally regarded as an attempt to demonstrate the efficiency of the New York telephone service, in view of the possible competition of the "Independents" in the near future. In this booth was a section of a central exchange with connections to every booth in the exhibition, as well as with the outside world. There were also some historical telephone relics on exhibition, including the first Bell telephone ever used for the actual transmission of human speech, and an historical range of transmitters and receivers connecting this instrument with those of the present day. Around the booth were a number of receivers connected each evening with a New York theater, through which visitors could hear, free of charge, the dialogue and music of a popular play.

Next in general interest was a working model, 30 feet long, of the municipal lighting plant and street-refuse destructor recently started in New York city. The working parts of this model were operated by a motor, and showed the whole method of sorting and utilizing the refuse, and its conversion, by means of a row of furnaces, into electric power, which in the original plant is used for lighting the Williamsburg Bridge.

The Electro-dynamic Company of Bayonne, N. J., exhibited, as its latest novelty, a vertical form of the well-known interpole variable-speed motor. The same company, in order to demonstrate the high efficiency of the motors, had one on exhibition, running with another as a generator, working at speeds from 250 to 1,600 revolutions per minute. Specially devised measuring instruments demonstrated to the spectators a loss of only four per cent. in conversion at any speed. The motors on exhibition were sparkless in operation. The Bayonne concern also showed the Molony transformer, for which it is agent.

Semi-portable electrically driven emery grinders were shown by the Stow Manufacturing Company of Binghamton, N. Y. These motors have been improved recently in several important details. The machine is entirely self-contained, being equipped with a specially designed multi-speed motor, and is capable of being driven at all speeds within its highest and lowest limits. This is accomplished without either controller or rheostat, the turn of a small wheel at the top being sufficient to vary the speed. For work which cannot be brought to the machine a smaller portable grinder is made. The Stow Manufacturing Company builds these grinders in various sizes, but emphasizes the fact that they are for direct current only.

Among a number of manufacturers represented by Elmer P. Morris was the United States Electric Tool Company. This company's electrically driven drills and grinders, both portable and stationary, were interesting developments of modern workmanship and utility. W. Greene & Co., New York, showed a noiseless direct-current lathe motor, capable of being driven at three separate speeds, with movable attachments suitable for polishing, drilling, grinding, turning and sawing.

Prominent displays of electrical apparatus for domestic use were made by several companies. That of the Simplex Electric Heating Company, represented by Roger Williams, included a portable heating pad to replace the old-fashioned hot-water bottle, a motor-driven sewing machine, electric irons, stoves, milk warmers and chafing dishes. From time to time a complete course dinner was cooked with this apparatus.

The Brunswick Refrigerating Company of New Brunswick, N. J., showed its motor-driven domestic ice-making machine, which is compact and easily operated. Another interesting exhibit of electric heating and cooking devices was that of the Prometheus Company. A portable electric vibrator for therapeutic use was shown by the Tonjes-Van Buskirk Company of New York.

A model car operated by the Pullen surface-contact system of electrical propulsion was a feature of the show. A full-sized working model of an electric locomotive for use in mines was also shown, running along a short length of track. Demonstrators at this exhibit asserted that this mode of traction is perfectly safe and economical, the cost of equipment of the surface-contact points being $3,300 per mile of single track, and the necessary magnetic attachments to each car costing $350. The simplicity of the contact mechanism and its entire impermeability to water or snow was emphasized. G. M. Gest of Cincinnati, Ohio, was on hand with his modern subway-constructing methods.

The Kinsman block system of automatic devices for securing safety of operation for steam and electric railroads was shown by means of full-sized working models. This system is the invention of F. E. Kinsman, and can be arranged to act automatically upon the motive and brake system so as to bring a train to a standstill on the death or neglect of the engineer or motorman. At the same time the engineer can re-establish his control almost instantly after the operation of the device has been communicated to the crew. The Kinsman Company also showed a newly invented instrument called the phonoscopic detector, upon which patents are pending. This is a compact device fitted with tele-

phone receivers, and when connected with any point (as at a lamp socket) of a wiring circuit enables the general conditions of the system to be diagnosed, even to the extent of detecting faulty conditions of the commutator brushes.

A working model of the method of operating elevators was displayed by the Safety Electric Elevator Company. Movement in this system is obtained by means of a horizontal drum beneath the car, revolved by a motor. On the periphery of the drum is fitted a spiral track which engages and travels on two series of rollers set in guide posts, and on starting the motor the drum revolves and causes the car to move.

A considerable show of artistic lighting devices was made by the Enos Company of New York city, which arranged its fixtures as they would be in a modern mansion. A somewhat similar display of lighting fixtures was made by the American Electrical Novelty and Manufacturing Company, which had fitted up a Christmas tree with a number of miniature incandescent lamps. The same firm

PROFESSOR OVINGTON EXPERIMENTING WITH HIGH-TENSION HIGH-FREQUENCY CURRENT.

showed electric clocks, cigar lighters, and many electrical toys.

The St. Mary's Incandescent Lamp Company of St. Mary's, Pa., made a feature of its lamp, which the company says, can be turned out at its new factory at the rate of 6,000 a day. This firm made a strong effort to bring its goods to the notice of visitors, and was ably represented by Robert J. Mulligan, G. A. Nisbet, O. J. Bryan, H. H. Balliet and Rudolph Miehling.

Felix Hamburger of New York city showed the Siemens flame arc-effect lamp, which produces a golden-yellow, red or brilliant white light, according to the character of the carbons used. Another flame lamp represented was the new Beck lamp. The Columbia enclosed arc carbons were put forward by the National Carbon Company of Cleveland, Ohio, as possessing marked economical features.

Gas and gasoline engines suitable for small lighting plants were exhibited by the National Meter Company. Various types of panel boards were shown by the Waterbury Company of New York and Brooklyn. These boards are all made of standardized dimensions and are claimed to be of the highest grade. This company, which was represented by Mr. J. J. Shaugnessy, also showed specimens of its seamless rubber-insulated wire and gave away a little booklet containing a mass of mathematical data relating to the gauges and resistances of copper wire, and also details of electrical units.

The Chicago Pneumatic Tool Company had a large and important showing of the Little Giant storage batteries, which it supplies with or without the Duntley washable cell. In the washable type a hard-rubber screw plug and gum-rubber gasket are fitted in the bottom of the cell, and after the electrolyte is withdrawn the interior of the cell can be thoroughly washed by means of a hose. The firm also offered a low-priced rheostat adapted to meet the requirements of charging its different types of batteries. It also exhibited as a novelty the Duntley air-cooled electric drill, which weighs but 13 pounds complete.

Batteries were shown by the General Storage Battery Company of New York and Boonton, N. J., which made a strong feature of the Bijur high-duty storage cells. Its exhibit, which occupied considerable space, showed the wide range of uses to which the batteries can be applied, and the mode of charging and operation. The display also included a charging booster, a constant-current booster, standard battery case for railroad signaling, a yacht battery and various switchboards illustrating how the charging current is regulated automatically by varying the field excitation of the charging generator.

The National Battery Company of Buffalo, N. Y., showed a full line of its storage batteries, suitable for all purposes, from street-railway work down to that of dental laboratories. The 1906 model of its National sparkers has distinct new features, and is said to be a non-corrodible battery of high capacity and great durability, constructed to withstand the hard service occasioned by the vibrations of a high-power car. The terminals are of non-corrodible metal and will bear a great deal of twisting.

A complete line of ignition apparatus for gas, gasoline or oil engines was shown by the United States Battery Company of New Rochelle, N. Y. For its batteries it claims high voltage and uniformity of action.

The Eastern Carbon Works of Jersey City, N. J., showed its Atlantic dry cell as adapted for intermittent work.

Interlocking clasps as made by the Clarke Electric Manufacturing Company were exhibited, being an entirely new line which obviates the use of tie wires. These clamps are made in various sizes and shapes, and securely hold the cables in the grooves of insulators constructed with an undercut recess. The company also showed the Clarke copper splicing sleeves for connecting hard-drawn copper wires and cables. These sleeves are annealed by a process which secures a hard exterior wall with a soft interior, and they will bear as many as eight turns without splitting.

An improved and consolidated form of the McMurtrie electric timing system, as used for automobile races and for all purposes where the exact and automatic recording of elapsed time is needed, was exhibited by Charles E. Dressler & Brother of New York, who also showed many specialties and novelties, including the projectograph and a line of sphygmomanometers. The McMurtrie electric timer was fully described in the Western Electrician on August 27, 1904, at the time of its first public appearance.

Measuring instruments were exhibited by the Electrical Construction and Manufacturing Company of New York city, and the Scheeffer integrating wattmeter was in charge of Caldwell and Osterhoudt, as representing the Diamond Meter Company of Peoria, Ill.

Daily demonstrations were given by Prof. Earle Ovington on the phenomena of high-tension high-frequency currents. Some of the experiments were said to be entirely new. Professor Ovington sent wireless messages through the human body, using an assistant in place of the vertical conducting rod, and he also lit five incandescent lamps by a current passing through his own body. Even more daring was the melting of a piece of platinum wire while held in the experimenter's hand.

The De Forest Wireless Telegraph Company devoted much attention to an exhibit which comprised a half-kilowatt transmitting set mounted on an automobile, both car and apparatus being operated from a 30-cell storage battery. It also showed, and operated, from time to time, a two-kilowatt set similar to that used recently on tests made on board the United States ship West Virginia, from which messages were transmitted overland to a distance of 1,100 miles. On the roof of the Madison Square Garden were antennæ to receive messages from ships at sea, which was successfully accomplished under favorable circumstances during the time of the show. An exhibition of the space-telegraphy apparatus used on board the dispatch boat Haiman in the Japanese-Russian war rounded out the De Forest efforts.

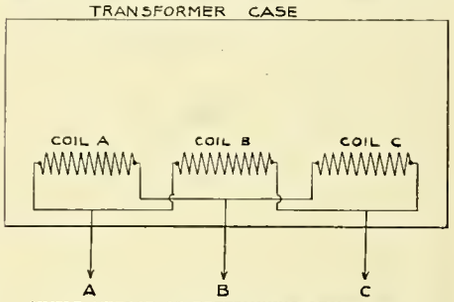
D. W. W.

The department of electrical engineering established two years ago, in the Agricultural and Mechanical College at College Station, Texas, is now said to be one of the largest in the institution. Prof. N. H. Brown is head of the department, with three assistants. Instructions are given in all branches, including telephone engineering.

Simple Method of Determining Resistance of Transformer Coils.

By E. O. Schweitzer.

In single-unit delta-connected three-phase transformers having the leads (A), (B) and (C) (see cut) brought out of the transformer case it is frequently desirable to determine the resistance of each of the three coils (A), (B) and (C) from measurements of resistance between the leads (A B), (B C) and (A C), without making any disconnections within the transformer case. These resistances having been obtained, the resistances of



SIMPLE METHOD OF DETERMINING RESISTANCE OF TRANSFORMER COILS.

coils (A), (B) and (C) may be calculated from formulæ derived in the following simple manner:

Let the measured resistance between leads (A) and (B) $= X_0$, between (B) and (C) $= Y_0$ between (A) and (C) $= Z_0$. Let the resistance of coil (A) $= a$; of coil (B) $= b$; of coil (C) $= c$.

$$\text{From } \left.\begin{aligned} \frac{a(b+c)}{a+b+c} &= X_0 \\ \frac{b(c+a)}{a+b+c} &= Y_0 \\ \frac{c(a+b)}{a+b+c} &= Z_0 \end{aligned}\right\} \quad \ldots\ldots\ldots\ldots\ldots\ldots 1$$

We have by addition

$$\frac{X_0}{a}+\frac{Y_0}{b}+\frac{Z_0}{c}=2 \quad \ldots\ldots\ldots\ldots\ldots\ldots 2$$

$$\text{Also, } -\frac{b}{c}(Y_0-X_0)-\frac{b}{a}X_0+Y_0=0$$

$$-\frac{b}{c}Z_0+\frac{b}{a}(Z_0-Y_0)-Y_0=0$$

$$\text{Hence } a=\frac{\rho}{Y_0+Z_0-X_0}$$

$$b=\frac{\rho}{Z_0+X_0-Y_0}$$

$$c=\frac{\rho}{X_0+Y_0-Z_0}$$

Where ρ is a factor which remains to be determined. Substituting these values of a, b and c in equation (2), we find $2\rho = 2(X_0Y_0 + Y_0Z_0 + Z_0X_0) - (X_0^2 + Y_0^2 + Z_0^2)$.

Hence

$$a=\frac{X_0^2+Y_0^2+Z_0^2-2(X_0Y_0+Y_0Z_0+Z_0X_0)}{2(X_0-Y_0-Z_0)}$$

$$b=\frac{X_0^2+Y_0^2+Z_0^2-2(X_0Y_0+Y_0Z_0+Z_0X_0)}{2(Y_0-Z_0-X_0)}$$

$$c=\frac{X_0^2+Y_0^2+Z_0^2-2(X_0Y_0+Y_0Z_0+Z_0X_0)}{2(Z_0-X_0-Y_0)}$$

Chicago City Railway Ultimatum.

Traction matters were not taken up at the meeting of the Chicago City Council this week, except to receive a communication from the Chicago City Railway Company stating that it would not accept the franchise ordinance agreed upon by the local transportation committee if it was amended materially by the council.

The communication, signed by President Mitten, contained this sentence: "The company, for the purpose of determining what it was possible for it to do under the conditions imposed by the proposed ordinance, secured the services of the well-known street-railway experts, Messrs. Ford, Bacon & Davis of New York, who now have completed a most thorough and comprehensive investigation of the property, and the conclusion arrived at, resulting from such investigation, has been that the company could not under any circumstances make greater concessions or assume greater obligations than those now required by the terms of the pending ordinance."

It was intended to bring up the franchise or-

dinances of all the companies and refer them to the council as a committee of the whole, which would consider them at special sessions during the week, but as many of the aldermen wished to leave the city over the holidays the whole matter was passed until the meeting of the council on January 2d.

Types of Modern Dam Construction.

In hydro-electric power developments the dam is naturally the groundwork of the installation. In modern construction there are four general types of dams, some one of which, with minor variations to suit local conditions, will usually be found applicable. These are the monolithic or masonry dam, the steel-concrete gravity dam, the steel gravity dam and the timber gravity dam. In a small folder sent out by the Roberts & Abbott Company, consulting engineers of Cleveland, these four types are described and illustrated by sectional diagrams, and the following, which is taken from this circular, will no doubt contain information which will be found generally useful.

The monolithic or masonry dam has for centuries been the one generally constructed where large interests or responsibilities have been involved. When properly designed and constructed this dam should endure for all time. The center of the hydraulic pressure acts at (P) (Fig. 1) perpendicular to the face of the dam. As all the force is practically horizontal and down the stream, this dam, as usually designed, depends for its safety upon its weight.

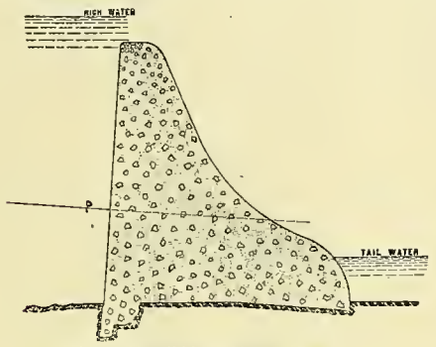


Fig. 1. Monolithic or Masonry Dam.

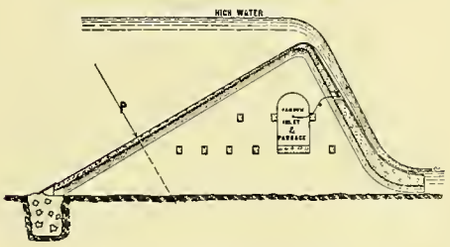


Fig. 2. Steel-concrete Gravity Dam.

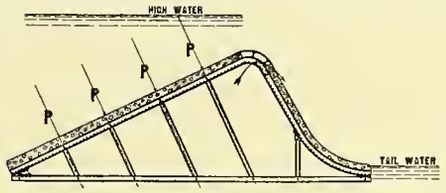


Fig. 3. Steel Gravity Dam.

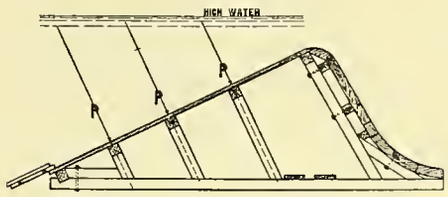


Fig. 4. Timber Gravity Dam.

TYPES OF MODERN DAM CONSTRUCTION.

Large bodies of concrete or masonry shrink on drying, causing dangerous stresses and cracks; hence careful supervision is necessary to assure safe construction. Extensive borings must be made to make sure that the foundation is secure; all cement must be honestly tested and every detail of the construction thoroughly supervised.

The concrete-steel gravity dam is shown in Fig. 2, and is of the type known as the Beardsley gravity dam. Concrete is well known to have no safe tensile strength, but its strength under compression can be relied upon at all times. In this type of dam steel is used to take all the tensional stresses; hence the reinforced members may be designed with the same exactness as may those wholly of steel. As applied to the dam, reinforced concrete will not crumble nor will the steel rust away.

The gravity dam, in principle, is one of the oldest types, and practically all of the old crib and rafter dams were built on this principle, the only difference being that their interior was filled with timber and other materials. The line of pressure (P), acting perpendicularly to the deck of the dam, strikes its base as shown in Fig. 2. The greater portion of the pressure of the water is therefore made to press the dam firmly upon the river bed or mat, as the case may be. The design, therefore, simply becomes a question of strength of materials, and the dam may be of any height and have any desired factor of safety.

Fig. 3 shows the steel gravity dam, the members being entirely of steel. The deck may be made of steel, concrete steel or timber. Not considering the cost, this is said to be the best of all dams, but usually the cost of steel is prohibitive. The interior of the dam being at all times open to inspection and repairs, the members may be kept painted and the rusting away of the steel prevented. Settling will not injure the steel gravity dam.

In Fig. 4 is illustrated the timber gravity dam, which, in many cases, is the best dam for the controlling condition. It is the cheapest of all dams. Settling will not injure it. Ice expansion affects it less than it does concrete or masonry dams. The average life without repairs of this dam is from 20 to 40 years, but owing to the very important fact that the dam is accessible at all times for inspection and repairs, its life depends only on the care with which it is inspected. The vacuum inlets at the ends of the dam admit a constant current of fresh air into the dam, thus keeping down the temperature and retarding decay. An important advantage is that it can be built with great rapidity.

Compact Panel-board Construction.

In the construction of panel boards it has hitherto been common practice to connect the fuse-plug receptacles to the bus-bars by means of cross-bars protruding from the outer side of the bus-bars. In a panel board recently patented by Hubert Krantz of New York the protruding cross-bars are done away with by placing the receptacle for the fuse plugs directly over the bus-bars, thus not only saving material for cross-bars and space on the panel board, but also doing away with joints between the bus-bars and cross-bars formerly leading to the receptacles.

As shown in Fig. 1, the porcelain shell of the receptacle may be single, as at (C C'), or it may be double, as shown at (C^2C^2). The porcelain shell (C) is shown in vertical section on the left-hand side of Fig. 2 and in sectional plan at the upper right-hand side of Fig. 1. This shell has a slot in the under side for a bus-bar, so that the shell passes over and encloses the sides of the bus-bar.

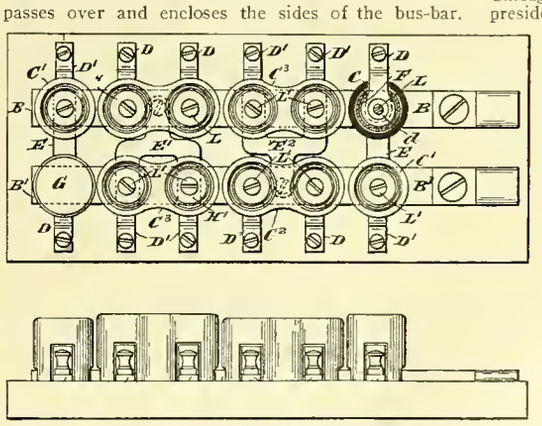


Fig. 1. Plan and Elevation of Panel Board.

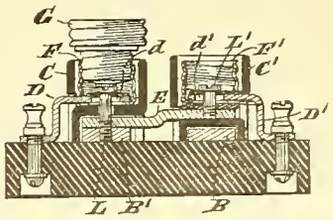


Fig. 2. Detail of Panel Board, Showing Construction.

COMPACT PANEL-BOARD CONSTRUCTION.

The shell is also provided with an opening through which passes the contact piece (D), leading to a branch line. On the other side of the shell there is another opening through which passes a connecting piece (E), forming a short cross-bar between the bus-bars. Within the porcelain shell the first contact piece is in contact with a screw shell adapted to receive the fuse plug. Above the contact piece is an insulating washer. A contact nut or screw passes through the insulating washer, an opening (d) (Fig. 1) in the contact piece, and directly down to the bus-bar (B) (B'), making contact with the bus-bar in any suitable way. By inserting a fuse plug into the shell (C) (Fig. 1), connection is made between the metal shell and contact screw, so that the circuit is closed from bus-bar (B'), through screw (L), the fuses in the plug and the screw cap (F) to contact piece (D).

The porcelain shell at the right-hand side of Fig. 2 is provided with slots or openings for the bus-bar, the contact-piece and the cross-bar, but in slightly different positions from the other shell. Within the right-hand porcelain shell a contact-piece (D') is in contact with the screw shell, adapted to receive a fuse plug. An insulating washer is placed above contact-piece (D'), and a second insulating washer is placed below the contact-piece and lower rim of the shell.

Since a portion of the porcelain insulating shell (C') lies between the bus-bar (B) and the cross-bar (E), as seen in Fig. 2, it will be evident that by inserting a plug into the shell (F) connection will be made from cross-bar (E), contact-screw (L'), the fuse-plug metal shell (F') and contact-piece (D').

Election of Western Society of Engineers.

Electrical engineers are especially interested in the forthcoming election of officers for the Western Society of Engineers, owing to the fact that one of their number, Mr. Bion J. Arnold, who is not only an electrical man but an old member of the society, is a candidate for the office of president. This is the first time that an electrical engineer has been nominated for the office, and, without disparaging the other candidate, Mr. G. A. M. Liljencrantz, the "electricals" hope that this long-deferred and, as they think, well-deserved honor will come to one of their own. The Electrical Section is a flourishing portion of the society, and the election of an electrical engineer as president of the whole organization would be a graceful recognition of a branch of engineering to which the Western Society has certainly not paid too much attention.

Mr. Arnold is, however, deserving of the distinction as an eminent Chicago engineer, for he has an international reputation, particularly in electric-railway work, and is past-president of the American Institute of Electrical Engineers, with over 3,500 members. His work as a member of the board of engineers planning the great terminal electrification of the New York Central in New York city, as consulting engineer for the Chicago City Council in the traction problem, and in many other directions, is well known. Recently he has been elected a member of the American Society of Civil Engineers and has received a commemorative diploma and medal from the Louisiana Purchase Exposition and a "diploma extraordinary" for "distinguished learning and achievements in invention and in mechanical and electrical engineering" from Hillsdale College.

But Mr. Arnold is not the only electrical candidate to be voted on at the forthcoming election. Mr. W. L. Abbott, chief operating engineer of the Chicago Edison Company, is named for first vice-president; S. G. McMeen, the well-known telephone engineer, for second vice-president, and Dugald C. Jackson, professor of electrical engineering in the University of Wisconsin, for third vice-president. The election is by letter ballot and the polls close at noon on January 2d.

The Western Society of Engineers is in a prosperous condition and has outgrown its rooms in the Monadnock Building. More space is needed for the assembly room, library and secretary's offices, and a movement is on foot to secure quarters better suited to its needs.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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DATES AHEAD.

New York Electrical Show, Madison Square Garden, New York city, December 12th to 23d.

Automobile Club of America (annual exhibition), Sixty-ninth Regiment Armory, New York city, January 13th to 20th.

Chicago Electrical Show (first annual exhibition of Electrical Trades Exposition Company), Coliseum, Chicago, January 15th to 27th.

American Electrical Salesmen's Association (first annual meeting), Grand Pacific Hotel, Chicago, January 20th, 9 a. m.

BRITISH engineers led the world in railroad construction 40 or 50 years ago, and other countries relied upon them for general knowledge and practical experience. Today this is not the case, and the Englishmen themselves acknowledge that their position, in relation to heavy electric traction at least, is not a flattering one. It is generally expected that the contract for the electrification of the South London line of the London, Brighton and South Coast Railway will be awarded to a German firm, and although such award may not entail a great loss of business to British manufacturers, it none the less illustrates the contrast between the state of affairs now and conditions when English railroad methods were the standard.

MR. B. J. ARNOLD'S candidacy for president of the Western Society of Engineers shows that Chicago's engineering society, or rather the principal body of engineers which makes its headquarters in Chicago, is now evincing some disposition to honor its electrical members. With an entirely successful Electrical Section and the names of three or four electrical engineers on its official ballot for the coming election, there is shown a gratifying tendency to recognize various branches of the engineering profession. This is the first time, it may be remarked, that an electrical engineer has been presented to the suffrages of the members of this society for election as president. The Western Society embraces civil, mechanical and electrical engineers, and may, perhaps, be regarded as a union engineering society. In a broad sense, however, all engineers are "civil" that are not military, and thus the employment of the word "union" may imply lines of division which are not very exactly defined, and which, in any case, we hope, do not suggest any suspicion of jealousy or hostility or any alignment into groups seeking self-aggrandizement. But, without drawing fine distinctions, Mr. Arnold is deserving of the presidency of the Western Society of Engineers simply as an engineer, without any qualifying adjective, and his election will be especially pleasing to all members and friends of the society who are engaged in electrical pursuits.

DIRECT-CURRENT potentials in railway work have been, somewhat arbitrarily perhaps, limited to 600 or 650 volts. But now comes Frank J. Sprague, "the father of the electric railway" and the tried and true friend of the direct current, to say that that limitation need not obtain. "I am prepared," he says, in an interesting communication published elsewhere in this issue of the Western Electrician, "to engineer and carry to a successful conclusion a direct-current installation at a working pressure, even on a third rail, of not less than 1,500 volts, which is at least two and one-half times that ordinarily used." This is an important announcement, and one which will receive great attention from electrical engineers. Mr. Sprague has a right to say, as he does with some pride, that he has never made a public proposal which he has not been ready to carry out. Therefore, he must have carefully studied out the details of the problem, including motor commutation, of comparatively high-potential direct current for railway work. It is quite conceivable that, under some circumstances, higher voltages may be of advantage in direct-current railway work, although, of course, it must be demonstrated that the change will make for simplicity and efficiency, which are qualities that make the alternating current such a bold bidder for the favor of the railway engineer.

STANDARDIZATION of electrical machinery and apparatus is freely discussed, both at home and abroad, but without as much actual accomplishment as might be wished. In some branches of the industry there has not been the slightest attempt at standard forms and measures of efficiency. Space telegraphy is one of these departments. It is true that "wireless" is difficult to standardize; but it does seem that in the eight years that various forms of this invention have been in commercial use some attempt might have been made to arrive at some common measure of accomplishment.

The wide variation that exists in the methods and expense of doing the same thing is strikingly shown when manufacturers of space-telegraph apparatus are invited to submit bids for supplying a certain installation. If it was generators that were to be supplied, for instance, a certain range of variation would be looked for in the tenders, but one would be utterly at a loss to understand how one bid on a set of specifications could be forty times as large as another. And yet that is what was disclosed, apparently, when bids were recently opened by the Navy Department for furnishing ten sets of space-telegraph apparatus for the navy, intended for stations mainly on the Pacific Coast. The propositions received, as to price, were $9,468 from the lowest bidder, ranging through $15,000, $25,100, $48,300, $67,950, $175,600, to $393,500. The contract was awarded to the next to the lowest bidder, so that the highest two bids were evidently excessive, not to say wild.

The discrepancy between the prices asked by different companies for space-telegraph apparatus has been noticeable in competitive bids heretofore, and it indicates that, aside from the difference in price which would naturally arise from differences in the nature of the apparatus, manufacturers have nothing in the shape of a common standard. Of course, systems will differ in various particulars; but of two equipments, each guaranteed to carry on communication for 100 miles at sea, we will say, there can be no possible reason why one should cost forty times as much as the other.

RATES for electric lighting and power, owing to the character of the business, present many complications which are puzzling to those who have made no study of the subject. If, says the average layman, a gas company can sell its product at one dollar a thousand feet at all hours and to all consumers, why cannot the electric-light company make a similar uniform charge? The fact is overlooked that electricity is intangible and that it cannot be stored as gas is stored in holders. The expensive machinery needed to generate the current must be equivalent to the maximum demand put upon it at times of "peak" load. But much of it is idle during the greater portion of the day, while interest, maintenance and other charges go on just the same. There is, too, the problem of transmission, distribution and connections, which helps to make the small customer at the "peak" cost the maximum of expense, proportionately, to the company. In fact, equitable methods of charging—fair alike to the small householder, the big office-building proprietor and the man who takes power ten hours a day to run a large factory—have for years been the subject of much careful study on the part of electric-light companies.

This problem is as acute in European as in American cities. In Paris, for instance, where a new company has made a proposition for the monopoly of supplying electricity until 1938, it is proposed that the consumer shall have the choice between a two-rate tariff and the maximum-demand system. Up to the year 1912 the charges would be 90 centimes and 35 centimes per kilowatt-hour (17.2 and 6.8 cents); from 1913 to 1922, 70 centimes and 20 centimes per kilowatt-hour (13.4 and 3.8 cents), and from 1923 onward, 60 centimes and 15 centimes (11.6 and 2.9 cents). The hours during which the higher of the two tariffs given above is to apply are as follows: January, 4:15 p. m. to 10 p. m.; February, 4:45 p. m. to 10 p. m.; March, 5:45 p. m. to 10 p. m.; April, 6:30 p. m. to 10 p. m.; May, 7:30 p. m. to 10 p. m.; June, lower tariff only; July, lower tariff only; August, 7 p. m. to 10 p. m.; September, 6 p. m. to 10 p. m.; October, 4:45 p. m. to 10 a. m.; November, 4 p. m. to 10 p. m.; December, 3:30 p. m. to 10 p. m. The prices are exclusive of meter rents, and the company proposes to charge from one franc to 3.50 francs a month (19 cents to 66 cents), according to the size of the meter, but if the consumer likes to have a quantity meter half the above prices are charged. An extra 50 centimes (9½ cents) a month will be charged for double-tariff meters. It appears, also, that the consumer will have to pay the company for the service lines and main fuse in each case in accordance with a tariff to be approved by the prefect of the Seine. The company is also to have the right to demand from the consumer a deposit at the rate of 20 francs ($3.80) per kilowatt capacity of the meter. In this country, it is to be remarked, meters and service connections are generally furnished free, while no deposits are usually required.

Phonographic Addresses by Brush and Thomson at Cleveland "Smoker."

The Electric Club of Cleveland, Ohio, had a "smoker" on the evening of December 15th which was thoroughly enjoyed by a large number of members and their friends. In addition to music by a colored quartet, a "Dutch lunch," etc., there was a special and unique feature, and which, incidentally, was considered as a joke on a number of those present.

The announcement stated that the meeting would be addressed by Mr. C. F. Brush and Prof. Elihu Thomson, and a number attended with the expectation of seeing these gentlemen. As a matter of fact, the addresses were delivered by means of a phonograph, and at the same time that the phonograph was in operation the portraits of the speakers were thrown on the screen.

In order to carry out the idea consistently, Mr. E. P. Roberts, president of the club, introduced the speakers by phonograph. Mr. Roberts said: "The Electric Club of Cleveland is, we believe, the foremost local electric club in the country, and tonight we will have the great honor of being addressed by Mr. C. F. Brush and by Prof. Elihu Thomson. As citizens of Cleveland, we all take pride in the achievements of Mr. Brush, who made arc lighting commercially practicable, and who developed the storage battery. In order to accomplish the former result, he invented an entire system—open coil constant-current dynamo, series arc lamps of comparatively high voltage and small-current double lamps for all-night lighting, and the manufacture of suitable carbons at a low cost. For many years he was actively engaged in the commercial development of electrical apparatus, since which time his investigations of phenomena in physics have shown his exceptional ability as a scientist.

"Prof. Elihu Thomson, as the inventor of the Thomson-Houston system and his numerous inventions, used by the General Electric Company, including electric welding, repulsion motor, wattmeters, and others too numerous to mention, and because of his general scientific attainments, will always be known as one of the foremost inventors and pioneers in electrical industries throughout the world. I will now take pleasure in introducing each of these gentlemen to you, but, before doing so, I propose a vote of thanks to each of them for his courtesy in addressing us."

The phonographic address of Charles F. Brush was as follows:

"This is my first attempt to talk by proxy, machine proxy at that, and it seems an uncanny performance. I cannot guess how many are present, or what your mood is, or who is whispering on the back seat, and I am at a disadvantage in not knowing what sort of an introduction your president has given me. He may have taken advantage of my absence, and said something nice about me, and tried to make the machine blush. I am blind and deaf for this occasion, yet the situation is not without its advantages; you cannot interrupt me, nor ask embarrassing questions when I have finished. In the early days of this club a certain friend of mine read a paper to you. It was his maiden effort, and he was scared, awfully scared. He told me about it afterward. He said, try as he might, he could not prevent one heel or the other chattering on the floor as he stood before you; he couldn't keep them both down at the same time. I am spared that agony; if you hear any chattering, blame it on the machine; it is not due to my heels.

"In the early years of electric lighting, my friends seemed to delight in telling me that electricity, as the servant of man, was yet in its infancy. I argued that it was too vigorous and well behaved, and too useful, to be called an infant. Yet, as I look back to that period, I am constrained to believe that my friends were right. Its subsequent growth has been wonderful. The applications of electricity have surpassed all prophecy, and the capital invested in electrical industry has grown to more than $4,000,000,000 in the United States alone.

"The old, old question, 'What is electricity?' is more to the front than ever before, but we need no longer make the old, unqualified and humiliating answer, 'We do not know.' We are now fairly on the way to finding out. The brilliant researches and speculations of J. J. Thomson and others seem pregnant with knowledge. We are told that the flying particles, or ether corpuscles, of the Crookes tube are far smaller than the chemical atom; that their mass is little more than the thousandth part of that of the hydrogen atom; that they move with a velocity of the order of the velocity of light, and that each corpuscle carries a definite and invariable charge of negative electricity.

"Inasmuch as the corpuscle always carries the same charge, whatever gas is the source of the corpuscle, some physicists hold that the corpuscle consists wholly of electricity. If this view is correct, then electricity, or at least negative electricity, must be regarded as a form of matter, and not a phenomenon of the ether, as hitherto supposed, because the corpuscle is certainly endowed with the properties of mass and inertia, the most fundamental attributes of matter. The same physicists advance the hypothesis that all forms of matter are composed wholly of electrical corpuscles, grouped in various ways, to form the chemical atom. This is an exceedingly interesting speculation, but cannot be verified or refuted until we know far more than we do now about positive electricity, and how it is associated with the negative corpuscle to form a neutral combination.

"The machine thanks you, gentlemen, for what, we trust, has been your kind attention."

Also by phonograph Prof. Elihu Thomson then spoke as follows:

"Were it not for the distance which separates us, and the time taken in going and coming, it would be better to greet the Cleveland Electric Club personally, and not by machine.

"Cleveland will always be associated with the pioneer work in series arc lighting by Mr. Charles F. Brush. The carbon industry remains as a testimony of his early work. We had then only the open carbon arc, and the volume of business done in the early '80's was not very large when compared with that of arc lighting alone in recent years. Now we have many forms of arc light, series and constant potential, open and enclosed, carbon crater, luminous flame and mercury arc, varying in adaptability and efficiency. What we have to look forward to is higher efficiency of light production. We now waste too much energy in heat, and get the light only as a sort of by-product.

"The luminous flame arc is almost twice as economical as the carbon arc, but has the bad habit of smoking incessantly, a condition which relegates it to open places only.

"The field is open for further advance, and this reminds me of an incident. A man called to see me a few days ago about a wave motor. My secretary told him I did not believe in them, and would not waste time in discussion. 'Good,' said he; 'I am greatly encouraged when such men leave wave motors alone; the field is open, and I have the whole field.'

"The field is now open for the next speaker, and my best wishes go with this to the members of the Cleveland Electric Club. So good bye."

Electrification on the Pennsylvania Railroad.

Hitherto the electrification of steam roads has been confined practically to terminal facilities and local service over short distances, so that the recent decision of the Pennsylvania railroad to equip electrically a portion of its system between Camden and Atlantic City, N. J., is of the greatest interest. The developments which have taken place at New York under direction of the New York Central and New York, New Haven and Hartford railroads have focused the eyes of the engineering world on this branch of railroad engineering. This further advance of electric traction, coming as it does when this special phase of railroading is fresh in the minds of the engineers, marks another milestone passed in the progress of electric traction.

That portion of the Pennsylvania railroad about to be electrified comprises 64 miles of steam road lying between Camden and Atlantic City, N. J. The route includes the station of Newfield, between which city and Camden there is already a double-track roadway. The double-tracking will be continued to Atlantic City, following the line of the single track already existing between that city and Newfield. Over this double-track line an express electric service will be established, cars having a headway of 15 minutes and making the run from Camden to Atlantic City in 80 minutes without stops. The maximum speed of the cars will be between 55 and 60 miles per hour.

In addition to the through service to Atlantic City, there will be a half-hourly local service, consisting of trains of two cars between Camden and Millville, 40 miles, and 10-minute service of single cars between Camden and Woodbury, 8½ miles. Full service will call for 58 cars in operation, each equipped with two 200-horsepower direct-current GE-69 motors. The motors will be similar to those now being manufactured by the General Electric Company for the equipments of the New York terminal of the New York Central and Hudson River railroad. These motors will be controlled by the Sprague-General Electric automatic multiple-unit system, which will permit the operation of cars in trains, all of the motors being under the control of the motorman in the cab of the forward car.

The third-rail system will be used throughout except on the section between Camden and Woodbury and Newfield and Millville, where the cars will be run on overhead trolley, the speed on these sections being less than on the main line.

Power for the operation of the cars will be supplied from a power house located at Camden, containing three 2,000-kilowatt General Electric Curtis turbines of the three-phase alternating-current 25-cycle type. Transmission at a potential of 33,000 volts will be made to six sub-stations between Camden and Atlantic City, and the seventh sub-station at Millville, to supply that section of the line between Millville and Newfield. A total capacity of 11,000 kilowatts in rotary converters is provided in the sub-stations delivering direct current to the third rail at a potential of 650 volts. Individual units will have capacity of 750 kilowatts, and will be of the standard General Electric type. They will be started from the alternating-current end by means of taps on the step-down transformers.

Electrical Section of the Western Society of Engineers.

The regular monthly meeting of the Electrical Section of the Western Society of Engineers was held December 15th, Vice-chairman Samuel G. McMeen presiding. There were about 60 members and guests present at the meeting. "Standardization of Methods and Appliances in Telephony" was the topic at the evening's discussion, a paper of that title having been prepared by Frank R. McBerty of the Western Electric Company, Chicago. Unfortunately, Mr. McBerty was unable to be present, the paper being read in his absence by Mr. McMeen. The paper was discussed by Professor Brooks of Illinois University, Professor Wilder of Armour Institute and Messrs., Wolf, Cracraft, K. B. Miller, McQuarrie, Taylor, Harkness, Dimond and McMeen.

The next meeting of the section will be held January 12th and will be under the direction of George A. Damon. This meeting will be devoted entirely to traction matters, and a very profitable evening is anticipated.

New York Meeting of the Institute.

President S. S. Wheeler called the meeting of the American Institute of Electrical Engineers together in the auditorium of the New York Edison Company on December 16th. Secretary Ralph W. Pope announced that at the meeting of the board of directors held in the afternoon 38 associate members had been elected. The following-named associate members had also been transferred to full membership: Samuel Thomson Dodd, Schenectady, N. Y.; Michael B. Field, Lancaster, England; George Gibbs, New York city; Orville Hiram Ensign, Los Angeles, Cal., and Jay Hugh Perkins, Wilkesbarre, Pa. The secretary also announced the death of F. A. Churchill, Jr., of St. Louis.

The evening was devoted to the consideration of topics connected with central-station practice for traction purposes. There were two papers read, one by Sydney W. Ashe upon "The Relation of Railway Sub-station Design to Its Operation," and the other by C. W. Ricker upon "Some Considerations Determining the Location of Electric-railway Sub-stations."

Massachusetts Street-railway Men Meet.

The Massachusetts Street Railway Association held its 182d consecutive meeting at Young's Hotel in Boston, on December 13th. The meeting occurred on the twenty-third anniversary of the organization of the society, which took place in the same hotel, December 13, 1882. It is a remarkable coincidence that the day of the month, the day of the week, the location, and even the hotel, were the same as at the initial meeting. President Caryl W. Ely and Secretary-treasurer B. V. Swenson of the American Street and Interurban Railway Association were in attendance. President Ely addressed the association on the general history of the American Street and Interurban Association and the reason of the reorganization of the old American Street Railway Association. Secretary Swenson addressed the meeting on the subject of the work now under way and the plans for the future of the association which he represents.

Is Brain Action Electrical?

Dr. Albert B. Atkins of San Francisco believes that he has proved by experiment that brain action is an electrical phenomenon. His theory has the support of Captain L. D. Wildman of the United States Signal Corps, who assisted him in the experiment. The apparatus used consisted of two platinum electrodes connected with a long copper wire running to a sensitive galvanometer. The electrodes were inserted into two lobes of the brain of a living steer.

After the first quiver caused by the insertion of the platinum points the animal lay quiet, yet the needle of the galvanometer was deflected four points on the scale and remained so for nearly six minutes. Then the animal's throat was cut. Immediately the needle deflected 19 points in the same direction. Then the needle gradually returned to its normal position.

As no battery was used Dr. Atkin is of the opinion that the electrical current indicated on the galvanometer originated in the animal's brain. In other words, that it was the brain action itself.

Status of Electrical Development in the Navy Department.

The annual report of the chief of the bureau of equipment of the Navy Department, just submitted to the Secretary of the Navy, contains as usual considerable matter of interest to the electrical fraternity. Referring to the electrical branch of the Brooklyn Navy Yard the report says that battery-control instruments under cognizance of the Bureau of Ordnance have been completed or are being manufactured for 28 battleships and cruisers. The necessary repairs to material on ships in commission and the manufacture of electrical appliances, fixtures and accessories have greatly increased during the last year, but the new machine tools, motors, etc., which have been obtained greatly facilitate the performance of this work and result in increased economy and efficiency.

Electrical schooling for enlisted men has continued at the Brooklyn yard during the year and 188 men have received instruction. Those who have completed the course in general electricity and space telegraphy have been transferred to cruising ships and space-telegraph stations whenever vacancies occurred. The school is under the charge of an officer of the navy, and there are at present three assistant instructors, viz., one chief electrician, one chief machinist and one electrician, first class.

The electrical testing laboratory at the Brooklyn yard has been removed to building No. 22 and its installation practically finished. The following important tests have been made during the year: Storage batteries for submarine use, storage batteries for space telegraphy; incandescent lamps; space-telegraph outfits; generating sets; magnet and resistance wire; lamps and dry cells, dynamotors, motors, searchlights, navy standard wire and cable, etc. The total number of separate tests, inspection calls, etc., was 1,975, and in addition many miscellaneous articles, such as annunciators, bells and switches, were inspected and tested.

During the year a school was established at the Mare Island (Cal.) Navy Yard for the instruction of enlisted men in electricity on the basis of the long-established school at the Brooklyn Navy Yard. The demand for electricians and space-telegraph operators on the Pacific Coast is great, and the establishment of such a school has already proved beneficial to the service.

Touching on the electric repair shop at the Cavite (P. I.) naval station, the report says this shop is the more important of the equipment establishments at the station. As the Manila market in the matter of electrical supplies is deficient, little or no navy standard material can be purchased at that point. Dealers there, as a rule, require from 60 to 90 days for delivery of small orders. Many cases are on record where three and four awards have been made on one requisition to get the material urgently required. Ten sets of space-telegraph outfits have been installed at the Cavite station, nine of which are on board vessels of war and one on shore at Cavite.

A long-distance space-telegraph station has been constructed at the San Juan (P. R.) naval station. One of less range keeps the station in regular communication with Culebra. The wireless station at the latter station has been in successful operation throughout the entire year without accident or hindrance, and proves of great value for communication from San Juan to the fleet in Target Bay, and also for transmitting messages from vessels which may be temporarily in the vicinity of St. Thomas. A long-distance wireless station is in course of construction at the Guantanamo station in Cuba.

Commander G. W. Denfeld, U. S. N., retired, has continued as inspector of electrical appliances during the year. The work of the office has progressed satisfactorily. The sum of $632,545 was expended for alterations, additions and repairs to vessels and for the manufacture of electrical supplies. The report recommends that junior officers be detailed as assistant inspectors at private shipyards and that gunners be detailed as assistants in connection with the installation of the electric plants.

The status of the naval space-telegraph at the close of the fiscal year 1905 was as follows: Vessels equipped with space-telegraph sets, 44; vessels being equipped, four; shore stations equipped, 23, and shore stations building, 13. The restriction of the Bureau of Equipment in its choice of sites for shore stations to land already possessed by the government acts as a bar to the most efficient distribution of the stations. The bureau will endeavor to provide against this condition when appropriations are submitted.

Shore stations at Portsmouth, N. H., Boston, New York, Washington, Norfolk, Key West and Mare Island send out noon-time signals by space telegraphy for use in comparing chronometers. Other stations will soon take up the same work.

Comparative tests of apparatus furnished by a number of space-telegraph companies have been made, particular attention being given to methods of secrecy in sending and prevention of interference with messages being sent; also to ascertaining the relative values of the various systems. All the principal space-telegraph companies at home and abroad, except the Marconi company, entered the competition. That company offered to compete, but for some unknown reason afterward withdrew.

The Continental Morse Code is now used for official communication between ships and stations in place of the wig-wag code which has been in use for six months and found to be less rapid than the Continental and to bar the development of expert operators in any code. Experts in two codes are rare; to become expert in three is practically impossible for the great majority of operators. All the operators at naval space-telegraph stations are of the enlisted force of the navy. They are efficient and trustworthy.

COMMUNICATION.

A New and Higher Standard of Direct-current Railway Operation.

To the Editor of the Western Electrician:

The hope of extended electric equipment and operation on the main lines of trunk railways, as distinguished from special problems such as terminals, tunnels and congested sections, lies not alone in the possibility of increased traffic or economy of operation, but in such limitation of capital investment as will keep the burden of interest account measurably below the savings effected.

A vital element in this investment is of course that relating to sub-stations and conductors. As to the latter, it is evident that greatly increased potentials are necessary to keep down their size, or with any given cost of conductor per mile to increase the distance between sub-stations, with resultant less aggregate investment in them and higher economy in operation. These are common requirements, no matter whether alternating or direct currents are used. The bearing of the increase of potential upon the problem is quite evident from a consideration of the following general facts:

When the traffic increases directly as the mileage, the distance between sub-stations, with any given loss and size of working conductor, will increase directly as the increase of working potential. On the other hand, so long as the train load between sub-stations is not increased, this distance will increase as the square of the potential. But, taking the average of service conditions on a trunk line, the allowable increase in sub-station distance will lie between these extremes. To illustrate: Doubling the working potential would probably on an average allow trebling the sub-station distances, and trebling the potential would very likely allow an increase to say, five times in distance.

To meet the various economic requirements and proceeding on the assumption that 500 to 600 volts is the limiting standard for direct-current operation, the principal energies of many engineers and manufacturing companies have of late been devoted to operation by alternating currents, with varying degrees of success as applied to railroads, with the abandonment of third-rail construction and adoption of a special type of overhead contact. These developments have resulted in a variety of designs for both polyphase and single-phase motors and considerable divergence in views as to potentials, frequency and mode of construction and operation where the single-phase has been adopted.

It is not my purpose at present to enter into a discussion as to the comparative merits of the various systems, all of which have their field of usefulness. I have long advocated and am keenly alive to the economic bearing of increased potentials, however obtained, but also mindful of certain practical features which must be considered in connection with them. I believe, however, that where alternating-current motor operation, with overhead construction, is adopted, there is little reason for halting at any moderate limit, but that such potential should be used as may be necessary, all things considered, to get a reasonably full measure of the possible economy of investment.

On the other hand, I have frequently pointed out that the limits of direct-current operation are by no means reached, and that 500 or 600 volts was an arbitrary standard which present possibilities in construction of apparatus no longer warranted, maintaining when leaving the field of tramways to take up the consideration of trunk-line applications.

The time has now come, I think, in view of the developments which are taking place on the terminals of the roads entering New York city, the interest which railway officials are taking in the subject, and especially because of the various claims which are from time to time made, when equipment engineers in considering the practical application of electricity to the more serious problems of railway operation, shall have as a choice the possibilities of higher limits in direct-current as well as in alternating-current operation.

To that end I beg therefore to announce that if in any case, after considering the various kinds of equipment possible, it should seem from an analysis of all elements entering into the problem that a comparatively high potential direct-current equipment would produce the best net results, I am prepared to engineer and carry to a successful conclusion a direct-current installation at a working pressure, even on a third rail, of not less than 1,500 volts, which is at least two and one-half times that ordinarily used.

I believe that it may be admitted that although oftentimes having taken a somewhat radical and advanced position in electric-railway matters, I have never made a public proposal which I have not been ready when called upon to carry out, and should conditions arise warranting an equipment such as is proposed, I propose to establish a new and necessary comparative standard in equipment possibilities. And I venture further to affirm that 1,500 volts is not the limit of practical direct-current operation.

FRANK J. SPRAGUE.

New York, December 14, 1905.

Indiana Interurban Statistics.

Figures compiled by Joseph H. Stubbs, chief of the Indiana Bureau of Statistics, relative to the interurban traction lines of the state for the year ended June 30, 1905, show the following data in reference to income and disbursements, together with other information:

EARNINGS.

Passengers	$6,308,653.95
Freight	120,770.37
Express	66,522.48
Mails	3,741.17
Rents	82,033.60
All other sources	176,008.65
Total earnings	$6,757,730.22

OPERATING EXPENSES.

Maintenance of way and structures	$ 405,039.43
Maintenance of equipment	369,265.60
Conducting transportation	1,798,928.91
General expenses	1,078,236.19
Additions and betterments	1,027,557.44
Total operating	$4,679,027.57

OTHER DISBURSEMENTS.

Interest on funded debt	$2,078,302.01
Taxes for Indiana	294,619.00
Taxes for other states	55,748.17
Rentals	267,001.68
Operating expenses, as above	4,679,027.57
Total disbursements	$7,374,698.43

There was a total of 847.49 miles of interurban main track in the state at the close of the year and 34.25 miles of side track. Freight and express to the amount of 33,216 tons was carried over the lines and 112,838,065 passengers were carried.

It is shown that 40 persons were killed on interurban railways during the year, but of this number all but one met death through their own carelessness. Of 4,346 persons injured, only 60 were hurt from causes beyond their own control, the others being attributed to carelessness. An amount of 96,661.30 was paid by the various companies in damages during the year.

The following table gives a list of employes and the rate of compensation:

Employes.	Number Employed.	Total Yearly Compensation.
General officers	51	$ 115,141.83
Other officers	38	65,875.68
General office clerks	140	70,889.64
Station agents	66	23,255.00
Other stationmen	29	13,340.00
Motormen	806	489,291.35
Conductors	803	480,235.38
Other trainmen	119	90,251.74
Machinists	33	23,093.61
Carpenters	39	26,231.54
Other shopmen	265	151,490.16
Section foremen	90	51,091.99
Other trackmen	524	199,271.05
Flagmen and watchmen	16	8,040.55
Operators and dispatchers	23	13,315.20
All other employes	295	172,346.30
Total	3,337	$2,003,161.02

Rates for Electric Light and Power in Chicago.

The effort of Mayor Dunne of Chicago to secure cheaper gas and telephone rates has now been supplemented by a similar endeavor to lower and adjust the rates for electric current. The mayor thinks that, on the whole, electric-light rates are too high. Like many other laymen, he does not understand how the rates vary to different customers. The mayor has, therefore, asked City Electrician Carroll for data and information regarding the cost of generating electricity and distributing it to customers. He has also conferred with representatives of the Chicago Edison Company and the Commonwealth Electric Company, telling them of complaints that the rates are not uniform. The mayor has an idea that gas, water, telephone and electric-light rates should be uniform, and he thinks the time has come when the various companies should make

a proposition to the city along the lines of an adjustment of rates.

As the mayor is an intelligent and honest man, a former judge on the bench, it is hoped that when the intricate elements that enter into equitable light and power rates are explained to him, he will see that, differing essentially from the gas business, water supply or even the telephone service, a cast-iron uniform rate would be positively unfair in the central-station business.

Direct-current Proposals for Victoria Falls Power Transmission.

The London Electrician furnishes some further particulars in relation to the direct-current proposals for power transmission from Victoria Falls to Johannesburg—a distance of 556 miles in a direct line and 745 miles by the new railroad. The broader aspects of this great power-transmission project were treated editorially in the Western Electrician last week. Far from agreeing that direct current is the better for the purpose, it will nevertheless be of interest to see how it is proposed to use it. The following is quoted from the London journal mentioned:

"The syndicate has taken the advice of Dr. E. Tissot, Mr. Blondel and Prof. Gisbert Kapp on a project by Mr. Thury, and Mr. R. D. Mershon, who is identified with many of the long-distance power-transmission schemes in California, has also been consulted. It appears that the three first-named gentlemen are all of opinion that Mr. Thury's continuous-current system would be the most suitable for the transmission from the Falls to the Rand, while Mr. Mershon, though favoring a three-phase system in the first instance, was considerably impressed by the views of the other experts and, having made an examination of Mr. Thury's recent high-pressure works, has reconsidered his views on the question.

"The proposal is to transmit 20,000 horsepower in the first instance from the Falls to the Rand and to erect a sub-station where the power received would be converted to three-phase alternating current for distribution. The Thury system would thus be employed for a purely point-to-point transmission system, which is the application in which it has been most successfully applied, and the difficulties of distribution on the high-tension continuous-current system would be avoided. A pressure of 140,000 volts between conductors is proposed. To produce this a number of dynamos are connected in series, and the center point of this generating system is earthed so that the pressure of each conductor above earth would be 70,000 volts. The commutator difficulty has been overcome in Mr. Thury's recent machines to the extent that 3,560-volt machines are being employed on the Moutiers-Lyons power-transmission scheme, which is now under construction. Four of these machines are driven by each turbine in the case of the Moutiers-Lyons scheme, and there the line pressure is 57,000 volts (28,500 volts between each line and earth).

"A difficulty will be the insulation of each machine from its turbine in the case of the higher pressure proposed for the Victoria Falls scheme, and doubtless Mr. Thury has been conducting experiments with his insulating coupling which have led him to expect that he can improve it sufficiently to stand more than double the voltage used hitherto. The pole line would follow the usual California practice—an aluminum cable supported on lattice-work towers—and the type of insulators which have been employed on the 60,000-volt three-phase alternating schemes in America could possibly be made to bear the higher continuous-current pressures without a prohibitive increase in dimensions or a radical alteration in design."

Naval Searchlights on the Hudson.

Electricity played a brilliant part in the recent ovation tendered to Prince Louis of Battenberg. The imposing array of battleships of two nations

SEARCHLIGHTS ON THE HUDSON.

anchored in the Hudson made a beautiful and impressive sight. By day their graceful lines stood out clearly and sharply against the dark background of the Jersey shore.

At night, however, the most beautiful effect was obtained when the searchlights of the many battleships were playing across the sky, and when each ship burst forth in a glory of electrical illumination from hull to topmast. Some idea of the night effect may be had from the accompanying illustration, which is taken from the Bulletin of the New York Edison Company. It will be noticed that the searchlights in particular added to the dazzling light.

Some Considerations Determining the Location of Electric-railway Sub-stations.[1]

By C. W. Ricker.

No attempt will be made in this paper to define the conditions under which indirect distribution, through the medium of transformer sub-stations, is more economical than direct distribution from one or more generating stations containing prime movers. It is assumed that because of the size of the railways to be considered and the local conditions determining the cost of generating power, the indirect method of distribution has been selected as offering the best economy in commercial operation, and an attempt will be made to outline a general method for determining the number and location of sub-stations.

In many cases, perhaps the majority of cases, a general solution of this problem is quite impossible. Most of the large electric-railway systems now in existence are the result of development not foreseen by their original projectors, and there is little reason to believe that future systems will be very widely different in this respect, but probably they will continue to grow by extensions and consolidations, depending upon the distribution and development of local centers of industry and population.

For convenience of discussion, electric railways large enough to require indirect distribution may be classified as follows:

1. Large simple networks, serving a single community.
2. Long single lines or groups of such lines, connecting separate communities or different parts of a very large one.
3. Complex networks, with connecting lines, serving a city and its suburbs.
4. Several networks with long connecting lines, serving separated communities.

Railways of the last-named class are usually consolidations of the local systems of neighboring cities or towns, and interurban lines which frequently furnish power for lighting and general uses in the towns served. There are usually well-marked centers of load which, together with local business conditions, determine the position and equipment of sub-stations.

Railways of class 3, those serving a large city and its suburbs, are also most often the result of the consolidation of separate lines and networks, and while the large central network belongs in class 1 the outlying districts present a difficult problem to the engineer, for he must anticipate the direction, character and sequence of growth so as to provide against it. This requires an intimate knowledge of local conditions, both industrial and social, and in addition he has need to be something of a prophet to foresee the changes which the building of new lines and the starting up of new works may produce. The problem is a local and particular one and must depend mainly upon individual judgment for its solution.

Classes 1 and 2 can be treated more generally. Take first the case in which a large network, or long line or group of lines, is contained wholly within a large city, so that a fairly uniform schedule can be operated over the whole, and the mean load upon each mile of road is approximately uniform throughout the system at any given time.

It is required to adjust the cost of losses in the primary distribution, the secondary distribution, including the track, and the sub-stations, the fixed charges upon each of these three divisions and the cost of sub-station attendance, so that their sum shall be a minimum, with due regard to the conditions of regulation and continuity of service.

As the density of the load in such a system is very great, the unit of sub-station equipment may be made large enough, so that at the time of least load one unit per sub-station may be operated at or near its best efficiency. Hence the sub-station losses per kilowatt-hour may be considered constant.

The aggregate capacity of the sub-stations will equal the capacity of the generating station plus the sub-station reserve capacity, if any is necessary, which will not exceed one unit per sub-station. The greater the distance between sub-stations the larger the sub-station unit will be; hence the cost of sub-station apparatus will decrease as the number of sub-stations increases until the largest practicable unit is reached. The same is true of sub-station land and buildings.

The cost of sub-station attendance will depend only upon the number of sub-stations, as the same number of attendants is required in a small as in a large sub-station unless the cost of land makes it necessary to double-deck the sub-stations, which will cause a sharp rise in the cost of attendance when the number of units becomes greater than can be placed on one floor.

When direct-current motors are used the secondary voltage is fixed by conditions of standard practice. The secondary conductors may be proportioned by Kelvin's law, subject to the limiting condition that the lowest potential shall be enough to allow the required acceleration. As the number of sub-stations increases the cost of the conductors will decrease rapidly. The energy losses in the conductors may be constant or decreasing. The primary distribution in this case must be by underground cables. The primary voltage will be determined by the relative cost of copper and insulation, and should be as high as is consistent with safety. Hence the losses per mean kilowatt in the primary distribution may be considered constant. The total weight of primary conductors will be practically independent of the number of sub-stations, depending upon the total energy and the mean distance of distribution, and may be determined by Kelvin's law.

To obtain the greatest reliability of service, each sub-station should be fed directly from the generating station by at least three cables, and in the case of a wide difference in the number of sub-stations considered the total cost of cables and conduits would be somewhat greater with the larger number of sub-stations as more and smaller cables would be required. Otherwise the cost of the high-tension distribution and the losses in it may be considered constant.

Neglecting those quantities which are constant, the fixed charges on sub-station land, buildings and apparatus and the cost of sub-station attendance increase as the number of sub-stations increases; the fixed charges on the secondary distributions decrease and the losses in the secondary distribution decrease or remain constant.

The various losses and charges upon which the solution of the problem depends may then be considered as constants or variables dependent directly upon the number of sub-stations and inversely upon the distance between sub-stations. These quantities may be reduced to a common base of annual kilowatt-hours, and curves representing them may be drawn with respect to the number of sub-stations as one co-ordinate, and a summational curve may be drawn which, if the premises are rightly chosen, will indicate the number of sub-stations at which the sum of the various charges is a minimum.

In a far greater number of railways the load is not uniform throughout the system. This is true especially of the long interurban railways using a comparatively small number of heavy train units. The load at any given time is concentrated upon parts of the system, or travels from end to end of the long lines. In such a system the aggregate capacity of the sub-station apparatus in operation at any given time is greater than that of the generators; hence the load factor of the sub-station is unfavorable, and in most cases the power factor of the system is low.

In a solution by the method outlined in this paper several new curves must be drawn in addition to those named. The first showing the all-day losses in the sub-station apparatus, which will increase with the number of sub-stations. The second showing the losses in the primary transmission lines, which will also increase with the number of sub-stations, due to the greater length of lines and to the lower power factor. The third showing the fixed charges on the primary transmission lines.

The last two curves are relatively much less important. It is possible by compounding or automatic adjustment of fields to keep the power factor of the synchronous converters very near unity, making the transmission losses more nearly constant and independent of the number of sub-stations. In such systems it is not usual, and seldom practicable, to use separate feeders from the generating station to each sub-station: and the primary distribution is usually by overhead lines, generally supported on poles which are used for other conductors as well. But with all the sub-stations along a single line of railway, or a group of such lines connected to one transmission line, the additional cost of extending the same for a greater number of sub-stations will usually be but a small part of the whole expense. So, for at least a preliminary consideration of the problem, the last two curves may be omitted and the same quantities used as are considered in the solution for a road having a uniform distribution of load, with the addition of one containing the all-day losses of the sub-station apparatus.

In systems consisting of long lines with infrequent train service the cost of attendance and all-day losses in converter sub-stations often become so great that the regulation in secondary conductors economically proportioned for standard direct-current voltage will not permit the operation of the required schedule. The usual remedy is to set the sub-stations nearer together, though at the cost of operating economy.

If other conditions still make the use of standard direct-current equipment desirable, it would seem that better economy could be obtained by lenthening the sub-station sections and using boosters, just as has been found profitable in the supply

1. Paper presented at the meeting of the American Institute of Electrical Engineers in New York on December 15, 1905. Mr. Ricker is assistant engineer in the electrical department of the New York Central and Hudson River Railroad Company.

of such lines of less length from direct-current generating stations. The fixed charges on and losses in the boosters should then be included in the curves of sub-station apparatus.

In the discussion of the method of treating the problem of sub-station location herein suggested the usual type of converter sub-station, with direct current, secondary distribution has been kept in mind, but the method is no less applicable to a complete alternating-current system with static sub-stations, in which case the curves of sub-station losses, attendance and fixed charges all become flatter, while the higher trolley voltage available permits a wider spacing of sub-stations without exceeding the limiting conditions of regulation, all of which indicate a better efficiency of sub-station apparatus and secondary distribution in roads of low and non-uniform load density.

Discussion (in Abstract).

Henry A. Lardner, New York city: Referring to the paper by Mr. C. W. Ricker, I note his suggestion that in the case of interurban railway sub-stations he thinks it possible that better economy can be secured by lengthening the sub-station sections and using boosters. The speaker questions whether this will actually work out in many cases. For instance, on a given interurban road the sub-station may normally operate with the two rotary converters of, say 300 kilowatts capacity. The entire capacity of this sub-station may be momentarily required by the starting of cars at the extreme end of the section fed by this sub-station, and schedules frequently work out in just this way. If it were attempted to install boosters to handle the load at the extreme ends of the section these boosters, even though under severe load for short periods only, would have to be of very considerable size, especially as to commutator capacity. I think that after considering the added cost of these machines, their switching apparatus, space required and maintenance, that their use would not be considered desirable nor justified by other savings made in first cost and operation.

Referring again to the last paragraph of Mr. Ricker's paper, in which he says that in alternating-current systems with static sub-stations the trolley voltage available permits a wider spacing of sub-stations, I would call attention to the fact that while this is undoubtedly true, it must be remembered that owing to the characteristics of alternating current the usual saving in connection with increase of pressure cannot be applied, owing to the fact that the drop in both rail and overhead, due to the alternating current, are considerably in excess per ampere of those for direct current.

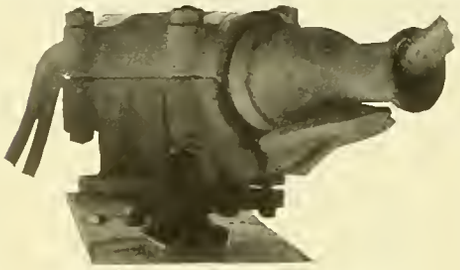
Prof. R. B. Owens, Montreal, Que.: I am very much interested in the title of the second paper, because the main consideration in connection with the location of electric-railway sub-stations seems to me to have been omitted, namely, voltage. We have two great systems of operating railways for heavy traffic—the alternating-current system and the direct-current system with sub-stations. Without going into the question of whether or not the direct-current generators can be successfully designed of large size, for voltages of 1,000 or 1,500, or 2,000, I believe it is true that the makers stand ready to furnish rotary converters of 1,000 volts, maybe more, and also at least bipolar motors that will operate successfully at such voltages. If this is true, it affects the whole question of sub-station location most materially, and materially interferes also with the field which some people suppose the alternating current had. I would like to bring on a discussion as to the relative merits of high-voltage rotaries and high-voltage motors as against, first of all, single-phase current systems for heavy traction and operation. It seems to me the gist of the whole thing is, How far can we carry the direct-current voltage? Can we obtain rotaries that will operate successfully at 1,000, 1,500 or 2,000 volts? Can we operate motors that will operate at such voltages? We see that the whole nature of the problem is changed. Instead of sub-stations with a load factor of a few per cent., perhaps, we can get sub-stations with load factors of a considerable percentage. I think it is a question of voltage. The question lies in the design of direct-current machinery in large units to operate successfully under conditions met in traction work at high voltages.

Prof. C. P. Steinmetz, Schenectady, N. Y.: So far as the sub-station is a converter sub-station, I believe, with many other people, that for a long time to come, if not forever, the largest number of railway sub-stations will remain converter sub-stations. It is proper, therefore, that a large part of the discussion should be devoted to the question of the rotary converter. The rotary-converter railway sub-station can be divided into two typical classes—the sub-station in a large, high-power distribution system, as the railway sub-station of the Manhattan, the Interurban and the New York City Railway sub-stations in this city, and corresponding sub-stations in other places. In these cases the loss between generating station and sub-station and the drop of voltage between sub-stations is very small. The sub-stations contain a large number of large units, which run practically always at steady full load. The individual momentary variations of load are not perceptible in the sub-station to any great extent, and the daily changes of load are taken care of by varying the number of converters. In such sub-stations the possible variation of voltage due to line drop is insignificant. Automatic control of voltage for variation of load on the converter is not necessary, since the converters are maintained at fairly steady voltage. Therefore, automatic voltage-controlling devices, as compound fields and reactive coils are not necessary, but the shunt-wound converter is suitable. Therefore, to have in such sub-stations series fields on the converters and reactive coils is undesirable, since they are an unnecessary source of a possible danger, the danger of racing in case of the direct-current system feeding back into the converter sub-station, which danger, due to the small resistance between sub-stations, is greater than in the interurban sub-station, which is the second class of sub-station.

Charging Receptacle for Electrically Operated Vehicles.

So extensive is the use of electrically operated vehicles and the varied application of storage batteries for train lighting, small electric locomotives, storage-battery cars, etc., that a demand has been created for convenient and durable accessories, one of the most important being a charging receptacle that will withstand hard usage, and can be handled without danger of short-circuiting the line when inserting or removing the plug.

With this idea in mind, the Westinghouse Electric and Manufacturing Company has developed and placed upon the market a charging receptacle



CHARGING RECEPTACLE COMPLETE WITH SWIVEL AND PLUG.

that will meet the most rigid requirements. The accompanying illustration shows the receptacle complete with swivel and plug. It consists of a cast-metal case, circular in form, that occupies a minimum amount of space. Within the case are suitably mounted contacts for receiving the plug. A hinged lid at one end, held normally closed by a coiled spring, affords access to the interior. The receptacle being entirely enclosed effectually protects it from dirt and water.

The plug and contacts within the receptacle are so designed that it is impossible to cause a short-circuit when inserting or withdrawing the plug. The swivel attachment shown is provided to conform to standard railway practice, which is a decided advantage, as it admits the pulling out of the plug when the vehicle or car starts, the receptacle swinging in line with the cable and allowing the plug to pull out without danger of breaking the cables or contacts.

As shown in the picture, the charging plug is intended for use with the charging receptacle. It is furnished with or without cables as desired. The construction is rugged, and all parts are well made, insuring a long period of service.

The Chicago Electrical Show.

No efforts are being spared toward making Chicago's electrical show, which occurs in the Coliseum from January 15th to 27th as broad and complete as possible. It has been decided to make the opening of the show on Monday night, January 15th, a formal affair, admission to be by invitation only. Arrangements are being perfected by which the thousands of lights in the big building will burst forth upon receipt of a wireless telegram from President Roosevelt. Greetings will also come in an aerogram from Thomas A. Edison. The exposition bids fair to be a decided success. All of the space is as yet not sold, but there is enough contracted for by 75 of the wealthiest electrical concerns in the United States to assure an interesting and extensive exposition.

Manager Thomas R. Mercein is in receipt of a communication from Dr. De Forest stating that he will establish a temporary station in the Coliseum during the two weeks of the show, and to demonstrate the practicability of his space-telegraph service will accept commercial business from this point to Kansas City, St. Louis and New York city. Dr. De Forest will also make some special tests of the apparatus.

Various telephone interests throughout the country have taken keen interest in the coming show and much that is new in telephone inventions will be shown. Prominent telephone men from all parts of the United States will attend the show and three days—January 22d, 23d and 24th—have been set aside as "telephone" days. During the exposition there will be three conventions at the Coliseum—the Northwestern Electrical Association, the Electrical Salesmen's Association and the Credit Men's Association of the Electrical Trades.

The Most Desirable Interurban Car.

At the regular monthly meeting of the Indiana Electric Railway Association held at the Claypool Hotel, Indianapolis, on December 14th, the principal topic for discussion was "The Most Desirable Interurban Car." The discussion was opened by P. J. Mitten, superintendent of motive power of the Indiana Union Traction Company. He read a carefully prepared paper describing what, in his judgment, constituted an ideal interurban car.

Mr. Mitten said it was economy to employ the longest car practicable in order to carry the greatest number of passengers per crew; however, a car more than 60 feet over the buffers is not desirable. A desirable car for interurban service should be 60 feet long, eight feet six inches wide over side sills, nine feet three inches from floor to underside of ceiling, 10 feet from underside of sill to top of roof, and should stand three feet six inches from top of rail to underside of sill.

Externally the car should resemble as nearly as practicable that of the standard Pullman. Air resistance is most easily overcome by a wedge-shaped front, but on account of the location of the motorman's cab with controlling apparatus this cannot be carried out to any appreciable extent.

After describing how the rear end and platform should be built, doors hung, etc., Mr. Mitten said the interior divisions should consist of smoker, passenger, toilet and heater compartments. For obvious reasons the place for smoking compartment is in the forward part of the car, and it should comprise one-third of the seating capacity, seats to be longitudinal, heavily upholstered in leather, with ample springs. The space beneath these seats may be used for storage of hand baggage. The floor of the smoker should be covered with inlay linoleum of small neat design. The partition between the smoking and passenger compartments should be constructed with plate-glass windows and door, thus permitting an unobstructed view.

The passenger compartment should have seats of the high, stationary back type, upholstered in dark-green figured plush, with all metal parts perfectly plain. In this as well as in the smoking compartment should be placed parcel racks at least 14 inches wide.

There is much argument in favor of the various positions for the toilet and heating cabinets, yet the location at the rear end seems least objectionable, the compartments occupying positions on directly opposite sides of the aisle. To facilitate firing, emptying ashes, etc., the heater door should open directly on to the rear platform. The expansion chamber, pressure and water gauge to be placed inside of the cabinet, the safety valve being so piped as to deliver expelled water below body of car, thus preventing damage to varnish, etc. By placing the toilet directly opposite from the heater it is in the most remote part of the car. The heater cabinet space should be relieved by an oval window on the outside of car, glazed with green opalescent glass. This type of window should also be used in the toilet compartment, arranged to swing open a short distance for ventilation. The interior finish throughout the car should be selected mahogany with very simple inlay. The ceiling, of full Empire, should be painted a light green, with neat gold striping.

A general discussion followed the reading of the paper. Charles L. Henry said the paper was interesting and well calculated to bring out the relative views of those who have had experience with interurban cars.

E. C. Emmons said the paper was open to criticism because of the omission to treat of the baggage compartment—a matter growing into importance day by day. He thought this compartment should be between the smoker and the motorman's vestibule. Mr. Nichols believed an ideal car should have three compartments, with the main passenger compartment just back of the motorman, with side entrance, and the smoker and baggage compartments in the rear end of the car. This would give the passengers a clear view of the country scenery. Mr. White thought a 50-foot car gets around the curves better than a 60-foot car. They also are not so expensive as a larger car and less apt to mix up the schedule.

Theodore Stibbens of Springfield, Ohio, said he was partial to a lighter car. Better have more cars and if necessary run them in trains. He said the time had come for a standardization of interurban cars. Cars should be built so as to be operated on any road. Ohio and Indiana are so intimately connected in the interurban business as to require standard cars and uniform road clearances so that special visiting cars could go over any road in either state. He would like to see a car built so as to store trunks and baggage under the floor out of sight of the passengers.

Will G. Irwin spoke of the importance of a compartment for light express matter. The time is coming when we will have to go into the express business and we must prepare for it. He said he could not say how long a car would be when

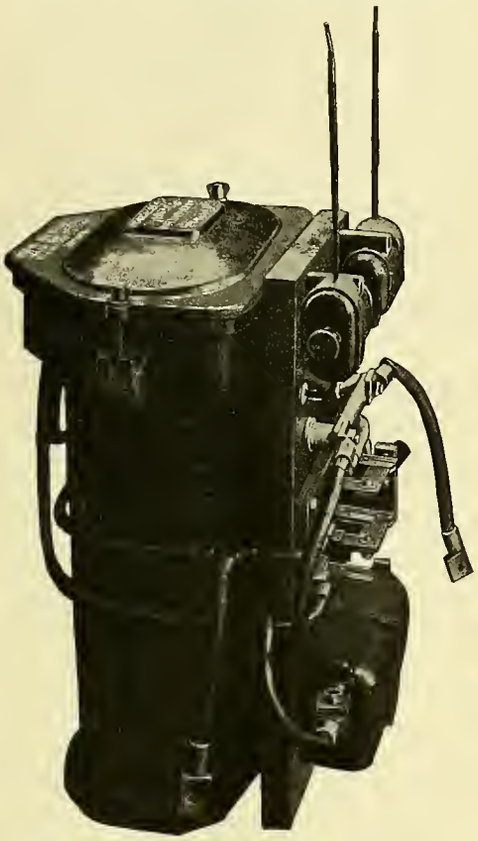
space is given to all the necessary compartments, but insisted that the feature of express matter should be seriously considered.

F. D. Carpenter of Lima, Ohio, found that a car 52 feet long, with three compartments, was well adapted to the needs of his road. He said it must be admitted that long cars run more smoothly than short ones.

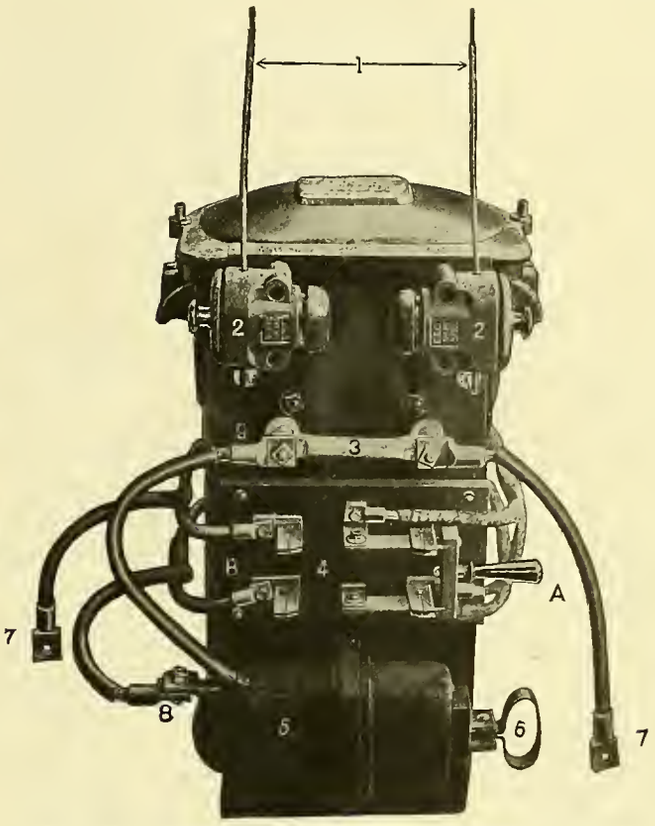
Messrs. Reynolds, Henry, Nichols and Shelton all defended the long car, with the necessary compartments, and said conditions would demonstrate the most convenient or available position for the several compartments. It was brought out that cars ought to be a little wider so as to make the seats of a more comfortable length.

Pittsburg Pipe-thawing Outfit.

Since the practicability of electricity for thawing out frozen water pipes was fully demonstrated a number of electrical companies have built compact portable transformer sets which may be transported from place to place as they may be required. Among the first companies to build such sets was the Pittsburg Transformer Company of Pittsburg, Pa. The first set which was built has been improved and changed as to detail, and the new model which it is offering for 1906 shows some interesting features. The two accompanying illustrations show a side and rear view of the transformer.



SIDE VIEW OF PIPE-THAWING OUTFIT.



REAR VIEW OF PIPE-THAWING OUTFIT, SHOWING CONNECTIONS AND SWITCH.

Looking at the rear view, it will be seen that the wires (1) run from the line to the primary fuse blocks (2). The primary leads of the transformer run through porcelain bushings in the backboard and into the fuse blocks. Within the transformer is a porcelain terminal block, changing the connection of which adapts the transformer to operation on circuits of approximately 1,100 volts or circuits of approximately 2,200 volts.

Four secondary leads issue from the front of the case and pass to the terminals of the double-pole double-throw switch (4). Throwing this switch to the left, (B), connects the secondary coils in multiple, so that the transformer delivers 37½ volts and has a capacity of about 800 amperes. Throwing switch to the right, (A), puts the secondary coils in series, so that 75 volts and about 400 amperes are obtained.

The secondary line passes through the choke coil (5), and from thence through the heat indicator (3). The terminals (7) are connected to the cables leading to the frozen pipe.

The choke coil consists of several turns of copper rod and has a laminated iron core, supplied with a handle (6) for pushing in and out, thus altering the choke effect to suit the conditions involved.

The heat indicator is simply a short section of lead pipe connected in series with the low-voltage winding, in the same manner as a fuse, its temperature being a guide as to the heating of the pipe under treatment.

The capacity of the thawer is normally 400 and 800 amperes, but currents considerably in excess of these values may be drawn for short periods. Usually the temperature of the air will be below freezing point, or even many degrees below zero. Under such conditions a temperature rise in the transformer as high as 100 to 125° Centigrade above the air will still be within the usual working limits.

The intermittent nature of the work is also favorable, and it will frequently be found that 500 to 600 or 1,000 to 1,200 amperes can safely be drawn from the thawer. Snow or ice can also be applied to the cast-iron case to assist in cooling when running under extreme loads for considerable periods of time.

While pipes exposed to the air generally burst in freezing, yet it has been found that when they are in the ground very few cases of bursting are met with. It has been observed that but one case in 600 shows rupture under such conditions, due, perhaps, to the fact that the earth first freezes solidly around the pipe, thus preventing its expansion from internal pressure. This is of the greatest importance, for were it otherwise electrical thawing would be of small practical use.

Voltmeters and ammeters are not used with these sets. The heating effect is the important feature, and it is a simple matter to judge this by touching the heat indicator with the hand or with a wet mitten. The most unskilled operator knows when this pipe is hot, although he might be entirely at a loss to know whether he should use 200 amperes or 500 amperes were he dependent upon an ammeter.

Electrification of the West Shore Railroad.

The Hudson River Electric Power Company is preparing to deliver a total output of 4,000 kilowatts, nominally for the Utica and Mohawk Valley Railway Company. In reality, it is confidently supposed that the power is for the coming electrical equipment of the section of the West Shore railroad between Syracuse and Utica, N. Y. Part of this stretch of the steam road is already electrified between Herkimer and Frankfort and is used by the Utica and Mohawk Valley as a link in its system. The power company will put in four new generators, bringing its total capacity up to 6,000 kilowatts by June 1, 1906. Most of the existing power has been taken by the street-railway system since it was opened on June 30th. A transmission line will be laid from the generating station to Clark Mills, near Utica, on the West Shore road, it is said, and between that point and Syracuse there will be two sub-stations. It is anticipated that electric traffic will commence on the West Shore road on September 1, 1906, as a positive order has been made for the delivery of 900 kilowatts of current on that date.

Book Received.

"Telegraphy." By T. E. Herbert. Published by Whittaker & Co. of London (New York: Macmillan Company). (Pages, 912. Price, $2.60).

United States Naval Station in the Philippines to Be Electrically Equipped.

That the United States government will maintain a naval station in the Far East is now an assured fact, and a contract has been awarded for the construction of a coaling station complete, with equipment, at Olongapo, Subig Bay, P. I. The first installation will constitute one unit out of six which will ultimately be built, providing a coal storage of 120,000 tons for the use of the United States Navy. The initial unit will cost approximately $500,000 and will require two years to complete.

Subig Bay, 75 miles north of Manila, is one of the finest harbors in the East. It will be heavily fortified, and in addition to the coal plant extensive repair shops will be built, together with such equipment as will enable the government to make any repairs required to the Pacific fleet or to build outright small cruisers and gunboats.

The coaling plant will consist of apparatus for unloading coal from vessels or cars and storing it, together with means for reclaiming the coal from storage and delivering it to vessels or cars again. A large water-storage tank having a capacity of 50,000 gallons will be located on top of a nearby hill and a pumping plant provided to supply it with water from the Benictigan River, about a mile and a half from the station. This water will be used for fire purposes in connection with the coaling station or for the use of vessels.

The coaling unit to be installed will be built upon a wharf 250 feet long and 275 feet wide. This wharf will be set upon clusters of piles which will be enclosed in concrete, thus protecting them from the action of the torredo. The dock of the wharf is of steel and concrete. From the outer edge of the wharf a steel and concrete coal bunker will be erected having a capacity of five tons of coal per running foot. It will be provided with chutes for delivering coal upon the decks of vessels or into cars. An electrically operated movable coal-unloading tower constructed of steel will be operated on a track extending along the top of the coal bunker. It is designed for taking coal from cars on the landward side of the wharf or from colliers on the seaward side and delivering this coal either into the bunker or upon a conveyor which will carry it to the coal-storage building. The conveyors will have a capacity of from 100 to 150 tons of coal per hour. The coal-storage shed will be a steel structure with a concrete floor 450 by 150 feet and will hold approximately 15,000 tons. The enclosure will be divided by concrete partition walls, so that the greatest amount of coal in one pocket will be 600 tons, thus preventing the spread of fire which is liable to occur spontaneously where large masses of bituminous coal are stored. Electric thermostats will be located at 20-foot intervals and will ring an alarm in the office of the superintendent should the temperature of the coal rise above a fixed point.

All of the conveyors and other apparatus for handling the coal will be electrically operated and a power house of ample capacity will be installed adjacent to the coal-storage building.

The unit as described will be supplemented from time to time by other units of similar size and type, the wharves extending continuously along the bay front. Each wharf will accommodate a battleship, which can be coaled to the extent of 2,000 tons in less than half a day.

All of the coal will be brought from the Virginia coal fields in tramp steamers via Suez. The cost is practically $8 a ton at Subig Bay as against $5 for Japanese coal and $5.50 for Australian coal. The American coal is, however, of a considerably higher grade and better adapted for use under the marine boilers. Large floating docks will also be built to accommodate the largest vessels in the American navy. J. G. White & Co. were awarded the contract for constructing the station.

The net revenue of the Western Union Telegraph Company for the quarter ended September 30th was $2,007,593.36. Adding to this $15,974,209.25, representing the surplus at the last quarterly report, gives a total of $17,981,802.61. Deducting from this total a 1¼ per cent. dividend, amounting to $1,217,021.25, and $331,300, interest on bonded debt, left a surplus on September 30th of $16,433,481.36.

A Practical Testing Laboratory.

Electrical engineering as a science originated in the laboratory, and even now the laboratory is the basis of all exact measurements, and the large and progressive manufacturing companies maintain their own laboratories. Manufacturers of smaller output, however, often find it impracticable to maintain expensive laboratories of their own, though their product must none the less be thoroughly tested. To meet their needs the Electrial Testing Laboratories in New York has sprung up as a commercial enterprise and is doing an important work. In a paper read by Mr. Clayton H. Sharp at the meeting of the American Institute of Electrical Engineers in New York on Novemher 24th the author presented clearly and from a non-commercial point of view the scope of the Electrical Testing Laboratories. Being a test officer of the laboratories, he is in a position to explain clearly the nature of the work there undertaken.

The Electrical Testing Laboratories has now been permanently established and in practical operation for nearly two years in a large and substantial building in East Eightieth Street, New York city. The purpose of these laboratories is to fill a hitherto existing lack in the electrical field. The Electrical Testing Laboratories is not engaged in producing any manufactured product. It does not attempt or expect to supplant the testing laboratories organized by operating and manufacturing companies, but rather to supplement them. By abstaining from giving advice or rendering opinions it does not encroach upon the particular province of the consulting engineer, while it places at his disposal facilities for obtaining such experimental data as he may need in his practice.

Each order taken hy the laboratories is considered as a unit, no account being taken of the number of articles to be tested under it. Thus an order for a check of a voltmeter counts the same as one for the complete study of a set of integrating watt-hour meters or for the determination of the conductivity insulation resistance, capacity and dielectic strength of several lengths of wire or cable. A partial examination of the records shows, for instance, that 310 orders covered a total of 581 individual instruments; 148 orders a total of 484 reflectors.

In these classifications certain large tests performed under general contracts are not included. These contracts cover tests of incandescent lamps bought in large quantities. The tests are made to determine the acceptability of the lamps under the specifications which are agreed to by the manufacturer and the purchaser, or to fix the value of the lamps, the laboratories in this case acting as the intermediary between the producer and the consumer.

The Electrical Testing Laboratories was engaged in this class of work previously to entering into the field of general testing. The volume of lamp testing is very large, the total number of lamps tested and inspected during the year ending April 30, 1904, was 13,000,000. The existence of this well-established line of testing has made it financially possible for the Laboratories to engage in the larger work upon which it had entered, and still constitutes the real backbone and substantial income of the business, without which the maintenance of the general laboratories would be impracticable.

The following table classifies the orders received with respect to the occupation or position of the clients from whom such orders have come. This classification is approximate only, since, for instance, it frequently happens that a manufacturer requires a test of materials which he is purchasing, and hence for purposes of classification would properly be placed under the head of consumer. These cases cannot be distinguished from those in which the manufacturer has a test made of his own product:

Manufacturers.	Consumers.	Electrical Engineers.	Dealers.	Colleges and Other Laboratories.	Other Parties.
56%	29%	8%	4%	2%	1%

It is seen that more than one-half of all orders came from manufacturers and that consumers' orders number only about one-half of the manufacturers' orders. There is, however, a well-marked tendency for the relative number of orders from consumers, electrical engineers and dealers to increase more rapidly than orders from manufacturers. Consumers and dealers will undoubtedly realize more and more with increasing competition and increasing demands upon them the importance of testing materials and supplies.

Certain further approximate analyses of the work done by the Laboratories can be made which indicate some of its fields of usefulness. For example, a large number of orders from manufacturers have covered tests and experiments required in developing new or improved products and in getting exact data on their existing product. Some manufacturers submit samples of their output systematically and periodically to the Electrical Testing Laboratories for test and use the data thus obtained for their own information. This is sometimes done when the manufacturer is supplied with his own testing department, and it serves as a check on his own results. Sometimes the results are used for advertising purposes. A catalogue of a certain line of appliances of interest to the illuminating engineer has recently been issued in which the characteristics of each article are shown by curves obtained by the Laboratories. Manufacturers, consumers and others frequently submit samples of different makes of an article for competitive tests. These are all subjected to similar tests and a separate report is written covering the behavior of each. A comparison of such reports is sufficient to give a clear idea of the relative merits of the articles tested. It will be noticed that the method of returning separate and independent reports on competitive articles precludes the possibility of the Laboratories making any direct comparison between them or drawing conclusions as to their relative merits. This is in accord with the fixed policy of the Laboratories.

An exception is made in case samples are designated in such a way as not to reveal their true identity. Thus a comparative report will be returned on samples of cable marked A, B and C, but separate and independent reports if they are designated as Smith's make, Jone's make and Brown's make. In no case is an opinion rendered as to the relative merits of articles as disclosed by the data obtained.

A number of tests have been made which are noteworthy either for their unusual nature or for their magnitude and comprehensiveness. Among these may be mentioned a study of the heat-dissipating qualities of various insulating varnishes; an efficiency test by electrical means of a variable-speed gearing; a study of the relation between voltage and sparking distance in air on the high-tension transformer set installed in the laboratory; complete studies of nearly every kind of integrating watt-hour meter which is or might be a commercial possibility in this country; spectro-photometric tests of most of the usual light sources; stroboscopic tests to determine the amount of variation of the light from incandescent lamps during each half cycle of alternating currents of various frequencies; complete tests of Nernst, osmium, tantalum and flaming arc lamps; comparative life tests of incandescent lamps on direct-current and alternating-current circuits, and determination of the influence of frosting the bulb of incandescent lamps, or enclosing them in globes on their life and efficiency; international comparison of standards of light by the exchange of standard lamps with the principal European laboratories.

Thus it will he seen that while the laboratory equipment is intended primarily for routine testing of the everyday useful sort, it has been made use of for tests which are out of the ordinary and which would ordinarily he carried on in a physical laboratory.

To sum up, it may he noted that systematic and constant testing and experimenting are of the greatest importance in promoting electrical science and industry. By testing the manufacturer is able to determine the quality and properties of the raw material entering into his product; and he is able to detect faults, to make improvements and to blaze a trial into unexplored fields. By testing the purchaser may assure himself that he is getting the quality that he has specified and can protect himself against carelessness and fraud. By testing the electrical engineer is enabled to collect the data needed for his plans and recommendations. The attainment of accuracy in practical electrical measurements is also of great importance and can be obtained only by reference to accurate laboratory standards.

Mexican Light and Power Company's Operations.

The Mexican Light and Power Company, which is installing a large hydro-electric plant at Necaxa, Federal District, Mexico, started a portion of its plant a few days ago, as stated in the Western Electrician last week, and it is now transmitting electrical energy for power and light to the City of Mexico and El Oro. The distance covered by this transmission line is 170 miles. The generator now in operation furnishes about 6,000 kilowatts. The new installation is pronounced a complete success by the company. In about 10 days or two weeks the company will place its second generator of like capacity in operation, and in another two months a third will be started running. It is stated that with these three generators the company will be able to supply present demands and that the price of electric lighting in the City of Mexico will be reduced. In order to be prepared for additional demands for the service the company will install three more units during the year 1906.

At present the companies controlled by the Mexican Light and Power Company have connected 8,200 horsepower in motors, which are operated daily, and the equivalent of 18,000 horsepower in arc and incandescent lamps, making a total of 26,200 horsepower connected. It is stated that the prospects are favorable that in addition to this use of power the mining companies of the El Oro district will require about 10,000 horsepower of electrical energy and that 10,000 additional horsepower will be required to supply the demands in the Federal District, making a total of nearly 50,000 horsepower that will be required. The company will continue to make enlargements of its plant as the demands arise, and for this purpose the capital stock of the company was recently increased by $4,000,000 gold. The company has agreed to give the City of Mexico, without additional cost, 40 per cent. more lighting service than has heretofore been done.

A 70,000-volt Transmission Line.[1]

By Charles F. Scott.

"If we consider both high-tension commercial service and time, I believe we must accord to Mr. Gerry the honor of having operated at the highest voltage over the longest time. He has been operating nominally at 50,000 volts, but actually at 55,000 volts in continuous commercial service for two years and a half. His line is about 65 miles from the power house of the Missouri Power Company, near Helena, to Butte, Mont. Other plants have operated at a little higher voltage; others have operated at longer distances, but taking all together—high voltage, length of time, continuity of service, amount of power—his plant may be taken as one of the foremost, if not the foremost example of high-tension transmission at this time. I believe he told me that he had not lost an insulator through breakdown on the line due to electrical causes."

The foregoing paragraph is my comment taken from the Transactions of the International Electrical Congress, September, 1904, in the discussion of papers upon high-tension lines. I had visited the plant of the Missouri Power Company during the preceding month.

A year later I again visited Helena and made specific inquiry as to the operation of the system during the year which had elapsed since I had been there before. I found that the record of the plant for the year has been a remarkably successful one. The service is for 24 hours a day, seven days a week, and the power delivered at Butte for mining and smelting operations shows a very high load factor. There had been a few interruptions, due to the high-voltage system. These were four or five in number; one had occurred in the sub-station, and was a discharge between line and ground across an apparatus terminal which had been recently installed. The discharge, however, did not cause a short circuit and the service was not interrupted. There were several line short circuits, which were attributed to lightning. When this occurred the circuit at the power house was opened and immediately closed again. The resulting inconvenience was simply the restarting of such of the motors as had stopped as the result of the momentary interruption.

The users of this power have found that it is more reliable than steam power generated on their own premises.

The endorsement of the success of this plant, both from its commercial and electrical standpoints, is proved by the present plans for extension. A new dam and power house will be constructed a few miles below the Canyon Ferry plant. The old and new power houses will be operated in parallel over the present lines to a new sub-station at Butte and an additional sub-station at Anaconda.

The transmission voltage will he increased to 70,000 volts at the power houses, and new transformers are to be installed in the old power house for the higher voltage. The maximum distance of transmission will be approximately 100 miles. There are at present two pole lines which will be used for the higher voltage.

The additional lines, which will join the two power houses at one end and the two sub-stations at the other end, will employ insulators of the same kind which have been used, although the pins will be increased slightly in length.

The new power house will contain three banks of raising transformers, each consisting of three 2,000-kilowatt units; two of these will be for regular service, and the additional one will be available as reserve, also for use in line tests, and further may become a part of the regular working equipment when additional generators are installed.

An important adjunct to the system will be a steam turbine auxiliary plant at Butte. During seasons of low water the steam plant will be used to supply power; at other seasons, when water power is abundant, and the limit of the amount of power transmitted is the capacity of thee generators and transmission circuits, the turbo-generators will be uncoupled from the turhines in order that they may be run as idle synchronous motors for increasing the power factor of the current from the transmission lines.

The contracts for the electrical equipment of the new plant have been placed with the Westinghouse company, which furnished the apparatus for the first plant.

The particularly interesting feature of the new plant is the adoption of a higher voltage than has ever been employed commercially by the engineer who already holds an enviable record for operating at high voltage. It also is of interest to note the form of construction used.

A brief description of the insulators and pole-

1. From The Electric Journal for November, 1905.

construction, which have been found so well adapted to conditions in Montana, is given in the following extract from a paper before the International Electrical Congress by Mr. M. H. Gerry, Jr., who has had under his direction the engineering of the early plant and of the extensions which are being made by the new company, the Helena Power Transmission Company.

"As a further illustration of current practice, the high-tension of the Missouri River Power Company, built under the direction of the writer, is here briefly described.

"This transmission has been in service for over three years, operating at 57,000 volts, delivering power at a distance of over 65 miles in a satisfactory manner. The country through which it passes is very rough.

"The lines leave the generating station at an elevation of about 3,700 feet, pass over three distinct summits, including the Continental divide, at which point they reach an elevation of 7,300 feet above sea level. There are two parallel lines extending from the generating station on the Missouri River to the Butte sub-station. They are located, in the main, on a private right-of-way 200 feet in width, from which all timber was removed. Each of the lines carries three copper cables, arranged in a triangular position, 78 inches apart. The cables are composed of seven strands and have an area of 106,000 circular mils.

The poles are of Idaho cedar, the cross-arms of Oregon fir, the braces and pins of white oak and the insulators and sleeves of glass. The cross-arms, braces and pins are held in place by means of through bolts. The pins in the top of the poles are of larger size and of greater length than those in the cross-arms, to provide for the greater strains there present. The pins were prepared by being first dried and then treated in paraffine until all moisture was removed, and were then tested to 60,000 volts. The glass sleeves are not fastened to the insulators and merely rest on a shoulder of the pins.

"The circuits are transposed five times, making two complete turns between the generating station and the sub-station. The switching arrangements are such that the circuits may be operated either singly or in multiple. A telephone circuit is located on one of the lines and gives good results in service. The poles are from 35 to 75 feet in length, and the pole tops are from nine to 12 inches in diameter. The poles are set from six to eight feet in the ground, according to height, and the standard spacing is 110 feet, with a maximum spacing of 150 feet."

Homopolar Dynamo.

Another contribution to the development of the homopolar or acyclic dynamo is that of Mr. Henry H. Wait of Chicago, who was recently granted a patent on such a machine. The dynamo is of the radial type, in which a disk is arranged to rotate in an annular field of force concentric with the disk, the lines of force passing transversely through the disk. The disk or rotary member is built of thin laminæ of steel, the direction of the laminations being substantially coincident with the direction of the magnetic flux—that is to say, transverse to the direction of the electromotive force which is induced in the disk by its movement through the field. The object of using steel laminæ is to allow the passage of magnetic flux to occur as freely as it would if the rotor was of solid steel, at the same time offering resistance to eddy currents.

One of the principal features of the invention lies in the use of conductors for the rotor, which are inclined with respect to the direction of their motion through the magnetic field. One of the advantages of this construction is that the induced current flowing in the conductors tends itself to set up a field of force, and by the inclination of the conductor in one direction or the other this field may be caused to oppose or assist the magnetization of the coils and in this way to compound the machine. In a machine having the conductors perpendicular to the direction of motion the gross effect of their current is neither to assist nor oppose the magnetizing coil. The current flowing in each spiral conductor forms a loop which acts as a supplemental magnetizing winding to assist the field coils.

Another advantage in inclining the rotor conductors is that each conductor will lie in all radial elements of the field, so that the potential between the inner and outer ends of all conductors at any one instant will be substantially the same. The advantage, in other words, is to equalize the flow of current through all the conductors to compensate for possible variations in the field strength at different places around the circumference.

The Seattle-Issaquah Traction and Coal Company of Seattle, Wash., has been incorporated with a capital of $3,500,000, and will operate an interurban electric railway.

Extensions of the Milwaukee Electric Railway and Light Company.

Announcement is made of the purchase of $2,000,000 refunding and extension mortgage 4½-per cent. gold bonds of the Milwaukee Electric Railway and Light Company. The bonds mature January 1, 1931. The total authorized issue is $20,000,000, of which $1,000,000 is set aside against $1,000,000 first-mortgage five-per cent. bonds of the Milwaukee City Railroad Company, due December 1, 1908; $500,000 against $500,000 first-mortgage five-per cent. bonds of the West Side Railroad Company, due July 1, 1909; $6,500,000, against $6,500,000 consolidated mortgage five-per cent. bonds of the Milwaukee Electric Railway and Light Company, due February 1, 1926, and $200,000, or so much thereof as may be necessary, against certain five-per cent. purchase money mortgage notes of the Milwaukee Electric Railway and Light Company, $198,405 principal. Of the remaining $11,800,000 authorized, $2,800,000 bonds may be sold from time to time to meet floating indebtedness or provide for improvement, equipment and development of the properties of the company or for new properties. The remaining $9,000,000 may be issued after January 1, 1907, at a rate not to exceed $1,000,000 a year for acquisitions, extensions, improvements, etc.

The company has a monopoly of the street-railway and electric-lighting and power plants of Milwaukee. The railway franchises extend until December 31, 1934, while the electric-light, heat and power franchises are perpetual and cover the entire city. The company is building a large central car station and office building in Milwaukee to cost about $1,250,000. It is declared that the physical condition of the company's property compares favorably with that of any other street-railway system in the United States. In 1904 the company showed a surplus, after preferred stock dividends and the large depreciation and reserve fund of $506,505, against $427,729 in 1903. The company pays regular five-per cent. dividends on its outstanding common stock, all of which is owned by the North American Company.

Turbine Ships Seem to be Successfull.

The new Cunard liner Carmania, equipped with turbine engines, made its first trip across the Atlantic, arriving in New York city last week. The weather was of the severest kind and the fierce gales which raged gave the new turbine equipment a severe test. Cunard officials and engineers who watched the performance of the turbines speak in high praise of the new ship. Andrew Fletcher, member of the firm of W. & A. Fletcher & Co. of Hoboken, which has contracts for the engines for two new turbine boats to be built for the Metropolitan line between New York and Boston, said that the severe test showed that the use of turbines has passed the experimental stage and their usefulness has been demonstrated. He said turbine engines would be the engines of the future. There are now building throughout the world 42 turbine steamships, according to Mr. Fletcher, and many more are contracted for.

Thomas Bell, chief engineer for John Brown & Co., the company that built the Carmania, said that, in the face of the rough weather, the passengers suffered no discomfort, as there was no racing of the engines as in the case of a ship equipped with ordinary engines. The screws of the Carmania, he explained, are so far below the water that they are never exposed even in the roughest kind of weather. The Carmania, Mr. Bell said, had used up about as much coal as her sister ship, the Caronia, which latter vessel is equipped with reciprocating engines, would have done on a similarly severe voyage.

Others who were on hoard and praised the new ship were M. H. Maxwell, a director of the Cunard company; William Mackenzie, president of the Canadian Northern Railroad; Commander Wisnon of the British Royal Navy, and C. L. Wachter.

Electricity for Cuban Sugar Plantations.

Several of the larger sugar plantations of Cuba have decided to introduce electricity as the motive power for the operation of their machinery. Contracts for five large plants were awarded in the United States a few days ago, it is reported. The Sugar Plantation Company of Jatibonico will install two large generators and motors. One of the generators will furnish current for power and light and the other will operate centrifugal pumps.

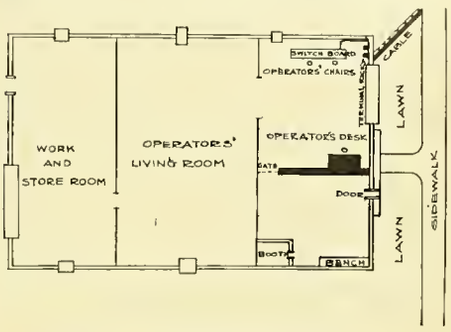
The Santos Jacito Sugar Company of Guantanamo will install a comolete plant, consisting of a 200-horsepower steam engine, generator, a number of motors and the necessary switchboard appliances. Two electric sugar-plant equipments will be furnished to Messrs. Obi, Stillman & Co. of Havana for factories near Limones, and the Guantanamo Sugar Manufacturing Company has contracted for electrical machinery of all kinds for operation of one of its factories, representing an expenditure of about $75,000. The electric apparatus to be installed on these five sugar plantation represents, it is said, approximately $200,000.

Operation of Small Telephone Exchanges.

By R. W. Kemp.

Operation of small telephone exchanges has been one of the most difficult problems for telephone managers to solve for several reasons—first, managers cannot give the exchange their personal attention; second, the profits are not large enough to justify an experienced man; third, the operator has had no training, and usually a young lady that has not been in public service before does not know how to handle the public.

Take for example an exchange in a small town, say of 500 inhabitants, properly constructed with the central-office equipment installed in a first-class manner with, say 20 business telephones at $2 a month and 60 residence telephones at $1 a month, making the revenue $100 a month. There



PLAN OF SMALL TELEPHONE EXCHANGE.

is the office rent, which at least will be $5 a month; office expenses on an average of $3 a month; central-office maintenance, such as batteries, cords, etc., $2 a month, making the total maintenance expense of central office $10 a month.

Maintenance of line, telephone and outside construction will on an average be 20 cents a telephone, amounting to $16 a month, and bringing the expense up to $26 a month without any labor. For operating, at least two persons must be figured on, besides a lineman. These operators cannot be secured for less than $15 a month and linemen at least $50, this bringing the expense up to $106. Now if the owner of the plant does the line work he is not even making good wages besides not paying interest on the investment.

The only manner in which it seems possible to solve this problem is for an operating company to be organized to do the building and operating of small exchanges and do it in this manner: Have the exchange well built and the central-office equipment properly installed, as shown in the accompanying diagram. Let a young lady be trained for several months at operating and repair work in the shop, taking her at the beginning when the exchange is being built and having her draw the diagrams of the cables, pole terminals and switchboard. By doing this she will have a good knowledge of the exchange proper, and her experience in the shop will enable her to do most of the repair work on the telephones and to keep both terminals in repair. With this done very little trouble will exist at first, and what there is she can patch up in some manner and keep working until there is some construction work to do, at which time she will have to secure the services of a lineman who can then do the repair work.

The operator can secure some girl in the town who is willing to learn operation, and who will relieve her for about $10 a month. Her room being furnished, and by doing light housekeeping, wages of from $30 to 40 a month will be good compensation. The maintenance expense will not exceed $10 a month and extra linework will not exceed the same amount, thus making the total expense not to exceed $70 a month, thus leaving $30 or more a month to pay interest and dividends.

NEW COMPANIES.

The Jasper County Telephone Company of Montrose, La., has been incorporated with a capital stock of $1,500 by L. L. Denson, P. L. Blackwell and others.

The Citizens' Telephone Company has been organized at Seattle, Wash., for the purpose of supplying a telephone service to the town of Columbia and various suburban districts.

The Quincy Long-distance Telephone Company of Quincy, Ill., has been incorporated with a capital stock of $2,000. Frank J. Penick, J. R. Pearce and Samuel D. Scott are the incorporators.

Indiana Telephone Items.

The employes of the Central Union Telephone Company in Indianapolis have formed a club, with E. T. Busselle, chief inspector of the Indianapolis district, president. It is to be known as the Central Union Telephone Club, and starts out with 80 charter members. The purpose of the organization is to maintain a school of instruction in all the work that falls to the employes of a telephone company in a modern plant, and for social purposes. The company has set aside two large rooms for the exclusive use of the club. The rooms have been fitted up with furniture, piano, magazines, games, and an exhibit of telephone apparatus and equipment, for instruction. The club rooms are open every day except Sunday. An open reception will be held once a month.

Stock and bonds of the New Telephone Company, lessee of the Indianapolis Telephone Company, have received more attention in local financial circles during the last week than any time since the Indianapolis Telephone Company and the New Long-distance company changed owners. There is considerable speculation relative to the object of the new owners. A meeting of the directors was held on December 12th, when the questions pertaining to the reorganization of operating methods were discussed. Among those present were President Stiefel of St. Louis, J. S. Brailey of Toledo and C. E. Stinson, local manager. It is understood that plans were discussed for obtaining from the city amendment to the company's franchise which will allow an increase of rates. A plan of increasing and improving the long-distance lines was also taken up, it is said.

Thomas D. Sheerin, president of the Citizens' Telephone Company at Columbus, has announced an advance in the rates to be charged for telephones after January 1st. The present charges are $12 and $18, respectively, for residence and business connection. The new schedule will be $15 and $20 for residences and $30 for business places. Mr. Sheerin says the increased cost of operating a larger plant, together with the rapid growth of Columbus and the consequent call for more telephones, have made it impossible to operate profitably at present rates.

The American Telephone and Telegraph Company had part of its system disabled on the night of December 11th by the robbery of a large quantity of heavy copper wire, which was stripped from the poles two miles east of Hammond. Over a mile of wire was taken, and it is thought at least a dozen men were required to do the work—some of whom must have been expert wiremen. Service between New York and Chicago was interrupted by the loss. The authorities have no clew to the identity of those connected with the robbery.

The franchise granted to O. L. Barger by the Board of Public Works of Marion, for an automatic telephone system in Marion, has been ratified by the council.

Fred T. Loftin, R. A. Rinehart and others have organized a press-report service from Indianapolis to the country newspapers throughout Indiana by long-distance telephone. By the aid of this service country newspapers are given the benefit of the latest news up to the hour of going to press.

The Indiana Telephone and Telegraph Company of Dana, Ind., has incorporated to establish a telephone system in Dana, and Vermillion County. The capital stock is $50,000. George W. Hughes, John L. Harney and J. H. Davis are the directors. S.

Telephone News from the Northwest.

The district court at Anoka, Minn., has granted a restoration of the exchange of the Cambridge Telephone Company at Cambridge, Minn., and ordered the connecting wires restored to the condition they were in before they were cut by the Tri-state Telephone Company. The latter thus loses the preliminary fight in the contest with the Northwestern, which bought the Cambridge Telephone Company exchange.

The council of Minneapolis proposes a campaign against aerial wires of all kinds. An ordinance is before the council creating an inspector of wires with power to order them down, if they become dangerous. The Northwestern Telephone Exchange Company has plans for conduit which will cost in excess of $75,000. The cables will cost $100,000 more by the time it is installed.

On April 1, 1906, the Duluth Telephone Company will open a branch exchange at Lakeside, a suburb of Duluth.

The Dakota Central Telephone Company of Aberdeen, S. D., contemplates starting a local exchange at Linton, N. D.

The Northwestern Telephone Exchange Company will erect a central-exchange building in Crookston, Minn. The company has also been granted the right to place poles in the village of Gaylord, Minn.

Edward E. Webster, formerly manager of the Twin City Telephone Company, in Minneapolis, but now of the Independent Telephone Company of Seattle, Wash., has just been granted a franchise at Tacoma, Wash., for an automatic system.

The Hand County Telephone Company of Miller, S. D., has filed articles of incorporation with $10,000 capital.

A suggestion is made in St. Paul to levy a tax on each telephone and telegraph pole in the city. A license fee of $5 a pole is thought would be a strong inducement toward getting wires underground.

The local exchange at Valley City, N. D., wants an extension of its franchise as a condition to rebuilding and improving the system.

The Tri-state Telephone Company has been granted admission to Pipestone, Minn., for a toll system.

J. S. Cain has sold the telephone system at Barnum, Minn., to Ray Giberson.

The Minnesota Central Telephone Company has put in a new metallic system at Ortonville, Minn.

Telephone connections have been completed between Zearing, Iowa, and McCallsburg by the Mutual Telephone Company. R.

Ohio Telephone Notes.

The Cleveland Telephone Company has purchased a lot on Prospect Street and will erect a three-story building, 48 by 123 feet. It will be of brick and terra cotta, with steel construction, and will cost between $50,000 and $60,000. The building will be used for the East Exchange, which has outgrown its present quarters. About $60,000 worth of new apparatus will be installed, giving a capacity of 9,600 lines. This is the first of a system of extensive improvements to be made in and about the city. It is said that $1,000,000 will be spent in extensions and improvements within the next year or two.

The Cuyahoga Telephone Company of Cleveland has installed a Santa Claus in one of the windows in the contract office, on the ground floor of the Electric Building. He not only maintains the appearance, but answers the little ones over the telephone and satisfies their curiosity.

A civil-service examination for telephone operators will be held at Columbus on January 3d. Besides experience, which counts 50 per cent., the examination will consist of spelling, arithmetic, penmanship, letter writing and copying. Salaries for these government positions range from $240 to $840 a year.

An ordinance has passed its first reading in the council of Chardon granting the Chardon Telephone Company (Bell) a franchise to operate an exchange in the town. The company agrees to build a modern exchange within six months. This has been a strong Independent field.

A meeting of the board of directors of the United States Telephone Company and the Cuyahoga Telephone Company was held a few days ago. Arrangements were completed for a loan for each from the St. Louis syndicate which has an option on the Federal. The money will be used to pay for the improvements and extensions recently made by the companies.

Hoskins, Washburn & Co. of Orrville are reported to have purchased the majority of the stock of the United Telephone and Switchboard Company of that place. The plant, it is said, will be run at full capacity in the manufacture of telephones, switchboards and cabinets.

The Western Ohio Telephone Company of Toledo has been incorporated with a capital stock of $100,000 by John G. Meilink, A. C. Stevenson, F. E. Palmer, I. W. Davis and Joshua Lindahl. The termini of the proposed lines to be built are given as Toledo and Cincinnati.

A Christmas treat is being prepared by the Cincinnati and Suburban Bell Telephone Company. Each employe who has been with the company a year or more will receive a six per cent dividend on his salary and each male employe, in addition, will receive a turkey and can of oysters. C.

MANUFACTURERS AND DEALERS.

The Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y., has issued a card of "don'ts." Last in the list is "don't forget the 1900 battery."

The Automatic Electric Company of Chicago is sending out a reprint of an article upon the 6,000-line automatic exchange of the Home Telephone Company of Dayton, Ohio.

The Farr Telephone and Construction Company of Chicago has issued its 1906 catalogue, which describes an extensive line of telephones and telephone parts, test sets, switchboards for farmers' lines, express self-restoring drop switchboards, etc. The company also carries a large stock of linemen's supplies, batteries and battery supplies.

G. M. Gest, the expert subway contractor of Cincinnati and New York, has just closed an additional contract with the Mexican Telephone Company at Mexico City for a further extension of its subway systems. This will require a large force of men and it will take the best part of a year for completion. A large quantity of conduit is now in transit from the United States to that point. Mr. Gest also recently closed a contract for the construction of an electrical subway system in Chattanooga, Tenn., for the East Tennessee Telephone Company.

Vermont Walters, assistant wire chief of the Toledo (Ohio) Home Telephone Company, has been chosen manager of the Daviess County Telephone Company in Indiana.

The Question of Telephone Rates in Chicago.

For some time Mayor Dunne of Chicago has been contemplating an effort to secure lower rates for the telephone users of the city. In response to a request from the mayor, A. S. Hibbard, general manager of the Chicago Telephone Company, has submitted a statement of the company's position in the matter. Coming at this time when the telephone company's main franchise has only about three more years of life the company has suggested taking the matter up with the city with a view to adjusting its entire affairs, looking also toward an extension of its franchise. The matter has been referred by the council to a standing committee for adjustment.

Mr. Hibbard states that the company is willing to make a reduction in its rates. The demand of the public, however, for telephone service is so great, requiring further large investment in the way of buildings, switchboards, conduit and other essential portions of the telephone plant, that any reduction of rates must take into consideration an extension of the period of its franchise.

It is announced further that improvements would be made in various classes of service which would be of advantage to every subscriber to the system. It is contended that the exchange offices of the company in Chicago are strictly up to date and are giving a modern and satisfactory service. The low rates introduced by the nickel service have been availed of by a very great number of users, and out of more than 103,000 telephones upwards of 80,000 are now operated either on the nickel plan or upon some measured-service rate whereby the subscriber pays for the amount of service rendered to him and no more. A further reduction of these rates and greater extension of the service would be for the direct benefit of every telephone user. The company thinks that it will be of advantage if the negotiations may lead to such an agreement as to terms of franchise, rates and other matters which will give the company the opportunity to extend its fields of operations and bring about the betterments which have been suggested.

GENERAL TELEPHONE NEWS.

The Welton Telephone Company of Welton, Iowa, is improving its lines by extending them throughout the county.

The Christian County Telephone Company of Taylorville, Ill., has increased its capital stock from $10,000 to $250,000.

The Nebraska Telephone Company of Nebraska City, Neb., is to spend $35,000 in putting in conduits and cables this winter.

It is said that the Michigan State Telephone Company will spend $2,000,000 in extensions next year. It is reported that in Detroit the company now has one telephone to every 10 persons. The system has 92,000 telephones, an increase of 30,000 this year.

Among the recently incorporated telephone companies are the Johnson Telephone Company, Smartville, Neb.; Independent Telephone Company, Cestos, Okla.; United Exchange Company, Reinbeck, Iowa; Seward and St. John Telephone Company, St. John, Kan.

Ray T. Vanettisch of Pueblo, Colo., is said to have broken the world's typewriting record for both the 30-minute and one-hour tests, taking 2,600 words during the first 30 minutes, and finishing the hour with 4,917 words. The dictation was received over the long-distance telephone from Denver, a distance of 120 miles.

The special telephone committee of the City Council of Brantford, Ont., has declared in favor of a competitive telephone system as tending to cheapen existing rates. Two companies are in the field, each with rates lower than the present Bell rates. It is considered likely that the council will grant a competitive franchise to one of the Independent companies as its last official act of the year.

While no action on new capital requirements of the American Telephone and Telegraph Company is expected until next spring, the directors believe it well to have authority to continue the broad and comprehensive policy of expansion and development. Without deciding definitely as to the form of new securities to be issued, the directors ask for authority to issue a total of $150,000,000 convertible bonds, in the event of this proving to be the most desirable form. In a circular letter to stockholders the directors say that the company has sufficient cash in its treasury to meet its probable requirements until well into the year 1906, but it is desirable that the requisite authority to issue such bonds should at an early date be conferred upon the directors that they may be in a position to take advantage of any favorable opportunity that may arise to consider and act promptly upon any financial plan that may seem to be advantageous.

CORRESPONDENCE.

Great Britain.

London, December 6.—The promotion of private bills in Parliament is for the moment overshadowed by more important happenings to the government itself, the Conservative administration having resigned and the Liberal leader having been asked by the king to form a cabinet. This has happened at a time of the year, however, which, whatever the course now pursued by the new government, can hardly interfere with a full session so far as private legislation is concerned. And this is not without importance to the many electric power bills for London in view of what happened last year. This brings me to what should be my last reference to these bills for the next month or two. I will just briefly mention the remaining bills of importance.

Much has been heard concerning the proposal of the London County Council to embark upon a power scheme, and considerable speculation existed as to the nature of the area. This has now been made public, and so ambitious is it that even the radical press is silent; it includes the whole of the County of London and portions of all the counties surrounding it, and will, if passed, clash with more than one existing electric power company—a state of affairs not existing hitherto in the history of power companies in London.

A general feeling has manifested itself among the various existing electric supply authorities in London to be able to supply each other with energy, a thing at present forbidden by law. Thus it comes about that all the companies in one bill, and a number of companies and borough councils in another bill, seek authority to do this. If it were not for the possibility of a royal commission being appointed to go deeply into the question of electric power supply in London—on the lines of the traffic commission—it would almost be safe to hazard a prophecy as to where the ultimate choice in this matter will lay.

The gratifying announcement has been officially made that the recent electrical exhibition at Olympia in London was so successful in the financial sense that all exhibitors will receive a rebate of 25 per cent. upon the sums paid as rentals for their stands. Beyond this it is also understood that a considerable sum will be paid over to some benevolent fund in connection with the industry.

The pneumatic dispatch system devised by Mr. Batchelor of the Batchelor Pneumatic Tube Company of America is to be used in a scheme which will be brought before Parliament next session for providing London with a parcels despatch system of this nature. A similar proposal was made last session, but unsuccessfully.

The Belfast municipal tramways system was opened to the public last week. The system represents one of the largest of its kind that has been changed from horse to electric traction on being acquired by the municipality from the local company. The expenditure upon the system, it is expected, will reach $5,000,000. An interesting feature in connection with these tramways is the establishment of a school for training the motormen. The inspecting officer of the Board of Trade, when going over the lines, also inspected this school and expressed entire approval of what was being done there.

The lighting of the city of London still continues to attract attention both inside and out of the City Council chamber. The latest development has been in connection with the notice which the electric-lighting company has had to remove its standards. Almost frequent appeals to the council to allow the company to put in a competitive tender as against the gas company have proved futile and the posts are to be taken away.

The great electrical frauds case has ended at last and as a consequence a number of undesirable individuals will be removed from public for considerable periods, varying downward from seven years. The frauds were perpetrated upon a very large number of electrical firms and the total sum gathered together was nearly $150,000. A bogus company was formed and goods ordered of it were never delivered, although by some smart business tactics the checks in payment were secured. The trial lasted nine days.

All the steam trains upon the District railway (Mr. Yerkes' line) were withdrawn a few days ago, and as far as the Inner Circle generally is concerned, only a few steam trains are run, these being necessary, as they run to a junction a little way off the circle.

The Local Government Board has at last given sanction to the Torquay corporation to borrow the necessary money in order to provide the plant to give a supply of current to the Dolter Electric Traction Company, which is constructing lines in that town.

The National Electrical Manufacturers' Association, which is composed of the majority of the principal electrical manufacturing firms in this country, has been considering for a long time the question of the propriety of continuing to contribute toward application for beanfeasts and Christmas-box funds. A circular has now been issued to the trade intimating that the members of the association have agreed to discontinue the practice in both instances.

Much attention is being directed in this country at the present moment to the suggested scheme of the British South Africa Company for the generation of electrical energy at the Victoria Falls in Central Africa and its transmission for a distance of 700 miles to the Rand. The engineering feature of the proposal is the strong belief that is held by the promoters that Mr. Thury's continuous-current system of generation will be suitable. Obviously this is challenged here, but no very complete details have yet been published. G.

New York.

New York city, December 16.—Work on the Brooklyn subway is entering upon an interesting phase. Recent authorized changes of plans call for a four-track instead of a two-track line under Fulton Street and for a six and seven-track construction under Flatbush Avenue. Peculiar engineering problems around the Borough Hall have been met by three different modes of construction. At the Joralemon Street corner two of the tracks pass under the others, and as it was not possible to build an arched roof at the lower level a cleverly devised "flat arch" has been constructed. This "arch" or roof has a span of 28 feet and was built not by lifting the concrete into position from below but by pouring it down through holes from above. The concrete is 4½ feet in thickness and supports a weight of 40 tons to the lineal foot. This part of the subway is a real bored tunnel, but most of the remainder of the system is "cut and cover" work. At the Temple Bar Building the track passes within 13 feet of the foundations, and here there is a single-track construction between concrete walls which take up some of the overhead load. A few yards westward are regular brick tunnels which descend to the under-river tubes. All the work to the east of Borough Hall is cut and cover, and much of it is being done along busy commercial thoroughfares where there are existing both surface and elevated lines. While excavating beneath the elevated pillars some very ingenious supports have been devised which interfere with the traffic as little as possible. In the matter of ventilating and in many other details the Brooklyn subways will be an improvement on those in Manhattan.

It is announced that the Interurban Rapid Transit Company will operate the extension to Kingsbridge for the first time on January 1st. This part of the subway has been delayed at least 12 months, owing to various engineering difficulties encountered when boring beneath Fort George.

On the Third Avenue elevated line on Monday the dropping of a steel wrench across the third rail and the track led to the fusing of a foot of the rail, a delay of traffic and serious injury to the man who dropped the implement.

The third annual report of the committee for the prevention of tuberculosis severely criticises the subway management for not taking any effective steps to keep the subway, and especially the stations, clean bacteriologically. There is an ever-increasing accumulation of filth on the tracks, it says, which are so laid with broken rock that they cannot be swept. The "dry cleaning" of the platforms is also criticized, and attention is called to the dirtiness of the cars. The health board has often condemned these conditions and the company is still "investigating" the complaints.

The Board of Estimate and Apportionment has approved, as far as it legally may in the present uncertain state of the franchise law, the application of the New York and Port Chester railroad for electric lines in the Bronx. The franchise is to be for 25 years, with privilege of renewal after revaluation. The price for the first five years is to be $8,000; for the second five, $13,000, and for the last 15, $35,000 a year. There is also a rental varying from 5.4 cents to 20 cents per foot of track, and $1,000,000 worth of work must be done within five years. The property may not be mortgaged or sold to any other street railroad in the city. There are to be no grade crossings, and sundry penalties for inefficient service are provided. W. C. Gotshall, president of the New York and Port Chester railroad, has been working toward this franchise for three years, and the matter now only awaits a favorable decision from the Appellate Court.

Development of the waterpower of the Oriskany Creek, near Clinton, N. Y., is foreshadowed in an application to the Kirkland town board this week for a franchise for a 25-mile trolley line between Clinton, Hamilton and Waterville. The power house, which is to be at Red Mill, will utilize an 80-foot head of water. George J. Hovey of Deansboro and Thomas F. McBride of Clinton are chiefly interested in the project.

The Public Service Corporation of New Jersey has been permanently restrained from interfering with the Hoboken and Manhattan Railroad Company in building an outlet for its under-river tunnel in Hudson Place, Hoboken.

The long-promised electrical show at the Madison Square Garden was opened on Tuesday evening. A general description of the exhibits appears elsewhere in this issue.

The Rival Gas and Electric Fixtures Supply Company of New York has been incorporated with a capital of $10,000.

J. G. Halleran and other Rochester men have incorporated as the Telegraph Signal Company with a capital of $1,000,000 to manufacture telegraph instruments at Rochester.

The Great Eastern Telephone Company, the general name for the Independents who are invading New York against the Bell interests, announces that it will begin to dig its ditches in Lower Manhattan before the end of the year, and promises actual service in Manhattan and Brooklyn within six months. All sorts of improvements are promised, including cheaper tariffs. One thousand messages on a private line will cost $50 and 4,000 $150. D. W. W.

Dominion of Canada.

Ottawa, Ont., December 16.—The City Council of Charlottetown, Prince Edward Island, has passed a resolution denouncing the action of the Charlottetown Light and Power Company in increasing flat rates on commercial and domestic lighting in violation, it is claimed, of an agreement whereby the company is to light the city for five years. The resolution also states that unless the increase is withdrawn the city will install its own electric plant.

The Stark Electric Light, Power and Telephone Company has come forward with an offer to purchase the municipal lighting plant of Paris, Ont., making it the center of a radius of 15 miles, in which the company will supply light, power and telephones. The town council has set a price of $50,000 upon the plant. The company states that it will sell power at eight cents a kilowatt, while the telephone rates will be one cent a cell, with a maximum rate of $15 for residence and $25 for business telephones.

It is said that the three electric railways in and around the city of Brantford, Ont., viz., the Grand Valley railroad, the Brantford street railway and the Thames Valley railroad, have changed hands. These three roads formerly belonged to practically the same people. The roads have been sold to Toronto capitalists.

A move of considerable importance in connection with the motive department of the Canadian Pacific railway is the decision of the management to take up actively the idea of using electricity as a motive power. For some time the officials of the electrical department have been working on the matter and have investigated the experiences of other railways in that connection. It is understood that electricity will first be installed on some of the branch lines in the Province of Quebec and a motor car for this purpose is now being constructed in the company's shops. If the trial trips with it are satisfactory it is expected that electricity will be used for nearly all the company's suburban and branch lines. Thomas Shaughnessy, president of the Canadian Pacific, foresees the day when electricity will take the engines from coast to coast. He points to the extraordinary advantages that Canada possesses in her unrivaled waterfalls, which could be used for the development of electric power all the way from the Atlantic Ocean to the Pacific.

Sir Wilfrid Laurier, together with the minister of public works and the minister of railways, received a large deputation from the counties of Northumberland and Durham, Ont., asking the government to leave the Northumberland-Durham Power Company its portion of the undeveloped power at Healy Falls on the Trent River. The municipalities, particularly the towns of Port Hope and Coburg, are without adequate waterpower for electric purposes, while efforts are being made by other interests to secure the falls and transmit electric energy to Peterboro. Sir Wilfrid said that at first glance he could not see why the application should not be granted.

The new Canadian Pacific steamships for the Atlantic line will be fitted up with the new appliances for receiving sound signals through the water. At important points in the St. Lawrence River submarine bells have been placed, which in thick or foggy weather are sounded automatically by pneumatic pressure.

Tilling the soil by electric power may not be so far distant as it at first seems. The electric roads being constructed throughout the country are in some cases making preparation for supplying farmers with power at reasonable price, and many of the tasks on the farm could be performed by this power, such as running machinery, etc.

Mexico.

City of Mexico, December 15.—The Parral Power and Reduction Company has acquired the concession which the federal government recently granted to Eugene Davis of Washington, D. C., for the establishment of an electric power plant in the state of Durango to provide power for the Parral mining district as well as for other mining camps of that section. Mr. Davis also held a concession from the Mexican government for the establishment of a reduction plant of 1,000 tons daily capacity at Parral. He has transferred this concession also to the Parral Power and Reduction Company, which has been organized with a capital stock of $1,200,000. Ex-United States Attorney-general Griggs is president of the company. The plans for the proposed power and reduction plants have been prepared by Major Henry D. Catlin as chief engineer. F. L. Slocum is consulting engineer for the company.

The Torreon Electric Street Railway Company

will increase its capital stock and erect a modern electric power plant. Other important improvements are to be made.

A new electric-light company is being formed in Torreon by local citizens. More than $100,000 of the capital stock has already been subscribed.

The El Mamey Iron Company will install a large hydro-electric plant at the falls of the Mamey River, near Villa de Alvarez.

The City Council of Jiminez has entered into a contract with Ramon G. Aguirre for the installation of an electric-light and power plant for lighting the city and for furnishing light and power for commercial purposes.

The authoritative announcement is made that the Facundo Perez water concession, covering the use of the water of the Santiago River between Las Juntas and San Cristobal, a distance of about 30 miles, has been purchased by La Electra, the light and power company of Guadalajara. The price paid for the concession was $125,000. It was secured by Mr. Perez, a capitalist of the City of Mexico, several years ago. It is estimated by engineers who have made a careful examination of the water-power afforded by the river that it is sufficient to generate at least 25,000 horsepower of electrical energy. It is stated that the purchase of this concession is a step in the plan of the men interested in La Electra to effect a consolidation of light and power interests in Guadalajara. W. D. H.

New England.

Boston, December 16.—The railroad commissioners have authorized the Old Colony Street Railway Company to issue $200,000 new capital stock, $141,000 of which is to be applied to the payment for the alternating-current system of the company, and the balance to improvements in the equipment.

The Eastern Manufacturing Company of Bangor, Maine, has contracted with the Westinghouse company for motors, wire, etc., for the introduction of electric power at the paper mill of the company. A deal has also been made with the Bodwell Power Company, which has nearly completed its immense electric power plant at Milford, 13 miles above Bangor, for the supply of upward of 3,000 horsepower of electric energy. The sawmill of the Eastern company will probably be run by electric power also.

The American Telephone and Telegraph Company has begun the construction of a telephone line between Norwalk, Conn., and Pittsfield, Mass. The line will be 112 miles long, and there will be accommodations on the poles for 40 to 60 wires.

Purchases of stock of the Worcester Consolidated Street Railway Company, apparently for the purpose of securing control, have been in progress lately, and it is understood that the same interests which operated in behalf of the New York, New Haven and Hartford for the acquisition of other lines in this state, have been at work.

A corporation has been formed at Augusta, Maine, to build the Portland and Brunswick Extension railway. The purposes are to construct a street railway between Yarmouth and Portland, a distance of 12 miles. Among the directors are E. J. Lawrence of Fairfield and Cyrus W. Davis of Waterville.

Salem M. Hardy, manufacturer of electric lamps at Pittsfield, has filed a bankruptcy petition in the United States District Court. His liabilities amount to $37,517, which he owes to 80 unsecured creditors.

George Hanlon, age 52, died in this city on December 12th. He was a member of a family of inventors, and came to this country about 30 years ago. Among his greatest achievements was the invention of block and electrical train signals which were accepted by the Boston and Maine railroad, but which, through some contract difficulty, were never used. B.

Ohio.

Cleveland, Decembeer 16.—The Toledo, Bowling Green and Southern is taking contracts for the transportation of grain from farmers along its line. This will enable farmers to ship their grain to warehouses during the winter when wagon roads are almost impassable. The Toledo and Western has had an arrangement of this kind, with the exception of delivering to the warehouses.

It has been stated that if Randall Morgan secures the property of the Cleveland Electric Railway Company for his syndicate that it will have to be done by actual purchase, as the owners will not consider a leasing arrangement, and that a handsome price is all that will tempt them to part with it. This perhaps would not stand so much in the way if the Philadelphia syndicate could see a way of securing certain desired extensions of franchise.

A franchise ordinance for the Youngstown and Southern was passed by the council at Youngstown a few days ago over the veto of Mayor W. T. Gibson.

For a certain period in the evening all vehicles and horses are prohibited from passing through the public square in Cleveland in order that persons waiting for cars may not be in so much danger. This also enables the cars to make a little better time, but that is hardly taken into consideration.

Marshall Morgan has completed an inspection trip over the Columbus and Buckeye properties in which his father is interested. It is said that he will return and take a prominent part in their operation after the first of the year in order to learn thoroughly the traction business.

The Toledo Council has passed an ordinance fixing the price of electric current furnished to private consumers for lighting at nine cents per kilowatt hour. If bills are paid on or before the 10th of each month a discount of 10 per cent. will be allowed.

Plans are almost complete for the reorganization of the Springfield, Washington C. H. and Chillicothe Traction Company, as worked out by I. S. Harshman of Springfield. Three Cleveland capitalists, represented by E. W. Christie, will probably take the road over. Bonds to the amount of $800,000 will be issued to complete the line to Washington C. H. and build a power house. The indebtedness of the company is about $175,000.

At the annual meeting of the Order of Street Railway Conductors and the Order of Electric Railway Motormen at Lorain last week action was taken to unite the two orders, and in place of a life-insurance feature a benefit of $250 for funeral expenses was incorporated. Temporary officers were elected to serve until next May, when the annual meeting will be held at Lorain. The new order will be known as the Brotherhood of Interurban Trainmen.

A limited train has been put on the Cleveland and Southwestern between Cleveland and Oberlin. Ten new cars have been received by the company and five others are yet to be delivered.

The Girard natural-gas properties in Kentucky have been purchased by the interests of the Cincinnati Gas and Electric Company, which has asked for a franchise to furnish gas in Cincinnati. It is said that a company with a capital of $5,000,000 will be organized to operate the property.

The Cincinnati Traction Company will tender its usual annual entertainment to the 2,000 employes on the evening of January 1st, when a Christmas tree will be given the children. The arrangements are in the hands of Superintendent Robert E. Lee.

The new line of the Lake Shore Electric from Avon Beach to South Lorain will be put in operation within a short time. Cars will be run between Cleveland and Elyria, according to the schedule which has been made out.

By the annexation of South Brooklyn to the city, Cleveland has come into possession of a small municipal lighting plant. It is said that the plant will be operated at full capacity and that the area of service will not be limited to the former boundaries of the village.

The Cuyahoga county commissioners have declared the franchise of the Cleveland, Berea and Southern Railway Company forfeited because the certified check for $5,000 to guarantee good faith had not been put up. C. H. Hubbell is the projector of the road and had been working on the plans for a year or two.

It has been announced that the Widener-Elkins syndicate has secured the Zanesville Railway, Light and Power Company of Zanesville and will make it a portion of the system of Ohio roads.

The Board of Public Service at Columbus has signed a contract with the Columbus Public Service Company for the use of its poles for the municipal wires, the price to be 15 cents a year for each wire contact. The company is to have the use of the city's poles free of charge. An injunction suit was brought to prevent the consummation of this contract and it is said that it will be taken to the courts.

The Mohawk Company was formed at New York a few days ago to act as a holding company for the various electric-railway properties that have passed into the possession of the Andrews-Vanderbilt syndicate and the New York Central road. The officers of the company are as follows: President, Horace E. Andrews, Cleveland; vice-president, W. K. Vanderbilt, Jr.; treasurer, E. L. Rossiter; secretary, A. L. Pardee of the New York Central. The directors are the four vice-presidents of the New York Central, J. J. Stanley, Walter Kernan and President Andrews of the Cleveland Electric.

The Cincinnati Trust Company, trustee for the bond of the Miami and Erie Canal Transportation Company to the extent of $2,000,000, has filed an answer to the ouster suit brought against the company by the attorney general, in which it denies that the company has transgressed upon the rights of the state or has operated otherwise than under the authority of the state. O. M. C.

Indiana.

Indianapolis, December 16.—The Vanderburg and Posey Electric Railway Company, capitalized at $10,000, has been incorporated. It is proposed to build an electric railway from Evansville to New Harmony and Mt. Vernon. C. F. Martin, E. B. Bixley, J. A. Higgins and Frank Emerson are the incorporators.

The Indiana Rapid Transit Company has been incorporated with a capital stock of $50,000. The chief offices will be in Indianapolis. It is proposed to connect by an electric railway Indianapolis, Terre Haute, Crawfordsville, Frankfort, Kokomo, Logansport, Plymouth and South Bend. P. M. Dunn, A. M. Weeden, I. G. Belser and C. C. Cowgill are the incorporators.

The Indiana Union Traction Company has renewed its efforts to secure a right-of-way and build an electric railway from Middleton to Newcastle.

The Louisville and Southern Indiana Traction Company has purchased the property of the Jeffersonville City Electric Railway Company. The line transferred consists of three miles of track running through the city and joining Port Fulton and Clarksville. This was the last mule line in the state to give way to electric power.

The Indiana Union Traction Company has announced that after January 1st, instead of a flat rate of 25 cents an article of baggage, the company will allow 150 pounds of baggage to be checked free of charge, if the owner of the baggage holds a full first-class ticket. Small parcels, such as can be readily handled by the passenger, will not be checked. For excess baggage one-fourth the cost of the passenger's ticket will be charged. The new rule allows the payment of excess baggage with coupons from the company's own mileage book, or from the coupon books of any of the Indiana or Ohio lines included in the interchangeable-mileage agreement.

The Indianapolis and Northwestern adopted the free-baggage service some time ago, and it is thought all the companies will soon do likewise.

It is reported that the Indiana Union Traction Company has taken over the Indiana Northern Traction Company, which has been operating a line between Marion and Wabash, a distance of about 20 miles. The consideration is not given out. Most of the stock was owned by New Jersey capitalists. The merger of these two roads gives the Indiana Union Traction Company 298 miles of track in one system. Through service over this branch will now be had with Indianapolis, and in a short time between Fort Wayne and Indianapolis, since the same interests control the connecting lines.

The Indianapolis, Newcastle and Toledo Electric Railway Company announces the filing of a mortgage to secure a bond issue of $4,500,000. The Knickerbocker Trust Company of New York and F. L. Eldridge of Indianapolis are named in the mortgage as trustees. It is said the road will be pushed to a speedy completion. D. M. Parry is president of the company.

The South Bend, Laporte and Michigan City Railway Company has been consolidated with the Indiana Railway Company under the new name of the Northern Indiana Railway Company, with a capital stock of $4,000,000. The interests of the new company are now building a line from South Bend through Niles, St. Joseph and Benton Harbor, Mich. This line has been opened as far as Berrien Springs and will be completed to St. Joseph within 30 days. The interurban development in Northern Indiana is exciting much interest, and it is thought the consolidation under the name and management of the Northern Indiana Railway Company is significant of still greater development.

The City Council of Columbus has taken steps toward the construction of a commercial electric-light plant in the city. At present the light is furnished by the local street-railway company. S. S.

Northwestern States.

Minneapolis, December 16.—The initial development of power at Taylors Falls, Minn., on the St. Croix River, described in the Western Electrician of October 28th, will be completed, it is announced, by June 1, 1906, when 12,000 horsepower will be available. This will be one-half of the total power to be developed at the new plant now being constructed by the General Electric Company. F. J. Hovey, district manager, is in Minneapolis and Taylors Falls, looking after matters connected with the work.

Twenty-six answers have been received to an advertisement of the Milwaukee Board of Public Works for a site for a municipal lighting plant. The prices range from $10,000 to $144,500.

The Ladysmith (Wis.) Light and Power Company's plant has been sold to G. E. Newman at $3,100. The purchaser intends to install a new dynamo and to begin operations within 30 days.

The Omaha and Council Bluffs Street Railway Company has decided to begin work of building the new line to Fort Crook and Bellevue, Neb., as soon as possible, and to continue the work throughout the winter. Contracts will be let at once.

The Waterloo and Cedar Falls (Iowa) Gas and Electric Light Company has been sold to a syndicate of capitalists of which I. C. Ellston of St. Louis is the head. The consideration is understood to have been $516,000.

John Rath has announced that he will construct an electric-light plant at Ackley, Iowa, and that he will present it to the city. The plant will cost about $13,000.

An election will be held at Battle Lake, Minn., to devote $9,000 worth of bonds for the construction of an electric-light and waterworks system.

The contract for a new dynamo for the electric-light plant at Rochester, Minn., was let to the Fort Wayne Electric Works.

The Fox River Valley Railway Company has failed to accept the franchise offered, and the project of building an electric line from Sheboygan, Wis., to Manitowoc and Kaukauna has been abandoned.

The council at Langdon, N. D., is looking for

a purchaser for the electric-light plant. An offer of $9,000 has been made, but it is thought that it will be rejected. R.

Pacific Slope.

San Francisco, December 15.—Hunt, Mirk & Co. of San Francisco have taken the complete contract for an addition to the North Shore Railroad Company's electric power plant at Alto. A 1,000-kilowatt Westinghouse-Parsons turbo-generator, Keeler water-tube boilers, condensing apparatus and auxiliaries are included. The Fairfax extension of the company's electric system has not yet been operated.

The Ocean Shore Railway Company's plans for an uptown passenger terminal in San Francisco will include a tall steel and brick building. The lower floors will be occupied as a modern passenger station. A half block, 275 by 550 feet, will be occupied by the buildings, tracks and train sheds. Owing to a private right-of-way being used largely, rapid time can be made. The Southern Pacific tracks and Florida Street will be crossed by an overhead structure of steel. Eight miles of track have been completed, extending north from Santa Cruz. Nearly two miles of track have been built from the Ocean View base, reaching to the second trestle. A telegraph system now connects the San Francisco offices with the construction work around the city.

Patrick Calhoun, the principal individual stockholder of the United Railroads of San Francisco, who has been here for the last month in the interest of that company, left for the East on December 14th. He proposes to make improvement of the Sutter Street line. New cars will be ordered at once, and the road itself generally improved.

An important deal has just been made between the California Gas and Electric Corporation and the Northern California Power Company, by which the former corporation will become a large purchaser of power from the latter. Owing to the closing down of a large smelter in Shasta County, the Northern California Power Company was left with a surplus of power, and the new arrangement enables the company to secure a steady market for all the power it can produce. On the other hand, the California Gas and Electric Corporation, which operates extensively in and about San Francisco, has found a market for more power than it is able to produce.

The city trustees of Santa Ana, Cal., have called an election for January 10th to vote upon the proposition of bonding the city to the amount of $110,000, which includes $60,000 for an electric-lighting plant.

The East Shore Railway Company is running a survey for an extension of its electric road from Point Richmond, Cal., to Point San Pablo. Construction work on this line will begin about January 1st.

P. V. Moore has applied for a street-railway franchise along Thirty-first Street, San Diego, Cal.

At the last regular meeting of the city trustees of Vallejo, Cal., it was decided to call a special election to decide upon the question of building a municipal electric-light plant.

The Marysville and Nevada Development Company at a meeting held at Marysville, Cal., last week, decided to put in a large dam at the "Narrows," on the Yuba River, for the purpose of developing electric power. It is claimed that 35,000 inches of water are available at that place for the development of electric power at all seasons of the year. Power will be supplied to Nevada County and neighboring counties.

Recent rains have caused a substantial rise in the American River, and the Folsom plant of the California Gas and Electric Corporation is again running full. This plant supplies power for the California State Prison at Folsom and for the lighting and electric-railway systems of Sacramento and vicinity.

The power house, electric railway and other machinery of the Pacific Electric Railway Company on Echo Mountain, near Los Angeles, was burned on the night of December 8th, causing a heavy loss, estimated at upward of $40,000.

A telephone and mail-chute service is to be installed in the new postoffice building in San Francisco.

The Banfield-Vessey Fuel Company has petitioned the City Council of Portland, Ore., for a franchise to lay pipe, wires and conduits for the purpose of furnishing light, heat and power to the public.

The Citizens' Light and Traction Company, which owns the electric-lighting, street-railway and gas systems of Salem, Ore., has bought the plant of the Union Light and Power Company at Silverton, which supplies light and power to Silverton, Woodburn, Mt. Angel, Gervais and other towns. A.

PERSONAL.

H. A. Patterson has resigned as president of the Mankato (Minn.) Gas and Electric Light Company, and J. B. Meagher was elected to succeed him.

W. J. Sherwood, who has served as chief clerk of the general superintendent's office of the Brooklyn Rapid Transit Company under three general superintendents, has accepted a place as assistant to the general manager of the Mexican Electric Company. This company operates a large number of electric lines in the City of Mexico and its suburbs.

John G. Boyd, often known as "Texas," and an active disseminator of Columbia incandescent lamps in the state of Iowa, was a Chicago visitor this week.

A. M. Robertson has tendered his resignation as manager of the Minneapolis General Electric Company. Mr. Robertson will be succeeded by A. W. Leonard, who has been manager of the electric-light and street-railway companies at Houghton, Mich.

O. F. G. Markhus has resigned as manager of the Union Light, Heat and Power Company of Fargo, N. D., to accept a position as manager of all the plants operated in the Northwest by the Maryland interests, his territory covering five states.

The announcement that President Henry S. Pritchett of the Massachusetts Institute of Technology has tendered his resignation and will soon remove from Boston has brought regret to electrical interests in that section. The Institute has thrived under his guidance. President Pritchett desires to devote his entire time to the Carnegie Foundation, of which he is president, and which was endowed with $10,000,000 by Andrew Carnegie about a year ago. Many friends wish him success in his new field of labor.

Mr. Paul Lüpke, superintendent of the Trenton division of the Public Service Corporation of New Jersey, has been appointed editor of the Question Box for the twenty-ninth convention of the National Electric Light Association, to be held next May or June. Mr. Lüpke has been from the first one of the most enthusiastic admirers and close students of the Question Box and is a firm believer in its value to central stations. He is himself a thorough engineer and will undoubtedly make the next Question Box the equal at least of its predecessors.

Prof. Henry S. Carhart of the University of Michigan, one of the four delegates from the United States to the British Association for the Advancement of Science, which met in Johannesburg, South Africa, in August, has written an account of the journey from Cape Town to the Victoria Falls of the Zambesi River. The story was printed in the Chicago Tribune of December 14th. At present, he says, there is only one great industry in South Africa—that of mining. A visit to South Africa would not be complete, says Mr. Carhart, unless it included Victoria Falls on the Zambesi.

H. A. Fisher of Joliet, Ill., general manager of the Joliet, Plainfield and Aurora electric railway, has gone, with his family, to Crockett, Texas, where he will spend the winter in his beautiful country home, which he erected last winter, about two miles south of Crockett. Mr. Fisher is a member of the Fisher Construction Company, which is largely interested in the building of electric railways, and which negotiated for the building of the Temple-Belton (Texas) electric railway, which is now in operation. The proposed Galveston-Houston line may also receive consideration by Mr. Fisher's company.

Hugh J. McGowan of Indianapolis has resigned as general manager of the Indianapolis Traction and Terminal Company in order that he may devote his entire time to the affairs of the big traction merger, of which he is the head and in which are already included nine Indiana and six Ohio electric railways. Mr. McGowan will continue, however, as the active head of the Traction and Terminal Company. His successor as general manager of the Indianapolis local lines will be Robert I. Todd of Providence, R. I. Mr. Todd has a record of success with the lines with which he has heretofore been connected. He will assume control January 1, 1906.

ELECTRIC LIGHTING.

The Jackson (Tenn.) and Suburban Street Railway Company will erect a new power house.

The Silverton (N. M.) Electric Light Company is to furnish power for an electric-light system which is to be established in Aztec, N. M.

The Fisher Power, Heat and Electric Lighting Company of Lewistown, Ill., capitalized at $20,000, has been incorporated by F. M. Condit, Theodore Fisher and H. W. Masters.

The Utah County Light and Power Company, of which A. J. Evans of Salt Lake is president, is preparing to put in a new plant at American Fork Canyon, at a cost of $110,000.

The Jim Creek Water, Light and Power Company of Arlington, Wash., has been incorporated with a capital stock of $40,000 by Thomas Moran, J. T. Moran and T. A. Hansen.

The contract for the construction of an electric-light plant for the city of Sparta, Ga., has been let to the Electrical Supply Company of Savannah, Ga. Fifteen firms bid for the contract. The plant is to be in operation by April 1, 1906.

ELECTRIC RAILWAYS.

R. C. Rawlins has asked the city of Chanute, Kan., for a franchise for a street railway.

A municipal street-railway system will be established in Monroe, La. Mayor Forsyth will contract for material.

The Des Moines (Iowa), Winterset and Creston Railway Company has been incorporated and will construct an electric railway.

The various interests proposing the construction of electric railways between Houston and Galveston, Texas, are said to have consolidated, and are now actively at work pushing the enterprise that is to soon connect La Porte, Seabrook, North Galveston and Texas City direct with the great gulf port and the railroad center of Texas by electric railway. James Agen, W. E. Scott and Ed. Kennedy of Houston and F. L. Dana of Colorado Springs, Colo., are among those interested in the new project.

Street-railway service in the Market Street subway of the Philadelphia Rapid Transit Company from the Schuylkill River to the City Hall was begun this week. The subway when completed will extend from the Schuylkill River to the Delaware River, a distance of two miles. Work on the portion completed was begun in April, 1903. An elevated railroad along Market Street from Sixty-third Street east to the Schuylkill, a distance of three miles, is under construction by the Philadelphia Rapid Transit Company. When completed cars from the "L" road will cross the Schuylkill and dip into the subway The new underground road has four tracks.

Reports from Cleveland, where the control of the roads is owned, say that the Aurora, Elgin and Chicago Railway Company and the Elgin, Aurora and Southern Traction Company are to be consolidated within a few months. A new corporation will be formed, it is said, with a capital stock of $6,000,000. The new merged system would be one of the strongest in this part of the country in strategical importance. It would control the traction business from Aurora, Elgin, Batavia and the other important cities of the Fox River Valley into Chicago and would operate from the center of the business district in Chicago with as frequent and as rapid service as would be wanted.

The first active steps toward building an electric railway between the Delaware River and the Atlantic Ocean were taken a few days ago by the Pennsylvania Railroad, when it leased a part of its Newfield branch and the entire Summers Point branch to the Atlantic City and Shore Railroad Company for a period of 40 years. At the same time the leasing company sold $750,000 worth of bonds, the proceeds to be used in constructing an electric system between Atlantic City, Pleasantville and Somers Point. It is the purpose to electrify the Newfield branch between Pleasantville and Newfield and to build an electric line between Camden and Newfield, paralleling the steam road which extends from Camden to Cape May.

PUBLICATIONS.

The National Electric Company is sending out a neat mailing card which calls attention to National type IC induction motors.

The Goldschmidt Thermit Company of New York city has reprinted in pamphlet form the paper upon "Thermit Practice in America," by E. Stütz, which was presented before the Franklin Institute at its meeting on October 28th.

Percy Pitman of Ledbury, England, manufacturer of the Pitman tangential waterwheel with adjustable nozzle, has had reprinted an article recently appearing in a technical journal describing the waterwheel and the theory of its operation. The wheel is of the Pelton type, but unlike this type is constructed to operate efficiently at comparatively low heads.

Warner arc lamps, manufactured by the Warner Arc-lamp Company of Muncie, Ind., are described in a bulletin recently issued. The type described is for direct-current series arc lighting. Incidently it may be mentioned that this company has recently received a contract for 360 of its lamps for city lighting in Topeka, Kan. These lamps are now being installed.

"Control Apparatus and Trolleys for Single-phase Railway Systems" is the title of one of the Westinghouse Electric and Manufacturing Company's latest bulletins. As the leading illustration is shown a car of the new Atlanta Northern single-phase system. The various details of the control system the trolleys and line construction used on the latest type of Westinghouse single-phase construction are described in the bulletin, which is a valuable addition to the literature on this subject.

A very comprehensive catalogue has just been issued by the Chicago Pneumatic Tool Company of Chicago, which covers its entire line of pneumatic tools and appliances together with a complete price list of repair parts entering into all the tools in general use, including the Boyer and Keller products. It is of interest to note as showing the growth of this company that 11 years ago the first advertising literature that it issued consisted of a

16-page folder for enclosing in a 6¾-inch envelope, whereas the present handsome catalogue contains 192 pages six by nine inches. The new catalogue is now ready for distribution, and buyers in this line will find it of great value.

A handsome little booklet from the American Engineering Company of Indianapolis contains an interesting set of pictures showing the company's headquarters in the Traction Terminal Building. Besides making expert examinations, reports, valuations, etc., of existing properties, the company acts as designing and consulting engineer for steam and electric railways, electric power plants, waterpower developments, etc. The booklet contains an electric interurban map of Indiana as a desirable feature.

Bullock multipolar motors and generators of the types known as H and HI are described in a recent bulletin issued by the Allis-Chalmers Company of Milwaukee. These machines are intended for use wherever belted generators and motors of any but the smallest varieties are required. The designation HI is used to indicate that the machine to which it is applied has the brush-holder rigging attached to the magnetic yoke, whereas the regular type H has the brush-holder rigging attached to the bearing pedestal.

There is a wide field of application for motor drive in which the conditions are extremely severe. This class of service includes crane and hoisting work. The Northern Electrical Manufacturing Company of Madison, Wis., has developed a line of box-type motors. These equipments are completely enclosed and thus dustproof. They are frequently built weatherproof. This class of motors has an extremely sturdy armature shaft and liberal bearings, and compact although accessible arrangement of the motor parts. Bulletin No. 32 is descriptive of these equipments.

Those who have never visited the city of New York will find both interesting and instructive the handsome souvenir entitled "King's Views of New York," which is being presented to its friends by the Otis Elevator Company of that city. There are 400 illustrations in the souvenir, which is in magazine form, showing all the skyscrapers and public buildings, streets scenes indicative of the life of the city, the great bridges which span the East River, some of the finest shipping, the park system, monuments, etc. Particularly is the fine birdseye view of the downtown district of the Borough of Manhattan, taken evidently from the Statue of Liberty. The souvenir is comprehensive and prepared with due regard to the classification of the various pictures so as to give the whole book a pleasing appearance. The Otis Elevator Company is to be congratulated on the excellent character of the latest attempt to please its patrons, and the souvenir will be highly prized by recipients. It was due to the high-power high-speed elevator that the skyscrapers shown in the illustrations were made possible.

A useful and comprehensive book upon the Mannheim and multiplex slide rules—their theory and practical applications—by L. W. Rosenthal, has been issued by the Eugene Dietzgen Company. The book treats of the theory and operation of these two types of slide rule in a manner which is entirely adequate for practical purposes. There is also contained in the book a set of 29 conversion tables which will be of value as a time-saver in making calculations. Of most interest probably will be Part II., which takes up the latest invention in slide rules, namely, the multiplex slide rule. This is a calculation instrument with many uses, as its name indicates. Some of the things which can be accomplished with this rule besides the usual computations are the multiplication of three numbers at one setting, division of one number by two numbers at one setting, direct reading of cubes and cube roots, direct reading of three halves and two-third powers, etc.

MISCELLANEOUS.

Isham Randolph and Edward B. Ellicott were retained as chief engineer and principal assistant engineer, respectively, of the Sanitary District of Chicago by the new board of directors, which held its first meeting on December 13th. President McMormick of the board of directors called attention to the fact that 15,000 horsepower to be developed by the drainage canal will be available for the use of cities within the district by November of next year. The power will be delivered over the lines of the Sanitary District to Forty-eighth Avenue, Chicago, and all municipalities desiring power will be obliged to take it from that point.

The New York School of Automobile Engineers opened in New York city last week. Fifty-four students constituted the regular day class, besides an owners' class of 25 and a night class of 15. Prof. C. E. Lucke of Columbia University is director of the school, and there are six other instructors. The method of instruction has been outlined under 10 general heads. The students will be given eight weeks of thorough mechanical instruction as to construction of machines and in assembling and use of all the parts. Two weeks of actual road work will be included in the course. The school also proposes to keep a record of automobile breakdowns, and this data will be tabulated, with a view of compiling information that will assist in perfecting the design of automobiles. R. B. Whitman is business manager of the new school.

L. R. Hare of Seward, Alaska, is now on his way East to arrange for the installation of an extensive electric power plant and distributing system on the Kougarok River, Alaska. The plans of Mr. Hare and his associates include the utilization of 50,000 inches of water, the driving of a tunnel 661 feet long, and the construction of a reservoir and pipe lines. Three direct-connected centrifugal pumps capable of lifting 1,500 inches of water per minute will be installed next spring.

Both electricity and gas undertakings are said to be in severe competition in Birmingham, England, for the capture of the smaller manufacturers who require a power supply of from one to 20 horsepower daily. The charges per unit for electrical energy are to be reduced from 3d. to 2d., and from 2d. to 1½d., according to the quantity taken, while the gas charges will drop from 2s. 6d. to 1s. 10d. and 1s. 7d. per 1,000 cubic feet, according to quantity. It is expected that the new charges will entail initial losses in both departments.

The petition of the city of Chicago seeking to compel the Board of Review to assess the tunnels of the Illinois Tunnel Company has been dismissed by Judge Gibbons, who decided that the jurisdiction over the property sought to be assessed is vested in the State Board of Equalization and not in the Board of Review. The petition alleged that the company has tangible property worth approximately $20,000,000. The decision, if sustained by the Supreme Court, will mean a loss of about $100,000 to the city of Chicago, that being the amount the city would realize from taxation by the Board of Review more than by the State Board of Equalization.

The Consolidated Oxygen and Chemical Company is a new industry at Niagara Falls. The capital stock of the company is $50,000 and the works are located on Main Street near the factory district of the Niagara Falls Hydraulic Power and Manufacturing Company. The company will manufacture oxygen by a process invented by F. W. Clifford, who, with S. A. Clifford, both of New York; Thomas Stoddart of Buffalo; B. M. Hyde, Rochester; A. B. Husted of Albany and Weston Jones of Dunkirk, compose the company. The present output will be about 200 cubic feet of oxygen a day. Experiments will be made with by-products.

Reporting on the various industrial enterprises which are active in Japan, some of which he thinks may soon compete in America and Europe, Consul Sharp of Kobé has this to say of machinery: "A great deal of the simpler kinds of machinery is already made in Osaka, and exports amounted to $285,609. Electric motors are manufactured in Kyoto and Osaka, but not over 17 horsepower, ordinarily. Dynamos and other electrical appliances are also made in the district to a considerable extent. The majority of the locomotive engines are imported, but some are constructed here, usually with imported parts. Railway cars are made, the trucks being commonly imported."

Considerable power is now required in cement plants, and electricity is coming into general use. Either the alternating or direct-current system is adapted to this work, the choice depending on local conditions. The plant of the Iola Portland-cement Works at Dallas, Texas, is equipped with Westinghouse direct-current motors, and the Santa Cruz Portland-cement Company of San Francisco, Cal., is about to adopt electricity. The Santa Cruz equipment calls for one 800-horsepower type C motor, 10 250-horsepower, 15 150-horsepower, one 75-horsepower and one 30-horsepower motors. These are all alternating-current motors of the induction type and aggregate a total of 5,655 horsepower.

Several attempts have been made in Fort Wayne, Ind., to prevail upon the City Council to adopt an electrical inspection ordinance, but so far without success. The main objection raised is that it would involve the city in an additional expense. The election just closed is believed to have resulted favorably for aldermen who would be interested in an ordinance of this character. Most of the electrical contractors have signified a desire for municipal supervision, and a meeting to consider the matter will be called in the near future. The lighting company management has indorsed municipal supervision of electric wiring and would be glad to turn over this work to the city as soon as possible.

Electricity will be used from the outset for the motive power in the case of all trains passing through the Simplon Tunnel. The steam locomotive on the south-going train will be replaced by an electric locomotive at Brieg, which will take the train as far south as Domodossola, the first important junction station on the Italian side. This would imply the use of electric traction over a distance of about 25 miles in all, and it is proposed that in the first instance the electric locomotives employed should be those belonging to Italy, of which five will be placed at the disposal of the Swiss authorities for this purpose. The current will be conveyed from the generating station, which already exists for the service of the tunnel construction works at Brieg at a pressure of 3,000 volts. It is estimated that ample horsepower will be available at Iselle and Brieg for this service. The substitution of electricity for steam on the Swiss lines will no doubt be expedited by this decision.

TRADE NEWS.

William H. Black, president of the Missouri Valley College of Marshall, Mo., is reported as wanting prices on electrical equipment.

L. B. Stillwell and John Van Vleck announce the removal of their electrical and general engineering offices to 100 Broadway, New York city.

The Premier Electric Company of Chicago has recently opened a New York office at 227 Fulton Street, with A. S. Merrill in charge of all eastern trade.

William D. Gherky of Philadelphia, engineer and contractor, has removed to more commodious quarters in the Heed Building, 1211-13-15 Filbert Street, where all future communications should be mailed.

It is reported that inquiry among manufacturers and agents in New York indicates that more than 500,000 horsepower of steam turbines is now in operation in the United States and an additional 1,000,000 horsepower is contracted for and building in the works of two builders of steam turbines for power service in this country.

The Eastern office of the Sterling Electric Motor Company is now at 143 Liberty Street, New York city. Mr. Allen, formerly consulting electrical engineer of the Marine Engine Company, and J. J. Estabrook and others having formed a company called the Engineering Specialty Company, which will have the handling of the Sterling machines in that territory. Mr. Estabrook was formerly manager of the New York office for the Holtzer-Cabot Electric Company.

The Navy Department, through the Bureau of Supplies and Accounts, is inviting sealed proposals until January 2, 1906, for furnishing the League Island and New York navy yards with the following supplies: Schedule 285, panel boards, cable, conduit and fittings, electrical supplies; schedule 286, incandescent lamps, annunciators, cable, wire, insulating tape, fuses, testing generators, voltmeters, telephone headgear and electrical supplies; schedule 288, electrical wire. Proposal blanks and further information can be secured upon application to the bureau at Washington or to the navy pay office in New York. On January 9th the bureau will open bids for furnishing the Pensacola navy yard and the New Orleans naval station with wire and miscellaneous electrical supplies embraced in schedule 290, which can be obtained upon application to the bureau.

The American Stoker Company has acquired from the McMyler Manufacturing Company of Cleveland, Ohio, its chain-grate stoker business, which has been operated under the trade name of the Victor chain-grate stoker. The acquisition includes patterns, patents, drawings and good will. Mr. F. Girtanner, the designer of the stoker and the mechanical engineer under whom it has been developed, enters the employment of the American Stoker Company. The commercial development of the Victor stoker has been somewhat retarded, it is said, from the fact that the McMyler Manufacturing Company was extremely busy with its own special line of ore-handling machinery, but the aggressive management of the American Stoker Company, combined with the merits of the Victor stoker, is expected to soon make this machine an important factor in the field of automatic stoking. Hereafter it will be known as the American chain-grate stoker. It will be handled by the American Stoker Company concurrently with its well-known underfeed stoker.

Robert T. Lozier has been appointed New York district manager for the Power and Mining Machinery Company of Cudahy, Wis., of which Seward Babbitt is sales manager. Mr. Lozier is well known and well liked in electrical circles. Within recent years he has been manager of the eastern office of the Bullock company and afterward associated with the National Electric Company of Milwaukee. His headquarters in New York for the Power and Mining Machinery Company will be at 52 William Street. This company has made great progress in introducing into electric-light plants its large American Crosley gas engines, Loomis-Pettibone gas generating system and American-Crossley suction gas plants. It makes a specialty of manufacturing large gas power plants to drive all kinds of electrical generators not only for lighting but for traction and power work and asserts the attainment of a fuel cost less than one-half of that of the most efficient steam plant. During the last year success has been attained in the introduction of its power system in various sections not only in the United States but in other quarters of the world.

A contract recently closed by the Electric Storage Battery Company of Philadelphia with the Spokane and Inland Railway Company of Spokane, Wash. (see Western Electrician of October 14th) illustrates the flexibility of the storage battery and its adaptability to meet special conditions. In this instance the battery is installed to regulate the fluctuations of a single-phase railway load. Power is purchased as three-phase 60-cycle current from the

Washington Water Power Company on the maximum-demand basis, and delivered, through motor-generator sets, to the single-phase line. Each motor-generator set will be provided with a direct-current machine mounted on the same shaft and connected to the terminals of the battery circuit. The battery charge and discharge will be effected by two boosters in the battery circuit operating in parallel with each other, each having a capacity equal to one-half the maximum output of the battery. These boosters will be controlled by the Electric Storage Battery Company's carbon regulator, which in this case will be made responsive to fluctuations of the alternating-current supply, thus causing the battery to keep those fluctuations within narrow limits.

E. J. Kulas has been appointed secretary and general manager of the Brilliant Electric Company of Cleveland, Ohio, with office at 66 Chestnut Street. Mr. Kulas was for some years connected with the Buckeye Electric Company and did excellent work for that concern. Later he was with the Bryan-Marsh contingent, operating in both the New York and Chicago territory. Mr. Kulas has had a wide experience in the incandescent lamp business and in taking the management of the Brilliant Electric Company it is his purpose to manufacture a tipless lamp and to put it on the market at the same price as that offered by other manufacturers handling the tipped lamp. The Brilliant Electric Company has a special method of exhausting its tipless lamp manufactured under its patents, and it is a process that enables the company to make what it believes is a better tipless lamp than a tipped lamp. In addition to the special Brilliant tipless lamp which the Brilliant Electric Company will manufacture under Mr. Kulas' management, the company will also make a high-grade Brilliant tipped lamp to meet the competition in the regular incandescent lamp trade.

BUSINESS.

The Elkhart (Ind.) Review says that the business of the Kuhlman Electric Company of that city is so prosperous that the capacity of the plant will have to be doubled next year. Mr. Kuhlman returned recently from a business trip in the East.

The Indiana Rubber and Insulated Wire Company of Jonesboro, Ind., is installing at its factory additional wire-testing machinery in the way of a direct-connected generator, stationary switchboard fitted with rheostat and necessary switches and appliances for the testing of rubber-covered wire with from 100 to 50,000 volts. The maximum breakdown test of 30,000 volts required for 3,500-volt arc circuits by the Board of Underwriters, it will be noted, is 20,000 volts less than the test which this company is enabled to make by means of its increased testing apparatus.

From Los Angeles, Cal., comes the news that the Western Electric Company of Chicago has leased for five years from the time of completion the new business block to be erected for the Kerckhoff estate in Seventh Street, Los Angeles. The building will be 50 by 126 feet, three stories high.

A visit to the Indiana Steel and Wire Company's plant in Muncie, Ind., would interest any buyer of telephone and telegraph wire who wished to satisfy himself of the thoroughness and quality of the wire he intended buying. This company has an up-to-date well-equipped plant of large capacity with facilities for turning out high-grade double galvanized telephone and telegraph wire. This wire is made by a continuous process from the best obtainable iron, and it is said to have a high degree of strength and conductivity, and is pliable, tough and uniform. Three grades are made as follows: Extra Best Best (E. B. B.), Best Best (B. B.) and Steel. Robert Miller is in charge of the telephone and telegraph wire business of this company and, with many years practical experience in this line, is well qualified to give it careful attention.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) December 12, 1905.

806,769. Adjustable Support for Telegraph Line Wires. Jasper N. Bell, Stratford, Iowa. Application filed December 23, 1904.

An insulator for telegraph line wires is composed of two parts of rigid insulating material semicircular in cross-section, fitted together to produce a short tube having a longitudinal bore in its center extending from end to end to admit a wire conductor.

806,777. Controlling Means for Electric Motors. Charles M. Clark, South Orange, N. J. Application filed July 7, 1903.

Telpher and hoisting motors receiving current from different lines are provided with a single switch and connections for operating either of the motors. Means automatically reverse both motors when the circuit is broken at any point.

806,782. Magnetic Clutch. George A. Damon, Chicago, Ill., assignor to the Arnold Magnetic Clutch Company, Milwaukee, Wis. Application filed February 21, 1903. Renewed December 7, 1903.

Combined with coacting members is a yielding support for at least one of the members arranged to permit other than a right-line movement of one of the members in approaching the other member.

806,790. Telephone Bracket. Henry F. Foersterling, St. Louis, Mo. Application filed March 6, 1905.

Mechanical parts of an adjustable bracket for telephones are described in the patent.

806,801. Telegraph Repeater. Oscar C. Greene, St. Paul, Minn., and Charles H. Gaunt, Topeka, Kan. Application filed April 28, 1902.

Associated with two main telegraph lines and their relays are a pair of repeating sounders, the magnet of each sounder having two differential windings. One winding forms a permanently closed and energized local circuit and the opposite winding forms a local circuit through one of the contact points of the adjacent relay and one of the contact points of the other repeating sounder. By this arrangement the armature of the sounder upon the outgoing side will open or close the local circuit of the opposite sounder, which passes through the contact point of its relay.

806,812. Double Jack for Telegraph Circuits. Ola Johnson, Conway Springs, Kan. Application filed March 16, 1905.

The associated parts are a relay, a main circuit connected therewith for energizing it, a local circuit connected with the relay, a double jack connected with both the main circuit and the local circuit, a key and a sounder connected with the jack and main and local wiring connected with the jack, the local wiring containing an extra sounder to be energized in lieu of the first-mentioned sounder.

806,822. Carbureter. Orson Millard, Flint, Mich. Application filed April 18, 1905.

The oil-inlet valve of the carbureter is controlled by an electromagnet.

806,835. Electroplating Apparatus. Louis Potthoff, Flushing, N. Y. Application filed December 1, 1904.

A tumbling-barrel having a longitudinal opening in one side is provided with a shield over the opening and an interior cathode. A fixed outside anode is adapted to guide the material when discharged from the barrel.

806,853. Manufacture of Vaporelectric Apparatus. Percy H. Thomas, East Orange, N. J., assignor to the Cooper Hewitt Electric Company, New York, N. Y. Application filed February 12, 1904.

Removing injurious gases or vapors from an electrode inside a vapor electric container is accomplished by making the electrode a terminal of an electric circuit passing current therethrough, and regulating the pressure of the vapor in the path between the electrode and its cooperating electrode. (See cut.)

806,860. Spark-igniter System for Explosion Engines. David L. Winters, Chicago, Ill. Application filed March 6, 1905.

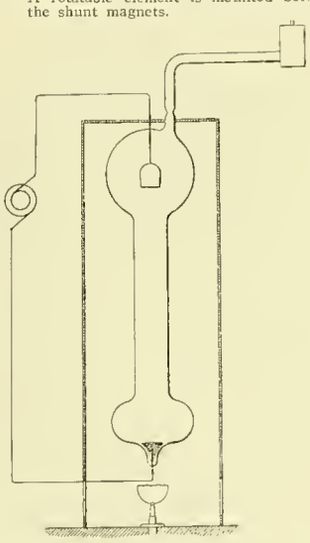
An electrical ignition system for explosion engines operated by battery-cells is described.

806,867. Trolley Contact. Ira J. Bradshaw, Waukegan, Ill., assignor of one-half to Jacob J. Dietmeyer, Waukegan, Ill. Application filed filed September 1, 1905.

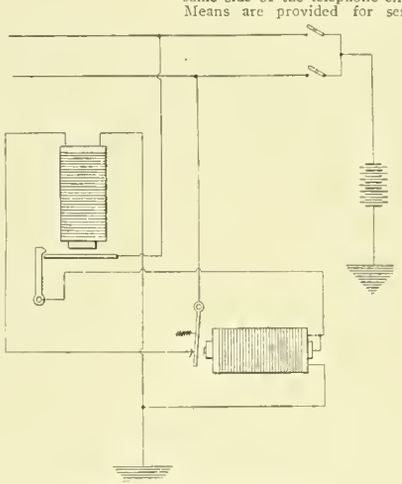
The contact of an annunciator placed above the trolley wire is moved by the trolley wheel as it passes beneath the wire.

806,881. Alternating-current Electricity Meter. Sebastian Z. de Ferranti and William Hamilton, Hollinwood, England. Application filed August 14, 1903.

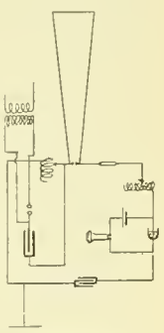
The essential parts are a series electromagnet, a multipolar shunt magnet and a coil connected as a shunt across the supply mains and wound on a part only of the shunt magnet. By means of this coil considerable magnetic leakage is produced from the remaining parts. A rotatable element is mounted between the series and the shunt magnets.



NO. 806,853.—MANUFACTURE OF VAPOR ELECTRIC APPARATUS.



NO. 806,950.—PARTY-LINE SELECTIVE TELEPHONE SYSTEM.



NO. 806,966.—SPACE-TELEGRAPH SYSTEM.

806,884. Telegraphic Repeater. Stephen D. Field, Stockbridge, Mass., assignor to John J. Ghegan, Newark, N. J. Application filed December 31, 1904.

A duplicate and a main line contain a relay, a circuit-controlling device being actuated by the relay, which controls line and local contacts of the opposite set. The relay is also adapted to operate the line contacts before the local contacts. Means for accelerating the movement of the relay-armature when the opposite controlling device closes the line contacts are provided.

806,891. Telegraphic Apparatus. Melville A. Hawley and William L. Rhoads, St. Louis, Mo.; said Rhoads assignor to said Hawley. Application filed April 3, 1905.

Combined with a relay having the main-line magnets and armature for shunting the circuit of a local battery are an auxiliary magnet and a secondary springy armature fixed to and insulated from the main armature. The free end of the secondary armature is extended beyond the corresponding end of the main armature and adapted to make and break contact with an adjustable contact point in the main-line circuit for directly repeating and transmitting signals into the opposite line.

806,937. Insulated Wire Support. John A. Sullivan, Cleveland, Ohio, assignor of one-half to I. F. Helper, Cleveland, Ohio. Application filed December 15, 1904.

An insulated wire support comprises a pair of semi-cylindrical grip sections having means to detachably secure them together and hold the insulator.

806,942. Electric Time Lock. John T. Van Dillen, St. Louis, Mo. Application filed August 17, 1904.

The armature of an electromagnet is connected to the locking bolts, so that when the magnet is energized the bolts are withdrawn. Clock mechanism opens and closes the electromagnet circuit inside of the safe. There are also means for opening and closing the circuit outside of the safe.

806,950. Selective System for Party-line Telephones. William M. Bruce, Jr., Springfield, Ohio, assignor of one-third to James S. Brailey, Jr., Wauseon, Ohio, and one-third to Charles D. Juvenal, Springfield, Ohio. Application filed April 3, 1905.

Associated with the telephone circuit is an operating magnet in a grounded circuit connected to one side of the main circuit. An auxiliary magnet in a grounded circuit is normally disconnected from the other side of the main circuit, but adapted to be brought into connection by the operation of the main magnet. A circuit-breaker operated by the auxiliary magnet breaks the circuit through the main magnet from one side of the telephone circuit and establishes a connection from the same side of the telephone circuit to the auxiliary magnet. Means are provided for sending an electrical impulse over both sides of the telephone circuit through the main and auxiliary magnets. (See cut.)

806,953. Electric Signaling Apparatus. Louis A. Codére and Alphonse E. Choquette, Sherbrooke, Canada. Application filed November 25, 1904.

A pair of line conductors is normally maintained in open circuit, the first of the conductors extending unbroken past a number of stations. A third conductor unbroken between each station is provided with electric signals connected across from it to the first circuit-conductor. Switches closes the third conductor at each station to extend its continuity beyond the station, the second of the pair of conductors being also unbroken between each railway station. A number of contact devices are connected across the second conductor and the third conductor.

806,966. Wireless-telegraph System. Lee De Forest, New York, N. Y. Application filed January 25, 1904. Renewed October 14, 1905.

Electric wave signaling apparatus embodies an antenna-loop joined at the top but insulated at the base. A closed electric circuit is connected to the antenna base terminals. Transmitting and receiving means are operatively associated with the closed electric circuit and a spark gap is constructed and arranged to permit both sides of the antenna loop to act as a single transmitting-radiator, and also to enable the antenna to act as a loop in receiving. (See cut.)

807,009. Safety Apparatus for Railways. Samuel L. Adelson, New York, N. Y., assignor of one-half to Maurice Adelson, New York, N. Y. Application filed June 29, 1905.

Two contact devices are arranged on a car or locomotive on the railway, and each is adapted to strike a corresponding contact-plate in a casing in each group of blocks. Devices connected with the car or locomotive and with each of the casings notify the engineer of a following car or locomotive of the fact that another car or locomotive is in a preceding block of the railway.

807,017. Electric Time Switch. Milton T. Campbell, Indianapolis, Ind., assignor of one-half to John C. Ertel, Indianapolis, Ind. Application Filed June 5, 1905.

Combined with a time train are a cam disk driven by an hour sleeve, intermediate connections between the disk and hour-sleeve permitting axial movement of the disk without preventing angular movement, means for automatically shifting the disk axially and means operated by the axial movement of the disk for operating the switch mechanism.

807,029. System of Electric Railways. Joseph H. Hoadley, New York, N. Y. Application filed September 16, 1904.

An electric generator is operated by a combustion engine on the car. The car is also supplied with a motor which takes its current from an external conductor. The motor thus has two sources of power either of which may be used.

807,034. Process of Decarburizing. Franz von Kügelgen and George O. Seward, Holcombs Rock, Va., assignors to the Willson Aluminum Company, New York, N. Y. Application filed January 16, 1904.

Decarburizing a metalliferous substance is done by fusing it as an electrode in presence of a substance having a high affinity for carbon. (See cut.)

807,051. Electric Attachment Plug. Frederick F. Strong, Boston, Mass. Application filed April 3, 1905.

An electric attachment plug comprises cooperating parts adapted to fit into each other and each provided with a number of independent threaded portions separated by longitudinal threadless portions, the containing part being tubular and having its threadless portions of greater radius than its threaded portions.

807,053. Switch Signal. John C. Wigman, Green Bay, Wis. Application filed April 6, 1905.

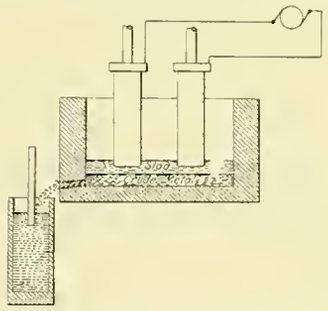
A circuit-closer for switch signals comprises a bar secured to the switch-point, a lever mounted to oscillate in a horizontal plane and positioned to be struck by the bar, electrical connections with the lever and a contact-post in the path of the oscillation of the lever.

807,089. Electrically Driven Suspended Railway. Rudolph Pfaffenbach, Leipsic, and Herman Müller, Leipsic-Gohlis, Germany. Application filed January 13, 1904.

An electrically operated system of telpherage is described in the patent. Two parts of the track upon which the carriers operate are at different levels, and the connecting inclined portion is provided with an auxiliary cable for mechanically propelling the car up the incline.

807,093. Safety Fuse. Joseph Sachs, Hartford, Conn., assignor to the Johns-Pratt Company, Hartford, Conn. Application filed December 11, 1903.

A fuse-strip has returned ends with terminals or ends composed of double wires threaded through the returned ends. The terminals also pass through apertures in the end caps of the casing into sunken parts, a material filling the sunken ends and surrounding the fuse ends.



NO. 807,034.—DECARBURIZING APPARATUS.

807,102. Cut-off Controlling Mechanism for Continuous Cigarette Machines. Edmund Zschernig, Dresden, Germany. Application filed February 23, 1905.

Electrical devices control the retarding device of the machine.

807,175. Multiple-cascade Driving System of Rotary-current Motors. Coloman de Kando, Budapest, Austria-Hungary, assignor to the Railway Electric Power Company. Application filed October 14, 1903.

A number of cascade systems, the primary motors of which are wound for direct connection with the line and the secondary motors of which are wound for connection with the secondaries of the primary motors are provided with means for connecting a secondary motor of one system as a cascade motor of higher order in another system. (See cut.)

807,198. Illuminated Sign. Lucius R. Paige, Worcester, Mass., assignor to Eugene A. Bofinger, New York, N. Y. Application filed November 14, 1903.

Incandescent electric lamps furnish the light for the interior of the sign casing.

807,199. Magnet-controlled Third-rail System. Henry J. Palmer, Philadelphia, Pa., assignor of one-half to Max Bleiman, New York, N. Y. Application filed October 3, 1904.

Combined with a cable is magnetic mechanism for attracting it, a contact member being engaged by the cable when lifted by the magnetic mechanism. A support mounted upon a vehicle sustains the magnetic mechanism, and magnetic mechanism mounted upon the vehicle is adapted to pass over the contact member. A conductor is adapted to temporarily engage the contact member for the purpose of completing a circuit through the movable conductor and the contact member. A metallic gutter supports the conductor.

807,235. Alarm and Telephone System. Garrison Babcock, Chicago, Ill. Application filed December 14, 1903.

Associated with a normally closed main circuit are a source of current in the circuit, a sensitive relay included serially in the circuit and responsive to slight resistance changes in the circuit, an additional relay in the circuit responsive only to comparatively great resistance change in the circuit and means for preventing actuation of the sensitive relay upon actuation of the additional relay.

807,263. Junction Box for Electrical Conductors. Edwin T. Greenfield, Monticello, N. Y. Application filed June 21, 1904.

A junction box is provided with clamping means concentric with the inner surface or wall of the box and additional means for causing it to act simultaneously upon all of the ends of the inleading armored conductors or conduits.

807,270. Thermal Cut-out for Electric Conductors. Bryson D. Horton, Detroit, Mich., assignor to the Horton-Morehouse Company, Detroit, Mich. Application filed March 13, 1905.

A fuse-wire traversing a case is provided at its middle part with a portion more readily fusible than other portions. A spring is located at one end of the case, a tie connecting the spring to the more readily fusible part of the conductor and holding the spring in a state of tension while the fuse remains in an uninjured condition.

807,277. High-voltage Spark Arrester. Fritz Jordan, Frankfort-on-the-Main, Germany, assignor to Society of Elektrizitäts Aktien-Gesellschaft vorm. W. Lahmeyer & Co., Frankfort-on-the-Main, Germany. Application filed January 6, 1904.

A high-voltage spark-arrester comprises two verticallly-disposed bars placed at a distance from each other, and presenting their sides as electrodes to each other, one of the bars being of metal and the other of carbon. When a spark is struck between the bars, a pearl of fused metal is formed on one bar and a corresponding depression is formed on the carbon bar, thereby maintaining the spark-gap constant.

807,287. Signaling and Train-controlling System for Railways. Frank E. Kinsman, Plainfield, N. J. Application filed April 18, 1905.

Combined with a line of way are controlling means on the line for governing the movement of a vehicle or train and a signal circuit separate therefrom and governing a semaphore or similar signal and governed as to its danger condition by a corresponding condition of the controlling means.

807,290. Method of Providing for the Extinguishment of Fires in Mines. Joseph Krzyzanowski and Stanislaus Wysocki, Juzowka, Russia. Application filed October 17, 1903.

The method of providing for the extinguishment of fires in mines consists in dividing the mine into sections distributed lengthwise along the principal air-passage, setting up in the air-passage which connects the sections permanent but normally open closing devices, one at each end of each section, and providing electrical means for closing at will any or all the devices.

807,307. Insulator. Louis McCarthy, Boston, Mass. Application filed February 18, 1904.

The insulator comprises a body of molded composition having formed thereon one or more skirts or projections for the shedding of moisture, and having an opening to permit the passage of supply-wires of a size sufficient for the reception of surplus wires.

807,316. Telephonic System. Robert H. Polk, Birmingham, Ala. Application filed January 19, 1904.

Two sets of receiving and transmitting instruments, and a single metallic talking-circuit therefor are contained in the system. An electrical signal device on each side of the circuit, one of the signal devices being designed to be actuated by current supplied through one side of the circuit, and electrically actuated means for reversing the sides of the circuit for supplying the current to the other of the signal devices are the other features.

807,336. Adjustable Lamp Hanger. John H. Thompson, Charleston, W. Va., assignor to the Universal Electric Equipment Company, Birmingham, Ala. Application filed March 8, 1905.

A cord adjusting device is described.

807,337. Switch and Lock Movement and Detector Bar. Louis H. Thullen, Edgewood, Pa. Application filed August 28, 1905.

A controlling device for the pneumatic valve is operated electrically.

807,345. Fusible Cut-out. George Baehr, McKeesport, Pa., assignor to the National Tube Company, Pittsburg, Pa. Application filed January 14, 1904.

Details are described.

807,386. Signaling and Train-controlling System for Railways. Frank E. Kinsman, Plainfield, N. J. Original application filed April 18, 1905. Divided and this application filed July 24, 1905.

Semaphore or equivalent signal is located in a fixed position on the line of way, a track circuit controlling the position of the signal

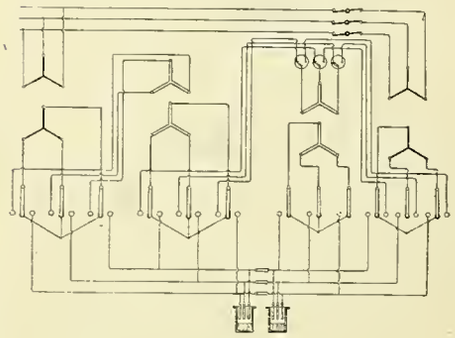
REISSUES.

12,419. Electromechanical Device for Electric Traction. Eugenio Cantono, Rome, Italy, assignor of thirty-six fortieths to Giovanni Mazzacorati, two-fortieths to Edward de Reszke and two-fortieths to Paul M. Herzog, New York, N. Y. Application filed May 10, 1905. Original application filed February 4, 1902.

Steering mechanism for vehicles comprises a number of motors independently geared to the driving-wheels, means for connecting the armatures of the motors in series, and means for steering the vehicle to the left or right when traveling backward, with the motors so connected, by increasing the excitation of the field and thereby increasing the speed of that motor on the same side as that of the direction of turning.

12,421. Apparatus for purifying, Sterilizing and Aging Liquids. Robert C. Turner, Columbus, Ohio, assignor of one-half to Clarence E. Turner, Columbus, Ohio. Application filed July 28, 1905.

Apparatus for purifying, sterilizing or aging liquids comprising two or more separate vessels having spouts or outlets near their tops and arranged to discharge from one into the other, a metallic funnel constituting an electrode. The funnel is arranged to discharge above the liquid level of the vessel and a metallic piece also constitutes an electrode in each of the vessels.



NO. 807,179.—MULTIPLE-CASCADE SYSTEM.

12,422. Electrical Stop-motion Mechanism for Textile Machinery. Joseph B. Whitney, Brooklyn, N. Y. Application filed October 2, 1905. Original application dated April 18, 1905.

In a stop-motion mechanism for textile machinery are pivoted detectors or fallers, wires, each of the detectors or fallers being adapted to coact with the wires as a circuit-closer, and means for maintaining the wires under tension.

12,423. Electric Stop Motion for Textile Machinery. Joseph B. Whitney, Brooklyn, N. Y. Application filed October 2, 1905. Original application dated May 23, 1905.

In electromagnetic stop-motion for looms are an electric circuit, a circuit-closer adapted to be controlled by one of the warp threads which is to form the material produced by the loom, an electromagnet adapted to be controlled by the circuit, an armature for the magnet and operative connecting means between the batten and the armature whereby the armature is periodically moved against the magnet.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on December 18, 1905:

394,568. Switch or Circuit Changer. William W. Griscom, Haverford College, Pa.
394,614. Separating Diaphragm for Galvanic Batteries. Isaiah L. Roberts and Henry L. Brevoort, New York, N. Y.
394,615. Treating Diaphragms and Cups for Use in Electric Batteries. Isaiah L. Roberts, Brooklyn, N. Y.
394,616. Diaphragm for Galvanic Batteries. Isaiah L. Roberts, Brooklyn, N. Y.
394,617. Diaphragm for Galvanic Batteries. Isaiah L. Roberts, Brooklyn, N. Y.
394,621. Electric Tramway. Michael H. Smith, Halifax, County of York, England.
394,627. Electric Brake System. Watson P. Widdifield, Uxbridge, Ontario, Canada.
394,638. Separting Partition for Galvanic Batteries. Henry L. Brevoort and Isaiah L. Roberts, Brooklyn, N. Y.
394,642. Distribution of Electricity by Secondary Batteries. Thomas P. Conant, New York, N. Y.
394,648. Conduit for Electric or Cable Railways. Thaddeus W. Harris, New York, N. Y.
394,670. Galvanic Battery. Robert D. Wright, Kirkwood, Mo.
394,680. Support for Incandescent Electric Lights. Alfred Dawes, Chelsea, Mass.
394,697. Telegraphy. Percy F. Jamieson, Batavia, Ohio.
394,728. Indicator for Electric Circuits. Oliver C. Shallenberger, Rochester, Pa.
394,734. Driving Gear for Electromagnetically Propelled Vehicles. William L. Stevens, Boston, Mass.
394,735. Electromagnetically Propelled Vehicle. William L. Stevens, Boston, Mass.
394,784. Electric Signalling Apparatus. George F. Milliken, Boston, Mass.
394,791. Electric Arc Lamp. Rupert Schefbauer, Dresden, Saxony, Germany.
394,807. Electrotherapeutic Tool Holder. Allan H. Bacon, New York, N. Y.
394,810. Carbon Electrode for Electric Batteries. John Beattie, Jr., Fall River, Mass.
394,818. Dynamo-electric Machinery. Charles S. Bradley, Yonkers, N. Y.
394,819. Dynamo-electric Machinery. Charles S. Bradley, Yonkers, N. Y.
394,832. Telephone System. John F. Casey, St. Louis, Mo.
394,837. Conveying Electric Energy. Sebastian Ziani De Ferranti, Hampstead, County of Middlesex, England.
394,838. Conveying Electric Energy. Sebastian Ziani De Ferranti, Hampstead, County of Middlesex, England.
394,839. Magneto Generator for Fire Alarm Circuits. William L. Denio, Rochester, N. Y.
394,880. Electric Meter. Anthony Reckenzaun and James A. Pentz, Philadelphia, Pa.
394,881. Electric Meter. Anthony Reckenzaun, Philadelphia, Pa.
394,883. Dynamo-electric Machine. George W. Riethmann, Denver, Colo.
394,887. Electric Locomotive. Sidney H. Short, Denver, Colo.
394,892. Portable Electric Welding Apparatus. Elihu Thomson, Lynn, Mass.
394,897. Connector for Secondary Batteries. Henry W. Wiegand, Baltimore, Md.
394,914. Telephone Exchange System. George F. Durant, St. Louis, Mo.
394,925. Electric Push Button. Andrew J. Hoyt, Philadelphia, Pa.
394,946. Electric Circuit. John B. Wood, Montreal, Quebec, Canada.

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Engineering Features of the Missouri Pacific Railroad Shops at Sedalia, Mo.

Features of general engineering interest are presented in the shops of the Missouri Pacific railroad at Sedalia, Mo., and there are besides many details in the equipment which are original and help to make the new shops among the most up-to-date and convenient of their kind. Electrical engineers will be most interested in the power equipment, which includes, briefly, the following: The power plant, capable of developing electrical power to a nominal rating of 700 kilowatts; an electrical distribution system for delivering the power to 26 motors and the lighting system; a high-pressure steam-piping system for delivering steam at 140 pounds pressure to the machine, boiler and blacksmith shops, and a compressed-air system supplied by a 2,000-cubic-foot air compressor in the power house for delivering air at 100 pounds pressure to seven of the principal buildings and throughout the entire freight-car repair yard. A general view of the various buildings which house the power plant and shops is shown in Fig. 1.

Fig. 1. Group of Buildings Occupied by Shops.

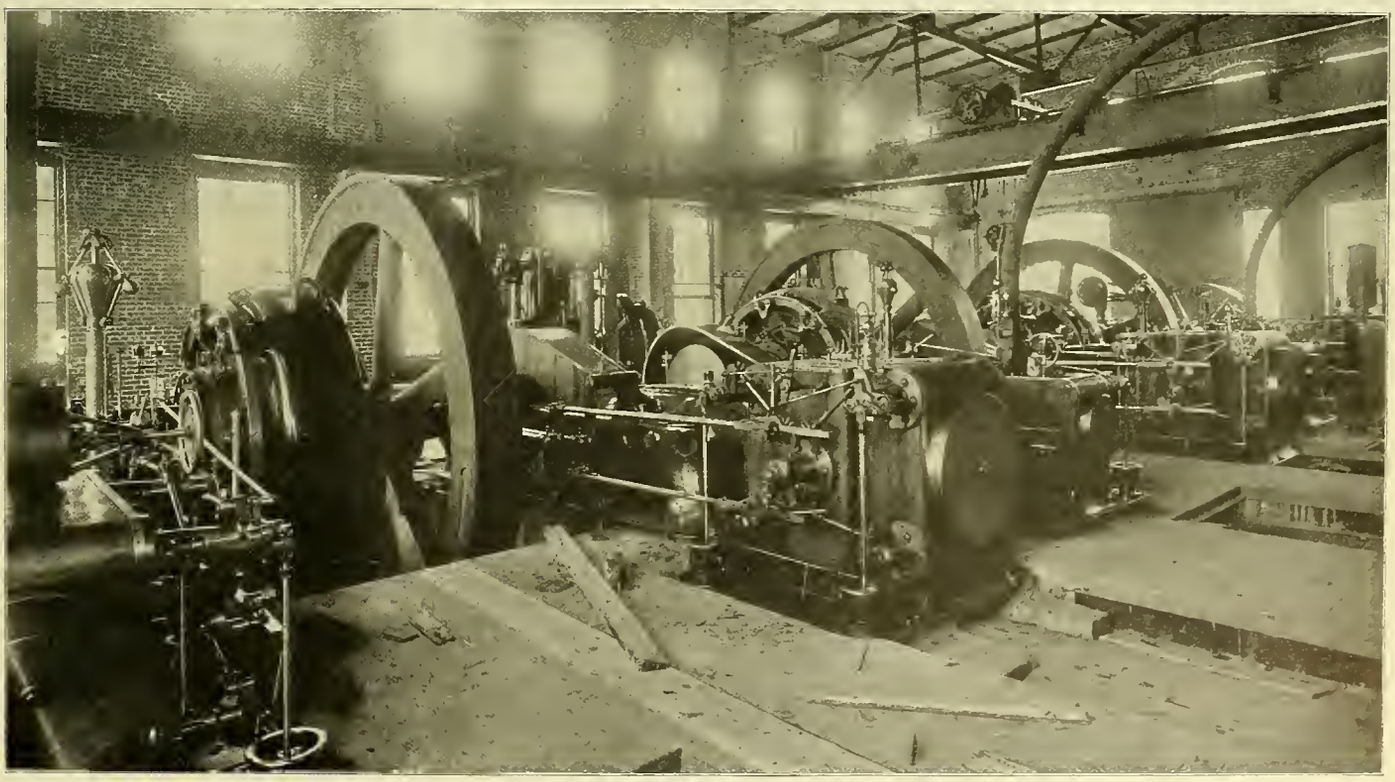


Fig. 2. Interior of Engine Room in Power House.

NEW MISSOURI PACIFIC RAILROAD SHOPS AT SEDALIA, MO.

Power Plant.

The power house is a brick and steel building 84 by 138 feet. It is well located with reference to the center of distribution of power if the combined output of air, steam and electrical power be considered. The oil house and storehouse are near by and there are two 12-inch driven wells 850 feet deep just west of the buildings which will soon supplement the present water supply derived from the city through an eight-inch main. A 317,000-gallon steel tank on a concrete foundation near the building constitutes a reservoir of ample capacity for continuous operation. Coal from the railway company's mines is delivered in cars to a siding south of the boiler room, the spur and coal bunker being of sufficient length to permit the simultaneous unloading of three cars of coal.

Situated two feet below the yard grade is the boiler room which is 48 by 84 feet. On the south side of the boiler room is the coal bunker, 20 by 84 feet, equipped at present only for manual handling of coal. In the boiler room are installed five Aultman & Taylor vertical-header water-tube boilers of 340 nominal horsepower each. They are set in 2½ batteries, the brickwork of the half battery being arranged for the future addition of the other half battery. Four boilers are equipped with Mansfield chain-grate stokers, the fifth being hand fired. The intention is to install an exhaust equipment for collecting the refuse from the planing mill and conveying it to the power house, where it will be fed directly to the hand-fired boiler or into the storage bin as may be desired.

A sheet-steel breeching of ample size conveys the furnace gases to the stack, which is located on an independent foundation 25 feet west of the power-house building. In the design of the breeching ample allowance has been made for the future addition of boilers. The chimney is of hollow segmental brick 175 feet high and seven feet in diameter at the top, and was designed and built by the Alphonse Custodis Chimney Construction Company

Between the boiler room and the engine room is the pump room (Fig. 3), 20 by 84 feet. The pumps, heater and major piping are in this room and so disposed as to give the simplest possible piping connections consistent with flexibility of con-

trol. The engine-room floor is seven feet above the pump-room and boiler-room floor and has a basement under its entire area. A part of the piping is run in this basement which adjoins the pump room.

In the pump room, supported on I-beams 17 feet above the floor, is the 12-inch main steam header. Long-radius return bends of eight-inch pipe lead from the auto stop and check valves on the boilers to the main header and are controlled at the header end by gate valves. All steam connections leaving the main header are taken from the top of the pipe through angle valves to eliminate moisture. The engines and compressor are supplied directly from the main header, protected by Crane ferro-steel steam separators. A throttle valve is placed at the machine end of each steam pipe leaving the header. A six-inch auxiliary steam header in the pump room supplies steam to all the pumps, and when desired to the receivers of the compound engines. Cross connections and dividing valves have been liberally used in main and auxiliary headers to prevent crippling of the plant in case of accident to any of the boilers or any section of the steam piping.

The six-inch high-pressure steam pipe for the shops may be supplied either from the main header or auxiliary header or both. There is also a four-inch connection from the high-pressure header leading through a reducing valve to the low-pressure supply main for the heating system.

Two 12 by 7½ by 12-inch Fairbanks pumps are for the boiler-feed purposes. Each pump has a capacity of 40,000 cubic feet of water per hour, or the normal supply for all boilers. An open heater supplies hot water for boiler feed.

The Damon system for returning the condensation from the high-pressure steam piping to the boilers has been employed. This system is connected into the boiler-feed piping in such a way that the water of condensation is continuously returned to the boilers.

Two 8 by 12 by 12-inch Marsh vacuum pumps draw the return condensation of the entire heating system of all buildings and discharge this hot water into the feed-water heater, where it is available as boiler-feed water.

The engine room, 48 by 84 feet, is in the north end of the building. It has large windows on east, north and west sides and is well lighted. The room, as shown in Fig. 2, is filled with machinery now, as the railway company has provided engine and generator capacity that will care for shop extensions of fully 50 per cent. of the total present equipment. The floor is of concrete with cement finish carried on steel, framed into the building walls and machine foundations. The entire room is served by a 12-ton hand traveling crane.

Three 14 by 24 by 36-inch cross-compound non-condensing Murray-Corliss engines are direct connected to Western Electric 200-kilowatt 250-volt compound-wound direct-current generators. Two of these units will probably care for the ultimate needs of the present group of buildings. For nights and other times of light load there is a 13 by 22 by 26-inch Westinghouse cross-compound non-condensing vertical automatic engine direct connected to a 100-kilowatt 250-volt compound-wound direct-current generator.

Compressed air for the plant is supplied by a Rand Imperial type 10 compressor with cylinders 18 and 30 by 28 and 17 by 24-inch—cross-compound steam and two-stage air—with a capacity rated at 2,000 cubic feet of free air per minute at 120 revolutions per minute. (See Fig. 4.) Additional compressor capacity will be needed long before the present engine or generator capacity will be found insufficient.

A six-panel switchboard distributes electrical power for all purposes to the shops and yards. The board is of blue Vermont marble, each panel 24 by 90 inches and divided into three sections, so that the heavy circuit-breakers at the top and bottom of the five panels are each mounted on a separate slab of marble. The board is a radical departure from the one specified, in that all power and generator feeders are protected by double-pole single-coil laminated I. T. E. circuit-breakers. All lighting circuits have knife switches only, fused on the rear of the board with D. & W. enclosed fuses. The lead-encased generator leads pass up through porcelain tubes in the floor back of the board to the machine circuit-breakers and through triple-pole knife switches to the bus-bars. Feeders leave the board at the top, passing through the power circuit-breakers on the upper sections of five of the panels.

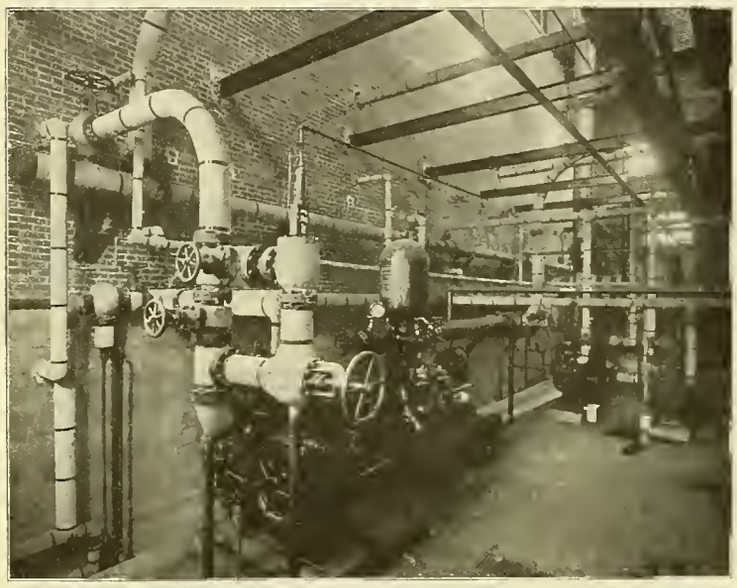


Fig. 3. Boiler Feed Pumps and Piping in Rear of Boilers.

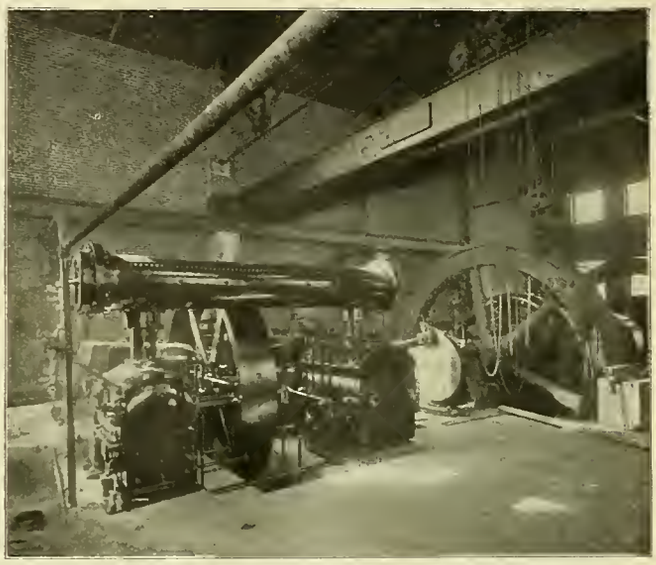


Fig. 4. Compressor Equipment.

ENGINEERING FEATURES OF NEW SHOPS OF MISSOURI PACIFIC RAILROAD AT SEDALIA, MO.

Distribution System.

Feeder lines run up the wall back of the switchboard and out to the transmission line. An ammeter mounted on the second panel is connected to a 12-circuit switch, by means of which the engineer can determine the load on any of the outgoing lines. The system is 220 volts direct current, light and power being taken from the same bus-bars. The use of any form of compensator for the lighting system has been dispensed with, as the engine-speed regulation under the wide range of load encountered is excellent, and unusual care has been taken to adjust the over-compounding of the generators so that the variation in voltage under the normal changes of shop load at no time exceeds six to eight volts. It has been found that the lights maintain a practically uniform brilliancy with no flickering of arcs or dimming of incandescent lamps.

Power and lighting feeders leaving the power house are carried on 35-foot iron poles to the various buildings. The poles are three-section, six-inch top, wrought-iron, with cast-iron six-pin crossarms, and are set five feet in the ground in concrete. On entering the buildings the power circuits are carried along the walls or ceilings directly above the lines of motors and the feeders maintain their full size from the switchboard to the extreme ends of the circuit. The motors are practically all mounted on brackets supported on the brick walls of the buildings, the floor of the platform being about 14 feet above the floor The branch wiring to the motors is carried down the pillars back of the motor from the mains through a service switch four or five feet above the motor bracket to the starting panel, which is mounted on the pillar below the motor and at a convenient height above the floor. The starting panels are of the Cutler-Hammer Company's Universal type, fuses, switch and starting rheostat being mounted on a single slate panel. Automatic overload and low-voltage release coils are on all of the starters, and motors of 50 horsepower and above have General Electric circuit-breakers instead of fuses and are also provided with starting rheostats of the multiple-switch type. Each motor is therefore protected by two pairs of fuses or a pair of fuses and a double-pole circuit-breaker in addition to the overload and low-voltage release on the starting box, and the main circuit is protected by the circuit-breaker on the switchboard. Most of the motors used are Western Electric semi-enclosed, shunt or compound wound as the nature of the work to be performed requires.

Seven feeder circuits control all of the lights of the plant, the lines being carried their full size from the switchboard to the panel boards located at the centers of distribution of each building. From these cabinets the branch circuits are run open overhead or in conduit below the floor as may be required. Arc lamps are used throughout for general illumination and incandescent lamps for individual machines and office lights.

For the control of the branch-lighting circuits 14 panel boards have been installed in seven of the principal buildings. These panels are of slate, mounted on dustproof steel cabinets. A fused main switch controls the entire panel and 15-ampere fused knife switches control the branch circuits, which are tapped from polished copper bus-bars mounted on the face of the panel.

In general the machine tools throughout the shops are driven in groups from line shafting, the machinery being grouped in sections such that the motor units are in comparatively small sizes, the general run being from 10 to 40 horsepower. An exception to this is a 50-horsepower motor used on a group of driving-wheel lathes and a heavy boring mill. There is also a 60-horsepower motor driving the blast fans in the blacksmith shop. There are very few individually motor-driven tools.

The machine, boiler and erecting shops are in one building 752 feet long by 142 feet wide. The erecting shop is of the transverse type and occupies the east portion of the building, 752 by 70 feet. It is served by two overhead traveling cranes and a 100-ton transfer table. The transfer table is electrically operated and derives its current from a special trolley arrangement shown in Fig. 5. The cranes were supplied by the Shaw Electric Crane Company of Muskegon, Mich., the larger one having a capacity of 120 tons, with two 60-ton hoists and a 15-ton auxiliary hoist. A 65-horsepower motor drives the bridge. The smaller crane is of 15 tons capacity and is of the high-speed type. There is sufficient headroom under the cranes so that a boiler may be removed from the frame of a locomotive and traverse the entire length of the shop to the boiler-shop stalls. There are 25 locomotive repair pits and nine stalls for boiler work, and the machine bay of the building, 752 by 68 feet, is divided off in about the same proportion as the erecting shop for machine and boiler tool work. Practically all of the machines are belt-driven from

the main shaft, which is 730 feet long and divided into nine sections, each section being driven by a motor. Bolted couplings terminate the ends of each length of shafting, so that the number of sections of the line shaft can be changed as the increase in machine-tool equipment requires. By means of these couplings also, in case of a breakdown of one motor, the section of shaft driven by that motor may be coupled to either of the adjacent sections of the line shaft, guaranteeing practically the continuous operation of every machine in the shop so far as power is concerned.

The lighting of the erecting shop is cared for by

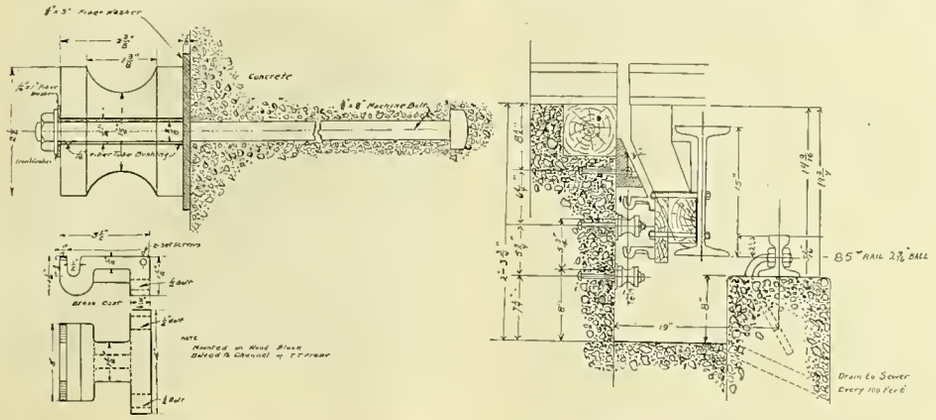


FIG. 5. DETAILS OF TRANSFER-TABLE TROLLEYS IN MISSOURI PACIFIC SHOPS.

33 220-volt 2½-ampere enclosed arc lamps mounted on posts at a convenient height between the locomotive pits, there being one light between each two pits. The detail construction of the post and lamp support is well shown in Fig. 6. The post rises through the center of a strongly built vise bench so that there is excellent illumination for all work on the exterior of the engines and on the benches between pits. In each post five feet above the floor is mounted a plug receptacle for extension lights. Lead-covered twin wire run in con-

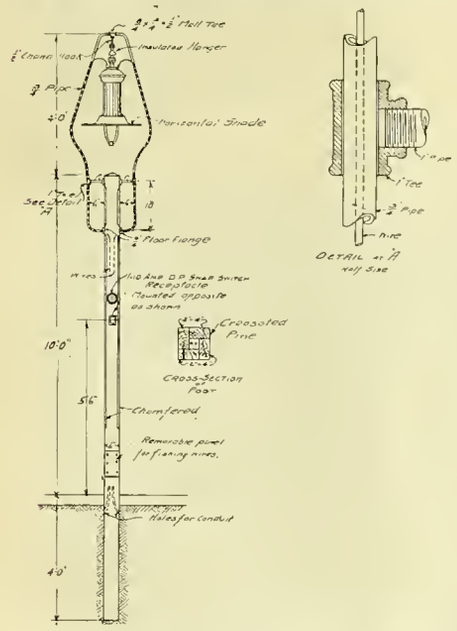


FIG. 6. DETAILS OF ARC-LAMP HANGER IN MISSOURI PACIFIC SHOPS.

duit under the floor delivers the current from the panelboards to these posts, a separate circuit being run for each post. A knife switch in the cabinet controls each post circuit and a snap switch just above the receptacle controls the arc lamp independently of the extension line.

Lighting of the machine bay is done by 17 arc lamps hung from the ceiling in a line down the center of the shop. Incandescent lamps with 10-inch enameled shades are hung at convenient points for each of the machine tools. All of the lights in the entire building are controlled from five distributing panels which are mounted on the steel columns between the machine and erecting bays of the building.

Heating in the erecting shop is accomplished by indirect steam radiation. Two heating equipments are located in fan rooms built out on the west side of the building. The apparatus consists of two 10 by 12-inch engines with 11 by 5½-foot fans and two heaters, each containing 11,600 lineal feet of one-inch pipe, arranged in 12 sections. Hot air is discharged by the fans through concrete tunnels underground to outlets located throughout the building. The main tunnels leaving the fan rooms run east as far as the west end of the locomotive pits, and there each main tunnel branches north and south along the line of the west end of the pits. These branch tunnels extend practically the entire length of the building. In the end wall of each locomotive pit are two 12 by 21-inch rectangular openings provided with galvanized iron dampers. These outlets have been found particularly efficient, as the hot air is driven without difficulty to the extreme east wall of the building and close to the floor at low fan speeds. Branching from the main tunnel to the west, 21-inch tile ducts carry the air to the center line of columns, where it is discharged at the floor level through special outlets designed with deflectors to direct the warm air currents along the floor. These outlets provide for the heating of the machine bay. At the boiler-shop end of the building, where there are no pits, all of the air is delivered from floor outlets located along the center line of columns.

Compressed air is brought to the machine-shop building in a four-inch main of Universal cast-iron pipe run underground with branches at the center line of columns between the erecting shop and machine shop. The branches run along this line of columns to the ends of the building terminating at a steel reservoir four feet in diameter and 12 feet long; risers from the underground mains are brought up at each column to controlling valves convenient for use either in machine or erecting bays.

In the blacksmith shop is a group of machinery of a purely manufacturing character. The motor equipment in this shop includes one 30, two 20, two 11½ and one 60-horsepower motors.

Machinery in the planing mill is driven by five motors in 30 and 40-horsepower units. The construction of woodworking machinery together with the methods of operating a planing mill for economical handling of material rendered it necessary to run the line shafting across the building rather than lengthwise. On this account, in case of a motor breakdown, the line shaft driven by that motor cannot readily be connected to another shaft for temporary power. Twelve enclosed arc lamps afford general illumination, and incandescent lamps are hung at all machines.

The building is heated by direct radiation, Colonial wall radiators being set horizontally along the walls under windows and vertically on pillars beside doors.

Lighting in the coach shop is by enclosed arc lamps, there being 19 on the first floor and 12 on the second floor. Those on the first floor are hung from the ceiling about midway between the columns and the nearest rail of a stall track and at a height of 14 feet from the floor, so that there is good lighting all around and on the roofs of coaches, and a moderate amount of light inside the coaches. There are 15 lamps for the 14 stalls. The 12 arcs on the second floor are hung for general illumination of the balcony, but six of them are hung at the edge of the opening so that the general illumination of the first floor is materially increased. All of the lights in the building are controlled by two panel boards, one on each floor. There is a wing 20 feet wide extending along the west side of the building nearly its entire length for work on trucks. This wing is lighted by four enclosed arc lamps.

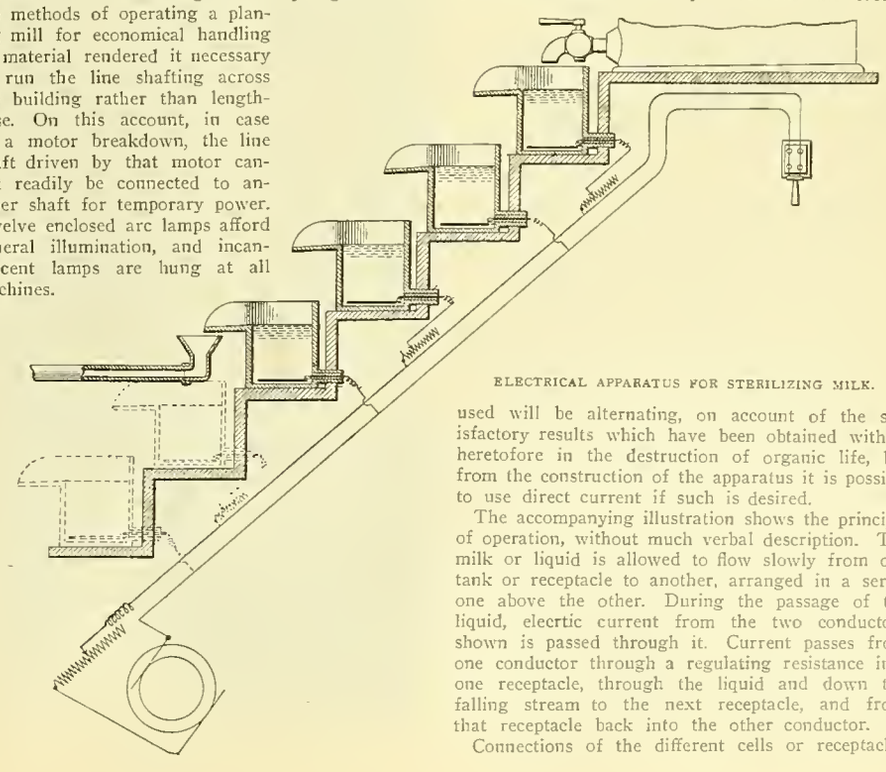
Fifteen enclosed arc lamps hung from the ceiling furnish light for the paint shop, and are 14 feet above the floor. There are also 26 receptacles mounted on the steel columns in a manner similar to that employed in the coach shop except that the wiring is run in conduit under the concrete floor and all of the lights are controlled from a panel board mounted at the center of the west wall.

Other buildings of minor importance in which the lighting features are much similar to those described are the paint storeroom, storehouse, oil house and lavatory building.

The contract for this installation was let to The Arnold Company of Chicago, J. W. Schaub, consulting engineer of Chicago, preparing the plans and specifications. Construction was begun last April and power was first turned on in the line shaft, and machine tools driven in the machine shop, on August 4th, the entire installation being completed and accepted by the railroad company on December 19, 1905, less than nine months after the signing of the contract. The engineering work of The Arnold Company was carried on under the supervision of Mr. R. M. Henderson, electrical engineer, and Mr. H. H. Dickinson, superintendent of construction.

Electrical Apparatus for Sterilizing Milk.

Electricity as a purifying or sterilizing agent possesses a property which has long been recognized, and this property of the electric current has been applied for various purposes, such, for instance, as the purification of water. An interesting example of a similar application is presented in an apparatus for sterilizing milk, recently patented by Robert C. Turner of Columbus, Ohio. Mr. Turner is at present employing the device in the sterilizing of milk, though there are obviously other applications of it which might be made for various sterilizing processes. Under ordinary conditions the current



ELECTRICAL APPARATUS FOR STERILIZING MILK.

used will be alternating, on account of the satisfactory results which have been obtained with it heretofore in the destruction of organic life, but from the construction of the apparatus it is possible to use direct current if such is desired.

The accompanying illustration shows the principle of operation, without much verbal description. The milk or liquid is allowed to flow slowly from one tank or receptacle to another, arranged in a series one above the other. During the passage of the liquid, electric current from the two conductors shown is passed through it. Current passes from one conductor through a regulating resistance into one receptacle, through the liquid and down the falling stream to the next receptacle, and from that receptacle back into the other conductor.

Connections of the different cells or receptacles

with the main line may be varied to suit the different kinds or grades of liquid which pass through the apparatus, or to vary the results attained. Instead of coupling them in such way as to have two in a set, which two are electrically in series, they may be connected so as to have three in a set, the entire series in such case being in a multiple of three. Care is to be taken that the electrical resistance in each of the sets is equal. This can be accomplished by having the receptacles uniform in their dimensions and spaced so that the distance between them shall be equal, or, by inserting variable resistances, as indicated, in the electrical circuits for each set of vessels.

Trinity River Power Plant of the North Mountain Power Company.

Among the power-transmission systems of the Pacific Coast, that have been constructed with an eye to the future, rather than the present needs of the communities which they serve, one of the most interesting is that of the North Mountain Power Company. This plant is located in the central part of Trinity County, Cal., two miles below the town of Junction City, where Canon Creek, from which the water used for power is obtained, flows into the Trinity River.

Weaverville, the county seat, is 12 miles distant by road. The nearest railroad point is Redding on the "Shasta Route" of the Southern Pacific railroad. Humboldt Bay, on the Pacific Ocean, with Eureka, the chief coast city of Northern California, lies almost due west, distant 59 miles in a straight line.

The altitude of the plant is about 1,480 feet. All material, cement and machinery were hauled in over 60 miles of the severest mountain roads, across three distinct divides or summits, viz., Trinity Mountain, Brown's Mountain and Oregon Mountain. It required 18 to 20 animals, as shown in Fig. 1, to pull each of the larger pieces, weighing 18,000 pounds, up the grades, and when mud was encountered it was necessary to hitch 18 animals to the fall of a block and tackle fitted with steel cables. Despite these difficulties, however, no mishap occurred to any of the machinery.

FIG. 1. TRANSPORTING EQUIPMENT FOR NORTH MOUNTAIN POWER PLANT BY 18-HORSE TEAM.

The water used at the plant is diverted from Canon Creek, which has a drainage area of 52 square miles above the diverting dam. The upper part of the basin is a rugged, glaciated granite country, extending up to an altitude of from 9,000 to 10,000 feet above sea level, where some snow remains throughout the year. The higher parts of this basin are in the nature of an immense amphitheater, lying on a flank of Thompson Peak, which is a characteristic feature of all elevated glaciated topography. As is so often the case, the converging and descending glaciers have scooped out immense holes with almost perpendicular sides, which now form the beds of two lakes. These have been utilized as storage reservoirs.

Part of the watershed is heavily timbered, and lies within the boundaries of a government forest reserve. This will insure the preservation of the forests, which are so effective in regulating the run-off. The average annual rainfall for the last 33 years at Weaverville, 12 miles from the plant, has been 42.50 inches. At the higher levels of the watershed the precipitation is much greater, but no records are available for that region, because the country is absolutely uninhabited, and without even trails, except for the one to the above-mentioned lakes.

Small in size, the dam serves merely for diverting the water. It is of the usual rock-filled crib form, which has been the type used for many years in mining operations on the Pacific Coast. The ditch system consists of alternating sections of ditch, flumes, and one tunnel. Part of the ditch is cut in solid rock, but the most of it is dug in the side-hill soil, which stands well and puddles well. Fig. 2 shows a section of the ditch.

Flumes are 19 in number and vary in length from 30 to 1,200 feet. Those immediately below the dam are laid upon a solid bedrock bench, and equipped with adequate spillways, waste gates and sand boxes. The total length of the flumes is 5,250 feet.

A tunnel 1,821 feet long has been driven to replace a temporary flume, which was unavoidably built upon treacherous sliding ground. This tunnel is heavily timbered throughout its entire length, and tightly lagged except where the rock is unusually hard. The dimensions of the main tunnel are four feet nine inches by five feet 10 inches in the clear. The total length of the ditch, flumes and tunnel is 7¼ miles. The average grade of all is 0.00184, or 9.73 feet per mile. The ditch is provided with waste gates and sand boxes at suitable locations. The capacity of the ditch is 80 cubic feet a second, which is sufficient to operate at full load three units like the two which are now installed.

Near its lower end the ditch passes through a gap in the narrow ridge separating Canon Creek from Trinity River, and terminates in a forebay on the river side of the divide. Thus is secured a head due not only to the fall in Canon Creek in the seven miles through which the creek and ditch parallel each other, but also to the additional fall in a further course of two miles to the creek's junction with the Trinity River, and to the added fall in two miles of the river's course between the junction and the plant.

A telephone line extends from the power house along the entire course of the ditch to the head dam. Instruments are placed in the station, the forebay tender's cabin, the headgate tender's house and at several other points along the line. Portable telephones can be readily connected at any point, and, as a result, any place along the ditch can have prompt communication with the power house.

Excavated out of the solid rock of the hillside is the forebay, which is 10 feet deep, 14 feet wide and 60 feet long. The ditch is provided with a gate at its entrance to the forebay, and the latter contains a gate and grizzly at the intake of each of the two penstocks. Provision has been made for a third penstock when a third unit shall become necessary in the plant. Suitable trash-racks are provided just above the forebay.

Power Plant and Penstocks.

The penstocks, two in number, are each 1,165 feet long. Under a total head of 604 feet there is an effective head of 600 feet, or working pressure of 260 pounds per square inch. There is one complete independent penstock for each of the two units. Each consists of a line of 36-inch and 28-inch, and at the lower end two lines of 18-inch, all-riveted steel pipe of various gauges, according to its position in the line. At the Y's, or points where the single 28-inch pipe branches into two 18-inch lines, the penstocks are enclosed and anchored in a massive block of masonry, laid up with imported Portland cement mortar. At their lower ends, just before entering the power house, they are secured by a similar form of construction, and at various points they are held by bands and anchor bolts leaded and sulphured into the bedrock. Throughout their entire length they are laid in trenches and covered by back filling, except at their lower ends, where the profile of the hill is such that it was best to lay each in a separate tunnel. After completing and testing the penstocks the tunnels were walled up and back-filled.

FIG. 2. SECTION OF DITCH DIVERTING WATER TO NORTH MOUNTAIN PLANT.

FIG. 3. TRINITY RIVER PLANT OF NORTH MOUNTAIN POWER COMPANY.

Each penstock is provided with an 18-inch standpipe just outside the forebay walls to allow air to enter when the forebay gates are closed, and thus prevent collapse of the pipe. They are also provided with air valves and manholes at suitable points.

The plant proper (Fig. 3) consists of the power house, the transformer house and the high-tension switch house. In addition there are the shop, operator's dwelling and the stable. At the forebay is the forebay tender's cabin, and at the dam is a house for the tender of the headgates.

Each of the two hydraulic units consists of a pair of 44-inch Pelton wheels under one sheet-steel housing, provided with ring-oiling, self-aligning bearings, coupled to the generator through flexible leather link couplings. The nozzles are of the deflecting type. With the largest tips in service the wheels are capable of driving the generators at 25 per cent. overload. Figs. 4 and 5 are views showing the generators, and part of the hydraulic apparatus is also to be seen.

The wheels are controlled by type F Lombard governors using oil, the pressure and vacuum being maintained by oil pumps belt-driven from the wheel shafts. The governors are not fitted with any form of switchboard speed control, but a single operator has no difficulty in synchronizing a generator under the load conditions which exist in the plant.

Back of the power house is the tailrace, which is 6½ feet wide and excavated for 280 feet through bed rock to the Trinity River.

Generators, two in number, are of the Bullock type, furnished by the Allis-Chalmers Company of Milwaukee, being of the three-phase 750-kilowatt 500-revolutions-per-minute 2,200-volt 25-cycle revolving-field six-pole type. Two Bullock exciters of 125 volts, 45 kilowatts, 900 revolutions per minute, are driven by belts from the generators. The switchboards are of marble and have Wagner instruments.

The power house, 36 by 51 feet, is built of concrete, made up with sand and gravel, taken from the river bars a few rods from the site of the plant, and with imported Portland cement. A special bay or alcove has been provided to give ample space behind the switchboard. The roof is of corrugated iron, supported on steel trusses.

A Cyclops hand-operated crane spans the main part of the building and is fitted with a 20,000-pound Triplex block. This easily handles the heaviest piece of machinery. Leads between the gen-

erators, exciters and switchboard are lead-covered cables laid in conduits within the concrete and cement floor.

Transformer House.

Fifty feet distant from the power plant is the transformer house, 13 feet by 51 feet six inches, also built of concrete. It contains seven step-up transformers, two banks of three each and one in reserve. They are of Bullock make, 300 kilovolt-amperes, water-cooled, oil-insulated, 2,200:19,050 volts, 25 cycles. Each bank is located in a separate room, and the seventh or spare transformer is in a third room. They stand upon rollers, which in turn rest upon T-rails set into concrete piers. The spaces between the piers are filled with gravel and provided with sub-drainage so as to allow any oil to rapidly escape in case of leakage or accident. The water piping is connected up with unions and so arranged that every transformer is interchangeable with every other one, as far as water and electric connections are concerned.

A track runs the entire length of the building and at such an elevation that the floor of a car is at the same height as the rails which are imbedded in the concrete piers. Thus any transformer can be quickly rolled out upon the car, removed, and another reconnected in its place in case of accident.

The penstocks are each tapped in the power-house, and after passing through shut-off and throttling valves under the control of the operator, water is delivered into a cylindrical steel tank, 36 inches in diameter by 24 feet long. This storage tank is set upon a little knoll about 20 feet above the level of the transformers. From this tank the water circulates through the cooling coils of the transformers by gravity.

Delta connection is used for the transformers on the low-voltage side, and Y connection on the high-voltage side, with ungrounded neutral.

High-tension Switch House and Pole Line.

Distant from the transformer house 20 feet is the high-tension switch house. It is a 16 by 36-foot frame structure, covered with corrugated iron. In it are two banks of M-T single-throw air-brake switches and G. E. alternating-current multiplex lightning arresters, connected up for the three-phase circuit.

The pole line extends almost due west from the plant to the sub-station in Eureka. The length is 65 miles. Of this 55 miles is over a severely rugged mountainous country; the altitude of the plant is only 1,480 feet, and Eureka is at sea level, but the line passes over several summits ranging from 4,500 to 5,500 feet in altitude. Fifty miles of its length lie in a heavily timbered country, requiring a tremendous amount of clearing, the trees ranging from two feet to four feet in diameter. It was necessary to construct a trail nearly the entire length of the line. Only where the topography made it unavoidable does the route deviate from a straight line, and then only slightly. It is a "thorough" transmission, so to speak, there being no taps on the line anywhere between the plant and the sub-station at Eureka.

The line is a single circuit, three-phase, averaging 35 poles to the mile. The poles are redwood at the western end; in the inaccessible stretches the native red fir was the only wood available.

Insulators are of the Locke two-piece single-petticoat porcelain type 8½ inches in diameter. In the fog belt a larger insulator of a similar design is used. Pins are sun-dried eucalyptus, oiled, 1½-inch diameter. The spread of wires on the standard length spans is 40 inches, the wire being No. 4 copper, except on some long spans, where stranded cable is used. The length of spans varies from 50 to 1,400 feet, according to the conditions and topography of the country. The telephone circuit is No. 10 B. B. galvanized wire, carried on glass insulators.

Telephones are connected to the line at several of the cabins which have been built for the accommodation of the patrolmen, and at frequent intervals are pole boxes consisting of magneto-generator and batteries into which the patrolmen plug their pocket sets and thus have long-distance loud-talking instruments.

Sub-station at Eureka.

At Eureka the sub-station includes an auxiliary steam plant, as follows: Two Babcock & Wilcox water-tube boilers fitted with Peabody patent oil-burning furnaces, duplicate oil-pumping system, Goubert auxiliary feed-water heater, Wheeler Admiralty surface condenser with self-contained steam-driven air and circulating pumps, cooling water being taken from Humboldt Bay, and a McIntosh & Seymour tandem-compound engine of nominal rating of 700 indicated horsepower. A jackshaft running at 500 revolutions per minute is connected to the engine by rope drive.

A Bullock rotary converter, 500-kilowatt, 500-revolutions per minute, six-pole, 25-cycle, 550-volt, is arranged for direct connection to this jackshaft by a jaw clutch and so driven by the engine. This permits of carrying the load by steam when necessary to shut down the transmission line for repairs.

The engine is fitted with a switchboard speed-control device. The clutch has a synchronism indicator in the nature of a lamp, so that the engine may be connected to the rotary while it is running at full speed on the power transmitted from the Trinity River plant.

For the rotary converter there are three Bullock transformers, 190-kilowatt, water-cooled, 25-cycle, 30,000:352 volts. For stepping down for the local distributing system are three G. E. transformers, 400-kilowatt, water-cooled.

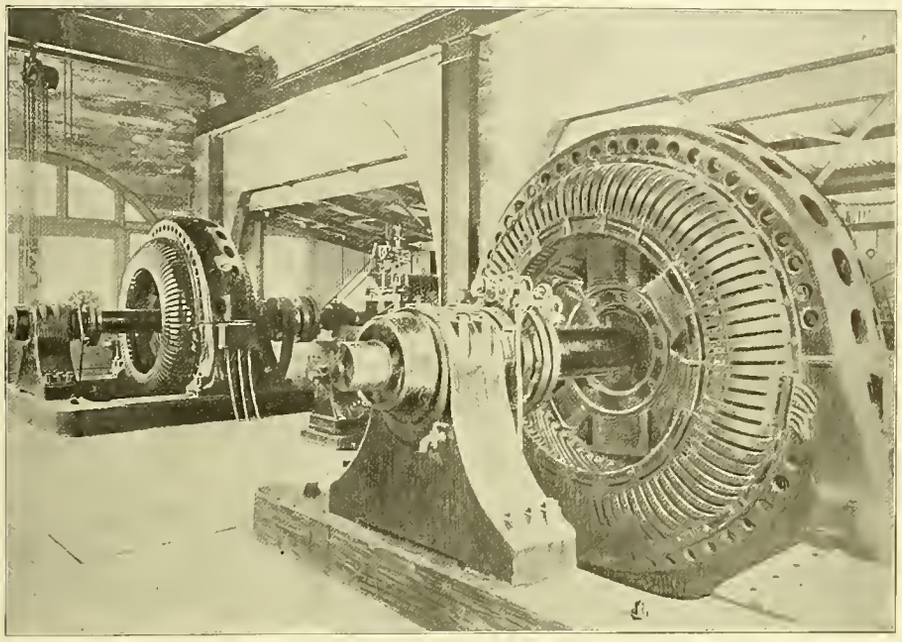


FIG. 5. 750-KILOWATT ALTERNATORS IN NORTH MOUNTAIN POWER PLANT.

For furnishing power to the 60-cycle incandescent and arc-lighting circuits of the city of Eureka, a three-phase 60-cycle generator is driven by the rotary, acting as a synchronous motor.

The sub-station is fitted with switchboards and high-tension switches, suitable for handling this equipment. A fuel-oil tank 54 feet in diameter by 25 feet deep, holding 10,000 barrels, has been built near the sub-station, and is connected to a dock on Humboldt Bay by a pipe line. The sub-station is 31 feet by 128 feet, built in the marsh on the waterfront of Eureka. Heavy concrete foundations rest on redwood piles cut off below low-tide level.

The load at present consists chiefly of lights in the city of Eureka. Some motors are already connected to the circuits, and the motor load is being rapidly developed. Local transmission lines are being constructed about the shores of Humboldt Bay, and in a very short time the company will be supplying power to the local companies in Eureka's suburbs, not only for light but for motors in the various industries of that rapidly developing region.

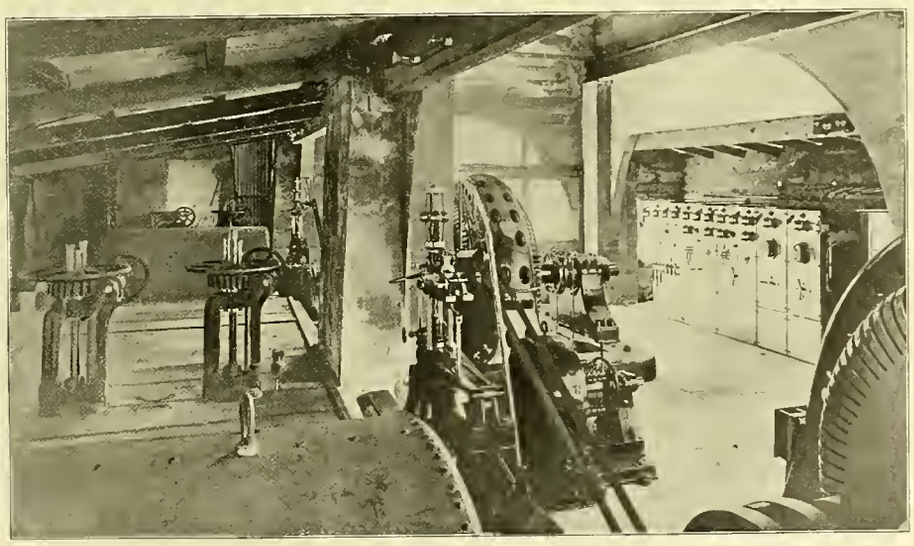


FIG. 4. WATERWHEEL HOUSING, GENERATORS AND SWITCHBOARD IN NORTH MOUNTAIN POWER PLANT.

Proposed Department of Highways.

A bill has been introduced in the House of Representatives looking to the creation of a new government department to be known as the Department of Highways. The new department, if formed, would have a secretary, who would become a member of the cabinet; first assistant secretary, who would have charge of all matters pertaining to steam and electric railroads; a second assistant, who would have charge of all matters pertaining to telegraph lines; a third assistant, who would have charge of all matters pertaining to telephone lines; a fourth assistant, under whose charge would be all waterways and transportation thereon; a fifth assistant, who would have charge of all pipe lines, and a sixth assistant, to whom would be referred all express matters.

To this department would be transferred the jurisdiction of all matters pertaining to interstate and foreign commerce, life-saving service, light-house board, lighthouse service, marine-hospital service, steamboat inspectors' service, bureau of navigation and the United States shipping commissioner. The bureaus now carrying on these various matters could be absorbed by the secretary of the new department as he should deem best for the service.

There would be six bureaus in the department to be known as the bureaus of transportation corporations, under which would come investigations relative to all corporations engaged in interstate and foreign commerce, and the gathering of all statistics relative to such corporations and their methods of business.

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DATES AHEAD.

Railway Signal Association, next meeting at the Grand Union Hotel, New York city, January 9, 1906.

Automobile Club of America (annual exhibition), Sixty-ninth Regiment Armory, New York city, January 13th to 20th.

Chicago Electrical Show (first annual exhibition of Electrical Trades Exposition Company), Coliseum, Chicago, January 15th to 27th.

American Electrical Salesmen's Association (first annual meeting), Grand Pacific Hotel, Chicago, January 20th, 9 a. m.

Nebraska Independent Telephone Association (annual convention), Lindell Hotel, Lincoln, Neb., January 23d and 24th.

Ohio Interurban Railway Association (annual meeting), Algonquin Hotel, Dayton, Ohio, January 25th.

AT THE close of a prosperous year for the electrical industry the Western Electrician hopes that all its readers have had a Merry Christmas and that they are looking forward without misgiving to a Happy New Year. On the whole, the electrical fraternity has good reason to rejoice and take courage as 1905 gives way to 1906.

Following the usual custom, the next number of the Western Electrician will be the Annual New Years Issue, with carefully prepared estimates of the value of the electrical manufactures of the United States, in the various lines, for 1905. This number will have a handsome colored cover of artistic design and will be considerably larger than usual, both in reading and advertising pages. It will contain a number of well-illustrated articles, several of them reviewing the state of the art, both at home and abroad. The index of Vol. XXXVII. of the Western Electrician will be issued with a subsequent number and given free to all subscribers.

THE AMIABLE Sir William Preece, in distributing prizes at a recent English technical-school commencement, is reported to have said that—

He was frequently asked to recommend young men for positions of responsibility in various parts of the world, and he often asked both Americans and Germans why, if their technical education was so very much superior to ours, they preferred Englishmen for foreign work, and the answer is that the American and continental systems of education are really too good; that these men can quote formulæ and data on any conceivable subject, but that when sent away from home in charge of work requiring initiative and self-reliance, these men fail entirely because they can only work to instructions and to formulæ. The Englishman, on the other hand, who is not so well educated, will tackle almost anything, and will carry it out to a successful issue.

So that is it. Americans "fail entirely" because they lack initiative and self-reliance, spirit and energy, verve, vim and go, snap and ginger. By inference they are dependent creatures, meekly receiving instructions but not venturing beyond them, strong on precedent but weak on originality, theoretical rather than practical, timid not bold, and presumably mild, modest and shrinking.

Strange that we haven't heard of all this before.

IT BEHOOVES the hydro-electric power interests at Niagara Falls to "watch out," at least so far as future extensions are concerned. We recently quoted what President Roosevelt had to say on the subject in his annual message, and now the newspapers report that Mr. Moody, the attorney-general, has given the president an opinion that the right of the federal government to intervene to preserve Niagara Falls is unquestionable. If the Falls were wholly within New York state they would be under the exclusive control of that commonwealth. The federal authorities would then legally have nothing to say in relation to what was done with them. But as they are on the national boundary line, being partly in Canada and partly in the United States, their disposition is a matter of international consequence. Action may, therefore, be properly taken in reference to them by the authorities of the nation. Mr. Root, the secretary of state, who is a good lawyer, has assumed that the law is as Mr. Moody states it, and has been negotiating with the British government, it is said, with a view to securing a treaty protecting the falls. But there is no reason to suppose that any effort will be made to attack existing legally established concessions on either side of the river. It is only the possibility that further withdrawals of water for power purposes may seriously affect the volume of the Falls and impair the cataract as a spectacle that alarms the advocates of restriction.

A NEW project for the construction of a deep waterway from Chicago to St. Louis by way of the present Drainage Canal, which would incidentally furnish great possibilities in the matter of electrical power development, has been brought to light by the introduction of a bill into Congress by Representative Kahn of San Francisco. In the bill is contemplated a plan whereby the government is to issue bonds to the amount of $60,000,000, upon which three power companies are to pay the interest for 99 years at the rate of two per cent. In return the power companies are to have exclusive use of all waterpower rights along the waterway, the equipment to be furnished by the companies and turned over to the government at the end of the 99 years. According to the bill, the waterway is to be divided into three sections—one for each company. The upper section includes the water rights through two levels in the Desplaines River. The Ottawa division is in the upper Illinois River, and would include also two levels. The last, or St. Louis section, would furnish a site at the Chain of Rocks for a dam and two power houses. The depth of the channel is to be not less than 20 feet and the width not less than 300 feet at the bottom. All construction would be done by the companies, and all the government would have to do would be to foot the bills.

That the government would assume financial responsibility for so large an expenditure, the results of which are to benefit private individuals, does not seem at all probable. Indeed, one representative gave his opinion that the proposition is ridiculous, as far as asking government aid is concerned. Be that is it may, however, the presentation of the bill indicates that there are possibilities in such a scheme which have been given careful consideration and thought to be promising enough to warrant the introduction of the bill. The sum of $60,000,000 nowadays is not an insurmountable obstacle, and if a deep waterway could be built from Chicago to St. Louis for that sum, and large amounts of water power be developed, the scheme is not so visionary, perhaps, as might appear at first sight.

ONE of the earliest theories of light was the emission theory, according to which it was at one time quite generally believed that light was caused by the emission from the sun of minute particles of matter which were shot into space at enormous velocities, and, impinging upon the eye, caused the manifestation of light. This theory gave place to the wave theory, which is now generally held.

Quite recently E. Walter Maunder, the well-known British astronomer, has propounded a theory concerning the connection between sunspots and magnetic disturbances on the earth which embodies the same idea that was held many years ago; i, e., that the earth is subject to bombardment by particles originating in the sun. The theory of Mr. Maunder is interesting, if no more, and at least has the merit of explaining the curious electrical and magnetic disturbances during the existence of large spots on the sun. Briefly stated, Mr. Maunder's theory is this: The earth is occasionally subjected to a bombardment with electrified particles shot forth with tremendous velocity from certain centers of activity on the sun. As the particles strike our atmosphere they set up magnetic disturbances, which are sometimes sufficiently violent to put the telegraph and cable lines out of commission over half the earth.

Mr. Maunder's investigation seems to indicate that there are particular places on the sun where the explosive forces appear to concentrate and from which the streams of electrified particles are shot forth in radial lines. A stream of this kind may or may not strike the earth, according to the position of the latter at the time when the explosion occurs. But, even if it misses, it may produce a magnetic disturbance by induction, and Mr. Maunder suggests that the "characteristic sharp twitch" of the magnetic needle, which occurs instantaneously over the whole earth at the beginning of a great magnetic storm, may be regarded as denoting an actual collision with the solar stream line, while the more sluggish disturbances observed at other times indicate that the stream is passing either above or below the earth. It has also been observed that the supposed projectile streams from the sun continue for long periods, and, as the sun revolves on its axis like a rotating turret, the streams sweep round with it, encountering the earth again and again once in every 27 days, which is the mean synodic period of the sun's rotation in the latitudes where the greatest spots break out. During total eclipses vast streamers of light are visible about the sun, and Mr. Maunder thinks that these indicate the stream lines of the projected particles. This is, of course, pure conjecture, for, so far as we know, this great corona radiation is proceeding at all times, while the "magnetic storms" on the earth are of comparatively infrequent occurrence.

Refuse Destructors and Their By-products.

Destructors for refuse serve to some extent not only in disposing of garbage in large cities, but also in furnishing heat which may be utilized for power purposes and the making of electricity. Although destructors have not as yet received a great deal of attention in this country, abroad, especially in England, they are common, and much has been alleged concerning their efficiency as power producers. Some valuable information relative to this subject has been furnished by Mr. T. Lloyd, who, in a paper read at the Sheffield congress of the Association of Cleansing Superintendents recently, gave particulars of a new destructor in his charge at Preston, England.

This destructor is of the Meldrum Simplex regenerative type, having four four-grate furnaces, and deals with about 20,000 tons of refuse per annum. The furnace is hand-fired. The boilers are of the Lancashire type, measuring 30 by eight feet, and work at a pressure of 200 pounds per square inch. The air entering the ashpit is heated to a temperature of 400° F. in the regenerator, and the feed water is heated in a Green economizer. Official tests carried out on one unit in April last gave the following results:

Refuse destroyed in 24 hours	66.86	tons
Duration of test	8¾	hours
Total refuse fired during test	54,684	lbs.
Total weight of clinker	30.3% = 16,576	lbs.
Total weight of asb	2.9% = 1,624	lbs.
Carbonic acid continuous samples	12.13	per cent.
Oxygen	6.46	per cent.
Carbonic oxide	.15	per cent.
Temperature of combustion chamber (average)	2,288°	F.
Temperature of combustion chamber (maximum)	2,700°	F.
Temperature of air entering regenerator	60°	F.
Temperature of air leaving regenerator	470°	F.
Gauge pressure	166	lbs. per sq.in.
Temperature of feed entering economizer	50°	F.
Temperature of feed leaving economizer	222°	F.
Temperature of flue gases entering economizer	648°	F.
Temperature of flue gases leaving economizer	320°	F.
Feed water evaporated per pound of refuse	1.41	lb.
Equivalent evaporation from and at 212° per pound of refuse, boiler and economizer combined	1.7	lb.
Electrical output, B. of T. units per hour	279.54	
Electrical output, B. of T. units per ton of refuse	100.24	

The steam is supplied to the tramways department, and suffices to generate 20,000 units per week on the average; the total quantity of energy generated from December 29, 1904, to June 21, 1905, was 487,644.

F. L. Watson is another contributor to the subject, who described at length, in a paper before the Leeds local section of the Institution of Electrical Engineers, modern methods in refuse destruction. What follows is taken from Mr. Watson's paper.

With regard to the construction of destructors themselves, the various designs differ principally in the methods of feeding, the methods of taking off the gases of combustion and the methods of applying forced draft to the furnaces. The simplest and most primitive method of feeding is the "front feed." In this system the furnace has only one door, into which the refuse is thrown by the shovel, and from which the clinker is withdrawn when necessary. This system is very suitable and convenient for small plants, where the cost of labor is of no great importance, and it has had a very considerable vogue, even for large plants, in cases where high steam-raising results have been considered more important than cost of labor or other considerations. This system lends itself readily to the "spoon-feeding" of a furnace, which, in the case of coal-fired boilers, as well as of destructors, is productive of a maximum rate of evaporation, but not necessarily of final economy. The "front-feed" system has the disadvantage that the unburnt refuse and the clinker have to be dealt with on the same floor, and there is always a risk of getting the two articles mixed up.

The "back-feed" system has been applied in many successful installations and has been adopted by various makers. It appears to possess every advantage which may be claimed for the "front-feed" system, and some additional advantages. In the "back-feed" system the refuse is stored in a convenient bin, which may, if desired, be enclosed to form a hopper at the back of the cells away from the heat of the furnace and at a level which may be most conveniently arranged for easy charging. The refuse is thrown into the furnace by the back door, and the clinker is withdrawn from the front. The grate and drying hearth may be conveniently sloped so as to facilitate both the charging and clinkering operations.

The "top-feed" system is also one which has enjoyed and still enjoys a very large measure of popularity, and has been adopted with more or less success by all the different makers of destructors. In the most usual form of "top-feed" destructors a floor is provided on the top of the furnaces, on which the refuse is tipped, and feed holes of various forms are arranged so that the refuse can be pushed or shoveled by hand into the furnace. "Top-feed" furnaces are frequently arranged "back-to-back," or in double rows, thus economizing space and keeping the whole plant more compact. The charging holes are sometimes closed by lids, and sometimes by packing the refuse into the feed hole, whose form is arranged to permit of this being done.

It will be observed that on all these methods of feeding, a provision is made for the storage of a certain quantity of refuse, and this is always necessary, because a destructor must work with strict regularity if it is to be successful, and the collection and cartage of refuse is usually arranged to be done in the shortest number of hours per day, and cannot very well be changed about to suit the requirements of the destructor.

It would solve a great many difficulties if ordinary town refuse could be stored in a large hopper tapering toward the bottom, and having a door out of which it could flow when required, exactly as is done in the case of the storage of coal for gas works and boiler purposes. Unfortunately, even with the best of arrangements, a piece of matting or oilcloth, or a large can coming through with the refuse is sufficient to cause a block and stop the whole business, and we must therefore reckon with the ascertained fact that refuse will not flow as a dry material will.

For larger plants another system of storing has been devised, which is being installed on a small scale for the Leeds corporation, and is also under construction in St. Petersburg, and will shortly be employed at Newcastle. In this arrangement the place of the spare carts is taken by a series of storage tubs having self-opening bottom doors which are held closed by means of lifting chains. Into these tubs the carts tip their loads on arrival at the destructor. The tubs are lifted by an overhead traveling crane, and stacked full until required. Each tub holds a full charge for a furnace, and in charging the tub is lifted by the crane and placed on the top of a movable hopper, which is caused to descend by the weight of the tub. The water-sealed door is connected to the hopper by an arrangement of rods and levers, and is thus automatically opened by the descent of the tub, and in the same way automatically closed when the tub, after being emptied, is lifted clear by the crane.

As regards the taking off of the gases of combustion, there are, speaking broadly, three methods in use. The first and most primitive is the drawing off of the gases at the back of the furnace. This answers quite well with "front-feed" cells, but if adopted with cells which are fed from the back it results in unburnt gases and smoke passing away to the flue.

The next method to be considered is that by which the gases from one cell, or "division," of the destructor (for in this system the destructor can hardly be said to have any cells) are carried into the next division, and so on to the end of the battery. The last section of the battery has thus to carry through the whole of the gases from the plant, which makes it pretty warm for the stoker at that end. Furthermore, there does not appear to be quite the same certainty of perfect combustion in the last section as there is with cellular systems, and it is not possible to repair any one section without stopping the whole plant.

The third system is that in which the outlet flues are situated toward the front of the furnaces, and are connected by cross-flues with a common combustion chamber, in which all the gases mix before passing to the boilers. This system, which was originally invented by Mr. William Horsfall of Leeds, has been adopted very largely, and is now used by several of the best-known makers.

To come now to the different methods of applying forced draft. Steam jet blowers are frequently accused of being very wasteful in steam, but as they have been tested down to 10 per cent. of the steam raised, fan draft cannot show a much more economical result. For refuse containing large quantities of carbon, the injection of steam with the air has an advantage in the production of water gas in the lower part of the fire, and the carrying of the combustion to a point further on in the furnace, and the production of a longer flame; it also assists in preserving the grate bars. Fan draft, on the other hand, seems specially suitable for refuse which is chiefly of a vegetable character, and when suitable fans or blowers are used, it is possible to get a very much higher blast pressure than is practicable with steam jets.

Too strong a chimney pull will at once reduce the temperature, and the aim should be to work with the least possible draw over the fire, practically a plenum in the furnace itself. It will also reduce to a minimum the amount of dust carried out of the furnace, which is most marked when a very strong chimney draft is used. As close as possible to the furnace-combustion chamber should be fixed the boiler or boilers which are to utilize the available heat. For every 10,000 inhabitants there is, roughly, 10 tons of refuse per 24 hours, and this is capable of producing over 50 horsepower if properly utilized. Therefore, the boilers are a most important item, and they should be properly proportioned to the plant.

After the boiler, in all but the smallest of plants, a dust catcher should be fixed. The most widely known form of dust catcher is on the centrifugal principle, the heavier particles of dust being separated from the gases by centrifugal force while the gases are passing rapidly around the interior of a circular annular chamber. The dust is collected in external pockets attached to the chamber. It has been found that such a dust catcher is capable of arresting over 98 per cent. of the total dust contained in flue gases. The material collected in the dust catcher is extremely fine, sharp and clean, and is used for various purposes, one of the most important being as a base for disinfecting powder. From the dust catcher the gases pass to the chimney, and this need not in most cases be of any great height. The old-fashioned high chimneys were only necessary for old-fashioned, low-temperature destructors. With a modern destructor, unless the situation is very exceptional, a chimney from 60 to 90 feet in height is all that is necessary.

Generally, it may be said that when all proper precautions have been taken in the construction and working of the plant, a destructor is a source of no nuisance whatever, and the only inconvenience of which the neighbors could possibly complain is that due to the carting of the refuse through the streets. Even that can be reduced to a minimum by the use of proper carts and by proper attention to cleanliness. In numerous instances dwelling houses have been built in large numbers close to an existing destructor, after the latter has been at work, and there was one instance in which the owners of some property near a proposed destructor, after attending at the Local Government Board inquiry and raising all the opposition of which they were capable, proceeded as soon as the plant had been erected to acquire more land and construct more houses much closer to the plant than those which they originally possessed.

New York Transit Merger.

It is announced that the Interborough Rapid Transit Company has obtained control of the Metropolitan street-railway system, mainly owned hitherto by Thomas F. Ryan.

The price paid for the control is not divulged, but at market rates the minimum stock needed would be worth $6,500,000. It is stated that a new holding company, or possibly two, will be formed, and that Mr. Ryan will be paid in shares, rather than in cash. The formation of such a new holding company would add still further to the financial entanglements surrounding all the New York traction companies. The stock which has changed hands is that of the Metropolitan Securities Company, which was incorporated on February 14, 1902, with a capital of $30,000,000, of which only half is paid up. The unpaid capital was a guaranty for the payment of the seven per cent. dividends on the $52,000,000 authorized and outstanding stock of the Metropolitan Street Railway Company, which the Securities company bought indirectly by the purchase of the entire share issue of the New York City Railway. The New York City Railway has a capitalization of $101,000,000, and controls, but not absolutely, the Metropolitan Street Railway Company and the Union Railway Company of the Bronx, and others.

The combined capital of all the lines in the new merger is $206,000,000, and its aggregate passenger total for 1904 represented over $50,000,000 in five-cent fares.

It is variously stated that the Belmont people will strengthen the seven per cent. guarantee on the Metropolitan shares; and, on the other hand, that they will seek to break the lease. Failure to pay the dividend causes the property to revert to the minority stockholders. There is a good deal of talk that the other transit lines, such as the Brooklyn Rapid Transit, the various Long Island trolley lines, owned jointly by Mr. Belmont and the Pennsylvania railroad, the Hudson tunnel companies and the Public Service Corporation of New Jersey, are likely to come into the combination. There is also talk of legislation to increase the borrowing powers of the city, so that municipal subways could be constructed.

The McCall's Ferry Power Plant.

Preparations for the building of the proposed dam and hydro-electric power plant by the McCall's Ferry Power Company, at McCall's Ferry, on the Susquehanna River, about 25 miles from York, Pa., are now well under way. An illustrated description of this interesting site and proposed development was given in the Western Electrician of September 16th. It is reported that a force of 900 men is now distributed in the region of McCall's Ferry, incident to the preliminary preparations for the important undertaking that is proposed. On both sides of the Susquehanna River lines of railway for hauling material to be used for constructing the dam, wheel-pits and foundations for the power house and other structures will be laid. The stone to be used in the construction of the power plant and dam will be quarried in the hills of York and Lancaster counties. The sand will be taken from the river and its shores at a point several miles south of McCall's Ferry, where there is sand of a fine quality for use in masonry.

Testing High-power Modern Gas Engines.[1]

By William H. Spiller.

A great many readers of even the technical papers do not know that the modern gas engine has to undergo prolonged and severe tests in the factory, far more critical than the majority of steam engines ever pass through. The duration of these tests vary from one week to 15 days, according to the size of the engine, the work it has to perform and the distance it will require to be shipped.

It can readily be seen that on a piece of mechanism weighing from 25 to 50 tons some of the parts will weigh from one to five tons, and that these various parts must represent a great deal of money expended for making and the high-class labor of finishing, to say nothing of the cost of the splendid grade of material required for this type of power machinery.

The first tests are made by the chemist, when he analyzes the pig iron or steel received from the mill, and this analysis must tally with the specifications calling for the particular grade required for certain parts of the machine.

Then, when a heat is run, a test piece is made and put under test until it is fractured, and the ultimate or breaking strength known, and then the unit stress per square inch with a proper factor of safety for the material is determined. The factors of safety in gas engines are very high, for the strains are exceedingly complex, there sometimes being not only compression and tension strains, but also cross or transverse strains in the various parts

When a casting has been made in the foundry it is gone all over with powerful blows, delivered with a heavy hammer, to ascertain if the casting is perfect, and if any chambers have been cored, this will show if there are any thin or weak spots in the walls. If any defect develops, the piece is immediately rejected

After the cylinders have been finished, and before assembling the engine, they are tested under a high-water pressure with a special device, and the pressure, number of the cylinder and engine recorded.

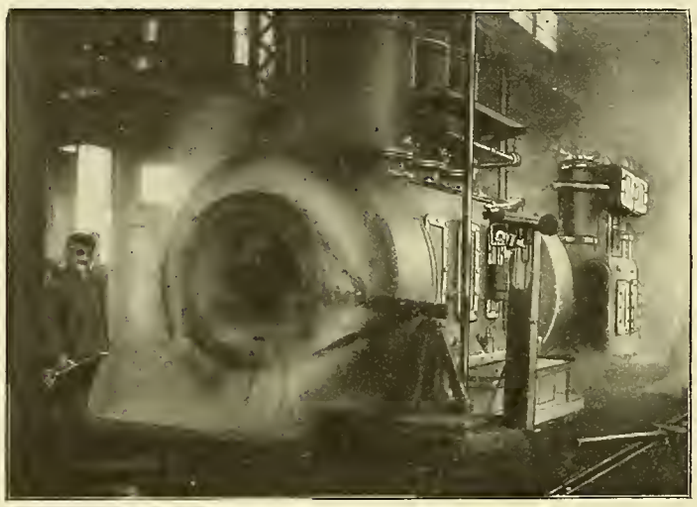
The various materials and parts of the engine having passed these preliminary but very systematic tests and been assembled, forming the completed engine, the cams and gears set correctly for the proper timing and igniting of the gases in the cylinders and the valves in proper position for admitting and exhausting of the gas, the engine is ready for its initial run.

The indicator, so familiar to steam engineers, is used, and a card is taken from each cylinder on the engine. It might not be out of place to state here that these large engines are started by means of compressed air, admitted through an automatic starting valve to one cylinder, and the engine operates by this means until gas has been drawn into the other cylinders upon the descent of the pistons, compressed and ignited, and then upon shutting off the compressed air and admitting gas to the first cylinder it immediately assumes its cycle of operations upon gas, giving its power also.

Compressed air is supplied by means of a small two or three horsepower gas engine, air compressor and air-receiving tank, furnished with every plant.

Indicator cards taken from the engine show to the trained testing engineer the exact amount of compression in pounds per square inch of the mixture of gas and air, the pressure of the burning gases after ignition, and the pressure of the exhaust; also whether the intake and exhaust valves are set properly for the highest economy and whether the ignitors are timed accurately for igniting the gas at the proper point of the stroke to gain greatest power.

The brake horsepower or delivered horsepower is determined by means of a type of dynamometer known as the prony brake The accompanying illustration shows a test being made of a 300-horsepower producer gas engine operating upon pea coal and consuming less than one pound per brake horsepower per hour, in the manufacturing establishment of the Weber Gas Engine Company, Kansas City, Mo. At the time the picture was taken the engine was delivering about 350 horsepower and the clouds of steam from the brake obscured part of the view.



TESTING HIGH-POWER MODERN GAS ENGINES.

1. Abstract of a paper read before the Technological Society of Kansas City, Mo., December 7, 1905.

COMMUNICATION.

The "Dynelectron" Defended.

To the Editor of the Western Electrician:

Your article in the issue of 16th inst., relative to Mr. J. H. Reid's "dynelectron" has been brought to my attention. I know nothing of Mr. Reid or his invention, but I do know that, if he has such a machine, he is not far from the kingdom of truth and is some distance, at least, out on Nature's highway to the production of electricity on a grand scale. This I say from personal research and a long chain of experiments, which prove conclusively that this is the golden key that shall ultimately unlock the gateway to Nature's stupendous electrical processes. Mr. Reid seems to have been holding close communion with Nature. Behold the grand electrical display in the torrid zone during a summer storm! And even here! How and from whence comes this mighty electric flow? All the machinery of the world has not been able to produce electricity on as grand a scale. He who best understands her processes is farthest out upon the highway to her grander temples beyond. If the mysteries of the firefly were revealed, the great problem of perpetual light without heat would be solved; and if Nature's great operations in the production of lightning were fully understood, the whole problem of electrical generation would be solved—the secrets of her stupendous Leyden jar. How and from whence comes this magnificent and unlimited supply of electric current? From boilers and engines and great whirling bundles of wires between massive iron jaws? No; this is far from Nature's operations. If we learn of Nature, she will teach us the wonderful story of electric generation, by heat, water and air, harnessed under proper conditions.

It is taught, and universally believed, that an electric battery (such as the galvanic or voltaic cell, etc.) cannot be had without two plates and two poles. This is untrue. Such may be had with but one (if you use any at all) as well as two. I have such a cell now in use that has been in constant operation since last May (on closed circuit) and at the present writing the volt and ammeters show higer readings than at any former reading.

For many generations the chemist has watched with untiring interest the wonderful operations which Nature employs in electric generation, and yet he is unaware that such will produce an electric current, just as the electrician watched for a time the dynamo produce current without knowing that such current would operate the same machine (motor).

J. M. Clement.

Mineral Bluff, Ga., December 18, 1905.

Plans for a complete trolley line from York to Harrisburg, Pa., have been completed by the Lewisberry and Strinestown Trolley Company. The company proposes extensions which will form connections with existing lines for a continuous trip between the two cities, a distance of about 31 miles.

BOOK TABLE.

Telegraphy. By T. E. Herbert. London: Whittaker & Co. (New York: The Macmillan Company). 1906. Pp. (5 by 7¼ inches), 912, with 509 illustrations. Price, $2.60.

Other branches of electrical engineering have sprung up so fast of late years that the telegraph, the most time-honored of them all, has not had much attention paid to it by engineers other than those directly connected with that line of work. Books in the various fields of electrical activity are coming out almost every day, but those upon the telegraph are few and far between. It should not be supposed, however, that there is a pause in the development of the telegraph, for, contrary to general opinion, this branch of electrical engineering is expanding continually and there are as many new turns in its development as in any other line. For this reason Mr Herbert's book, which is a detailed exposition of the telegraph system of the British Post Office, will be received gladly, for it shows examples of the most up-to-date practice in telegraphy and leaves no part of the field uncovered.

The author has tried to make this book as complete as possible and for this reason has gone at first into the elementary details, such as primary cells, circuits and conductors, galvanometers, galvanometer shunts, resistance coils, etc., explaining thoroughly each step leading to the telegraph apparatus itself. Then come in turn the single-current system, double-current system, the differential duplex, the quadruplex, Wheatstone automatic, etc., until the reader who is not thoroughly familiar with telegraph apparatus is surprised to find so many systems that he never knew about before. Having described all of the various systems, refinements of the apparatus are taken up, such alternations in circuit connections, repeaters, the test box and protective devices, also methods of testing, including localization of faults, etc. The last part of the book is of a highly practical nature, being a description of the latest practice in aerial and underground-line construction. The author is to be complimented for the especially thorough and painstaking manner in which he has taken up this part of the work, which will be found of great value to line men and those having in charge the outside work. Altogether the book is the most complete one on the telegraph that has appeared for a long time and is deserving of praise in every respect.

Gas, Gasoline and Oil Engines, Including Producer-gas Plants. By Gardner D. Hiscox, M. E. New York: The Norman W. Henley Publishing Company. 1906. Pp. (5⅝ by 9 inches), 442, with 351 illustrations. Price, $2.50.

Fifteen editions of this book have now appeared, which alone is sufficient recommendation. Constant rewriting and revision are necessary in a book upon such a rapidly developing class of apparatus as the gas engine in order to keep pace with new ideas. This the author knows well and he has consequently thoroughly gone over the subject matter so that this the fifteenth edition is well abreast of the times and practically new from cover to cover. As the title indicates, the engines are not alone treated but the subject of the gas producer is also treated in detail.

The theory of the gas engine is first explained, which is important, for the laws effecting the action of gases and the cycles upon which explosive motors perform are not as well understood as those of the steam engine, which has been in the field so much longer. Following the theoretical considerations the various types of engines are taken up and their parts described with minuteness of detail which makes the book one of the most comprehensive on the subject. Not alone are the large-power units described, but the smaller ones for automobiles, launches, motor cycles, etc., are explained with the same thoroughness, making the book of interest and value to the operators of all classes of gas and gasoline engines. Of particular value from the standpoint of practical operation is chapter 18 on the management of gas engines, many useful pointers being given as to the running and care of these machines which are not as yet any too well understood by the general engineer.

Producer gas and its production are treated in a separate chapter, which is an important one. Various types of gas generators are described and illustrated together with directions for operation. The next to the last chapter is an enumeration of the patents which have been issued in the United States for gas, gasoline and oil engines and their appliance from 1875 to September 1, 1905. It is interesting to note that in the length of time elapsed between these two dates nearly 2,000 patents have been issued

Typographically the book is prepared in an excellent manner. The cuts stand out clearly and the printing is upon a fine quality of paper.

The buildings and mast of the space-telegraph station on Lake Michigan at the foot of Oak Street, Chicago, were destroyed by fire a few nights ago. The station was built by the Marconi company for exnerimental purposes and was described and illustrated in the Western Electrician. About a year ago it was bought by the De Forest company. A watchman at the station says the structure was fired by three men, who poured oil over the building.

Single-phase versus Direct-current Railway Systems.

In the Western Electrician last week there appeared an interesting communication from Frank J. Sprague upon "A New and Higher Standard of Direct-current Railway Operation." Mr Sprague is a firm believer in the extended possibilities of direct-current traction and has at other times expressed himself freely on the subject. George Westinghouse, on the other hand, is a believer in single-phase operation, and partially in answer to the stand taken by Mr. Sprague at various times has expressed his views on single-phase traction in a communication to the Railroad Gazette. The points he brings out are of interest and are here summarized.

Mr. Westinghouse believes that the single-phase system possesses all the advantages of the direct-current system with some others in addition. One of these advantages relates to electrolytic action. In this connection he says:

"No problem is of higher importance than that relating to the avoidance of the destruction by electrolytic action of all underground metallic work such as employed in the great improvements of the New York Central, the Interborough and other underground work yet to be undertaken, and the water and gas pipes of New York. These works have been created, not to last a decade, but are intended to and should endure for ages. It has been shown fully and completely that the direct current is working all the time in the destruction of some of the metallic structures, especially water and gas pipes, adjacent to electric conductors, which metallic structures invariably act as conductors for some of the current escaping from the uninsulated rails forming part of the electric circuit in railroad operations."

To illustrate this point Mr. Westinghouse produced a photograph with data showing electrolytic action upon a pipe, due to leakage of electric current from a railway in Pittsburg. Although the results illustrated by the photograph might indicate greater rapidity of electrolytic action than is ordinarily the case, with alternating current, he maintained, the action could in no way take place.

"In the matter of the regulation of the speed of trains upon standard railroads," said Mr. Westinghouse, "the single-phase system will have it all its own way, because with the continuous current no speed can be attained greatly in excess of the predetermined one. In railroad practice it often happens that speeds of 70 and 80 miles per hour are necessary to make up for time lost. If the direct-current motors are constructed for this speed, then at the ordinary speeds of 40 or 50 miles there would have to be introduced a dead resistance in the motor circuits to reduce the voltage, which condition can be maintained only for a short time, and is in effect not unlike applying a brake to hold the speed down. The only other way to maintain an average low speed would be to put the current on and off, an intolerable and uncomfortable practice one frequently observes when a motorman is obliged to move a street car at a slow speed. In the single-phase system the auto-converters used in connection with the locomotive and car equipments provide for continuous running at any desired speed in a manner equivalent to the placing of the throttle and reverse lever in appropriate positions."

Surface-contact System Finds Favor in England.

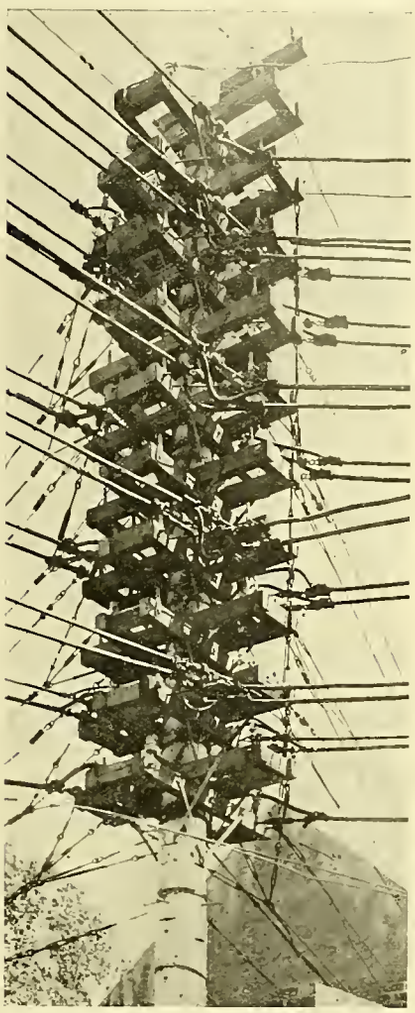
Reporting on electric railways in England, United States Consul Mahin of Nottingham tells of success in recent efforts to do away with the overhead trolley. The surface-contact system, he says, has met with much favor, and is now being installed in the town of Lincoln. Mr. Mahin writes:

"The town of Lincoln, with 50,000 population, 33 miles northeast of Nottingham, has adopted a street-railway system which has several unique features. Construction is now under way. The line will be about 13¼ miles in length, eight cars will be used, and the entire cost will be about $140,000. The system was adopted by the Lincoln City Council after long and careful investigation and consideration, and the securing of guaranties that place the corporation beyond possible risk of loss, such, for instance, as an undertaking by the constructors of the line to equip it with the familiar trolley if their system failed to work satisfactorily. The system adopted is known as the "G.-B." surface contact. The initials stand for Griffiths & Bedell, the patentees. The inventor is Mr. B. H. Bedell, an electrical engineer. The invention was substantially completed in 1904, though some modifications have since been introduced. An experimental line has been operated near London for over a year, but Lincoln is the first town to adopt the system.

"A dozen or more surface-contact systems have been tried and submitted to the judgment of tramway engineers and municipal authorities, but, if I am correctly informed, the "G.-B." is the first British invention to be adopted for practical use in this country. It is claimed, being the latest, to have eliminated all the faults discovered in other systems and to be as near to absolute perfection as is possible. An American surface-contact system, the Lorain, has been operated at Wolverhampton for the past three years. The last report of the tramway committee of that city's council says the operation of the system has been satisfactory."

Application of Kearney Cable Clamps.

Kearney cable clamps, which are designed to supplant the extra joints and cable suspension at angle poles and dead ends are a product of W. N. Matthews & Brothers of St. Louis. The Kearney clamp was fully described in the Western Electrician of November 4th. The opportunity is here taken, however, to reproduce an interesting photo-



APPLICATION OF THE KEARNEY CABLE CLAMPS

graph which shows clearly the use and great saving which may be accomplished by these clamps.

As shown in the picture, the pole, which is one belonging to the Edison Illuminating Company of Topeka, Kan., carries a great number of conductors. In connection with the cables there are 40 of the clamps used on this pole alone. As will be noted, the clamps make a neat and secure job, better than could be accomplished by the ordinary method of splicing.

C. R. Maunsell, superintendent of the Edison Illuminating Company, is authority for the statement that $250 was saved on this one pole by the use of the clamps, taking into consideration labor, material and cable.

The clamp is made in two parts joined by four bolts When the nuts are tightened the two parts of the clamp grip the conductor cable. The strain is then transmitted from the upper part of the clamp to a strain or similar insulator.

Tantalum Lamps Commercially Available in England.

Tantalum lamps are now commercially available as is shown by the fact that they are now extensively advertised in at least one English electrical journal. The claim is made that one 100-volt tantalum lamp burning for 500 hours with current at 10.15 cents per unit, will save $1.70 in comparison with an ordinary glow lamp of equal candlepower having an efficiency of 3.5 watts per candlepower when taking into account the first cost of the lamps. Commercial tantalum lamps are now made, according to the advertisement, with an efficiency of 1.7 watts per candlepower.

The Hutchinson Street Railway Company of Hutchinson, Kan., has changed hands. The system will be equipped for electric power.

Friction and Condensation in Outdoor Steam Pipes.

C. A. B., a Western Electrician subscriber, in an Illinois city, asks this question:

"Will you kindly inform me the approximate per cent. of loss in friction and condensation in carrying steam 250, 500 and 1,000 feet, respectively, in 10 and 12-inch mains overhead, exposed to the weather, the pipes being well covered with heavy asbestos covering and an outer covering of sheet iron. I would like very much to get this for summer and winter in order to obtain an average for the year."

ANSWER.

Inquiry fails to reveal any data on which to base an exact answer to this question. Obviously much would depend on the weather to which the steam mains were exposed, and this could only be forecasted approximately by making an average of the experience of past years from the weather records of the particular place in question. Again, it is evident that the condensation taking place in such pipes would be much greater, even though the mains were heavily insulated, than in the case of pipes buried in the ground, as is the usual practice. The loss of steam by friction would probably be no greater under the conditions named than in the case of sheltered piping, but practically it is impossible to determine in any aggregate loss what proportion is due to friction and what to radiation.

In St. Paul there is something over 4,000 feet of large steam mains placed in a large tunnel. This pipe, when carrying steam having a temperature of about 228 degrees, is slightly warmer outside of the insulation than the temperature of the human body; that is, it probably does not exceed 105 degrees. But of course this is not nearly so severe a condition as in the case of weather-exposed pipes, for the temperature of the tunnel does not vary within very wide limits. With the steam in the pipes the temperature of the air in the tunnel is about 80 degrees.

If any reader can give the results of actual experience with weather-exposed steam mains of the size and length mentioned, the Western Electrician will be glad to have him do so.

Long-distance Telegraphy in Australia.

An interesting account of some long-distance telegraph records made in Australia is given in the London Electrician. The experiments were commenced at 11 a. m., Melbourne, Sydney and Brisbane time, which, under the prevailing zone system, was 9 a. m. at Perth. Adelaide, Melbourne, Sydney, Brisbane and Townsville were in attendance and ready at the former hour and greeted each other. Cape York was then joined to the circuit, the signals to and from there being clear and firm. Owing to an unexpected delay at Eucla, which is a main repeating station situated on the Great Australian Bight, Perth was not in a position to communicate with Melbourne and the other capitals until 12 noon, but when it did there was no difficulty in speaking through to Cape York freely and well. Broome, a duplex station, 1,466 miles distant from Perth, was then connected to the circuit, and that place and Cape York passed the time of day and carried on a conversation for 15 minutes, at a key speed of 20 words per minute, without the least sign of lag in the signals. Broome stated that the temperature was 100 degrees in the shade there, while Cape York set it down at 80 at that end.

The signals passed from one terminal station to the other splendidly, annihilating distance in a most pronounced manner, and amply demonstrated to the satisfaction of all concerned that through telegraph working from one end of Australia to the other was a practicable feat. With the arrival of this successful issue the terminal stations were taken off, the intermediate circuits were dismantled and the experiments came to an end.

Railway Signal Association

The next meeting of the Railway Signal Association will be held at the Grand Union Hotel, New York city, January 9, 1906, at which time the following papers will be presented: "Signaling on the East Bengal State Railway," by George K. Rogers, signal engineer; "The Care of the Storage Battery as Used for Signaling Devices," by H. W. Lewis, supervisor of signals, Lehigh Valley railroad; "Line Wire," by F. F. Fowle, special agent, American Telephone and Telegraph Company, New York city.

A preliminary report of installation and maintenance of storage batteries will be presented by I. S. Raymer, chairman committee No. 4. Chairman Ames of committee No. 12 (rubber-covered wire) will take up for discussion the feasibility of a system for inspection for rubber-covered wires. In addition to this, an amendment of the constitution and one to the by-laws is to be voted on. H. S. Balliet, 335 Madison Avenue, New York city, is secretary of the association.

SELLING ELECTRICITY.

Under this heading will appear, from time to time, articles, suggestions and examples which will be of assistance in the constant effort to increase the existing demand for electric current and to create new demands.

Specification for Electric Wiring of New Buildings.

As the practice of wiring new buildings for the use of electric light and power is rapidly becoming universal, the idea of assisting, as much as possible, those contemplating the construction of new buildings has been found profitable. The Chicago Edison Company, through its contract agent, John F. Gilchrist, prepared a set of specifications for electric-wiring systems which are sent to prospective builders. A letter accompanies the specifications, the following paragraphs of which explain themselves:

"Realizing how many building owners spend money for wiring which is afterward found to be incomplete, we take the liberty of enclosing you a copy of a specification which, if complied with, will result in your building being wired in such a thorough manner that you will be under no expense for any changes when you wish to turn on electricity.

"If you care to look into the matter a little we shall be pleased to make suggestions to you of electric-light and power arrangements which are being put in nearly all modern buildings. These add greatly to the convenience of tenants and, consequently, to the income of owners."

Attached to the specificaions, Mr. Gilchrist gives a few of the most important of the rules governing installation of wires, issued by the City Electrical Inspection Department. He also advises architects, engineers, builders and electrical contractors to familiarize themselves with the latest edition of these rules.

Following is a reprint of the specifications themselves:

In General.—These specifications contemplate the installatioo of the necessary wiring to outlets of capacity for ..... incandescent lights, and ..... The outlets are to be distributed as shown on the plans of the building numbered .....

Should there be any changes or additions in the work called for in these plans or specifications, the contractor shall make additional proposals, stating the deduction or addition in price for such change or extra work. No change will be made io these specifications except on writteo order from the architect.

The contractor shall employ ooly thoroughly competant mechanics in the execution of the work, and all material is to be of approved manufacture, as listed by the Board of Fire Underwriters.

The contractor shall guarantee the wiring for one year from date of installation; injury or depreciation due to any cause beyood the control of the contractor aod ordioary wear being excepted.

The contractor must procure the necessary permit from the Department of Electricity of the City of Chicago before starting the work.

System of Wiring.—The wiring of mains and sub-mains will be oo the Edison three-wire system designed for a voltage of 115 volts between the neutral and each outside wire; braoch circuits to be run on the two-wire system from the distributing cut-outs.

All wiring oust be coocealed and encased in approved metal conduits, except that in cases where it is authorized by the architect, wires may be installed in molding, may be run on insulators openly, or may be fished in flexible fibrous conduit from outlet to outlet.

Wire.—The wire used throughout will be braided, rubber covered wire of a make approved by the National Board of Fire Underwriters. Before work is begun samples of the wire to be used will be submitted to the architect for his approval.

Mains.—Mains from service to cutout cabinets are to be provided of ample carryiog capacity and of such sizes that the maximum drop in voltage from service to cut-out cabioets will not exceed two per cent.

Mains are to be brought out of the building at a point designated by the company which is to furnish the supply of current, and the regulations of said company regarding service and meters shall be complied with in full. Service mains must not be brought out of building through a wall which stands on the property line abutting private property.

(Note: Arrangement has been made so that information concerning aforementiooed regulations, as well as the company inspection, will be furnished upon application without charge, by the compaoy supplying the current.)

Meter Loops.—Loops shall be arranged for meters as directed by the architect in conveniently accessible places and not over eight feet from the floor, and suitable boards will be provided on which to mount the meters.

Sufficient space will be provided to mount two Thompson watt-meters on each board, and the meter loops will be left sufficiently long to allow meters to be connected without splicing the wire.

Tap Lines or Distributing Circuits.—Distributing circuits are to be run from the tap cut-out cabinets to the various light outlets in the manoer hereinbefore described.

In laying out the distributing circuits for iocandescent lights ten lights shall be allowed for each distributing circuit aod the size of wire will not be less than No. 14 B. & S. gauge. For circuits more than 100 feet io length, the wire shall be of such size that the drop in potential shall not exceed two volts at full load.

Cut-outs and Cabinets.—The cut-outs will be grouped as far as possible and installed in cabinets of wood lined with asbestos. These cabinets will be located in convenient places, so as to be accessible at all hours without difficulty, as directed by the architect. The doors and framing of the cabioet are to correspond with the surrounding woodwork and the doors are to be provided with neat hinges and a snap latch.

All cut-outs for controlling 15 amperes or less sball be of an approved type capable of receiving Edison plug fuses and will be furnished with plugs complete. Strip cut-outs will be adapted to standard Edison type fuses and will be provided with fuses having copper terminals with their carrying capacity distinctly marked.

Switches.—A triple-pole knife switch of ample capacity is to be installed at a conveniently accessible point on the mains as near as possible to the service. This switch will be enclosed io a suitable box of approved construction, provided with hinges and snap latch.

All chandelier outlets will be controlled by snap switcbes conveniently located. Tbese switches will be Hart, or others equally as good to be approved by architect.

Additional switches will be installed to control lights as follows:

.....

Fixtures.—This contractor will install tbe wiring complete to outlets.

All fixtures are to be furnished by another contractor, who will hang them in positioo, and make the oecessary connection to light outlets, except that where receptacle sockets or drop cords with key sockets are called for, they are to be furnished by this contractor.

All sockets shall be of type suitable for receiving Edison base lamps.

Inspection.—The completed iostallation shall meet all requirements of tbe rules of tbe Departmeot of Electricity of tbe City of Cbicago, whose final certificate of inspectiop must be provided by he cootractor at his owo expense. Tbis certificate must be urned over to the architect before tbe work is accepted.

Getting New Business.

By R. L. Goodale.

In going out after new business and making an effort to increase your income thereby, I believe that no matter how small your town, a little system (and often large doses taken frequently) is the proper course to pursue.

This matter of system should first be applied to a systematic canvass of your commercial and residence districts, including every house that can be reached in any way by your lines; information secured as to whether the house is wired or not and has the fixtures or not, and any and all information that may lead to securing these parties for consumers, or if already consumers, selling them at some time some current-using device. This information can be kept on cards, filed in very inexpensive drawers or cabinets, and should be kept up to date as closely as your consumers' ledger is kept. This gives you a chance to go to a man knowing what he already has and almost what he needs.

For new business you must often look to new current-using devices and appliances—appliances that may not be new to you, but to your consumer or prospective consumer. In looking up the matter of current-using devices there is a wide field opened up, and although the larger cities will use more varied appliances and have a larger field for each, yet the smaller town has its field, and it only takes a little hustling to find out what that field is.

It is not within the possibilities for me to mention all the appliances that will be worth trying in your town, but I hope that some of those mentioned may appeal to someone and be productive of good results to his company. The general field for work along this line may be divided for convenience into a few general heads, as follows:

1. Commercial power business, including large and small installation of motors for varied purposes.
2. Sign, window and decorative lighting.
3. Residence lighting and appliances.

As a general thing the start is often the most difficult part of introducing any special device, and is often the only time when a central station management need make any special concession to a consumer. A consumer using other methods of power is often a little slow about adopting an electric motor in exchange for his old method, even if he does not succeed in getting the best results out of it and it is not entirely satisfactory to him. In nearly every town you will find small printing establishments operating small job presses by foot power, and the slower the man the more fertile he seems to be in excuses as to why he should not change to an electric motor drive. Some of these men can only be convinced in one way, and that is to show them. It doesn't cost much to have a motor in stock to install and make a demonstration with, and it is productive of good results, even if you don't sell a motor every time it is installed.

Often the first motor installed, and giving satisfaction, is the only thing necessary to open up a small or, possibly, a large field for the consumption of your current. Any appliance installed and giving satisfaction is a better advertisement to that line of the business than any paid advertisement that you can get out.

On small motors there is another opening at blacksmith and carriage shops in the forge blowers. They are not expensive to run, and any blacksmith will appreciate the saving of labor that it will give him. The motor-driven blower is a good wedge to start the blacksmith with, and if he is at all progressive you will find it easier to sell him motors to operate his drill-press and other small power-using tools and machines.

In putting out special appliances of this kind, if you approach the more progressive man in a special line of work you will not have very much difficulty in getting him to let you put an appliance in to try; and if you have picked your man well you will find he will keep it, and not only that, but boost it for all there is in it.

The original cost, even if it is high, does not always stand in the way of the sale of an appliance. In certain cases a man in a well-established business will pay a big sum for an appliance, simply because it will bring him big results. A case in point is a barber in Colorado Springs who is very slow to take up with anything new. He was approached by a traveling man from a barber supply house who induced him to buy a facial massage machine. This machine cost him $125, paying for it on the installment plan, and it represents a pretty good outlay for a slow man to make on a new appliance. Now that he has it, it would be hard to induce him to part with it, and he says he gives an average of about ten treatments a day at 35 cents a treatment. His current for this number of treatments will not run more than from eight to 12 units a month, and so he thinks he has a good thing. This item is not a large amount in itself for the company, but it is one of the many ways that in the aggregate mean more business.

The field in large motors is so large and varied that I cannot do more than mention it; but you will know of business that could be swung to a motor basis in your own town, and the thing to do is to go after it and get it. In some of these cases there may be only a small margin of profit, but they all add their mite to the general welfare and progress of the station.

The subject of sign and window lighting opens up an immense field for the use of current, and if presented in the right way will take with almost any merchant. Provided your town has saloons, you have a good basis to start on for a sign campaign. The saloon men don't advertise much, if any at all, but here is a method by which they can advertise and do it at a time when it will do them the most good and bring them the most trade.

Here is absolutely a new field for the consumption of current, viz., advertising; and if presented to the consumer along absolutely advertising lines will be one of the easiest methods of getting new business. You must not allow a consumer to believe that he is spending his money for lighting when you sell him a sign. Compare a sign costing him $15 a month to the amount of space that the same money will buy him in the papers and he will readily see that he has a cheap and most effective method of advertising.

The man who keeps open his place of business at night is not the only one to profit by a sign. The next man is the merchant who closes at, we will say, six o'clock. He has a good front and we will hope that he appreciates the advertising value of it. Why should he not keep his windows well lighted, as a pedestrian will look in at a well-lighted window at night when he will pass it up in the daytime? Add to that an attractive sign, well lighted and hung across the sidewalk, and he will have something that will draw the people. His windows will show them what he has, and his window lighting, if properly arranged, will make his goods looks so attractive that they will come back and buy.

I suppose we all, sooner or later, get up against the merchant who says he don't light up because there is no one on the streets; but you know and he will know, if he stops to think of it, that the people will not walk on dark streets. It makes no difference whether the city is New York or a village, the people will walk up the well-lighted streets and "pass up" the dark ones.

The merchants are the ones to make the start with, and you will have to help them. One of the ways is to light a sign for a certain number of hours per night, controlling the turning on and off by a patrolman or time switch; making a flat rate, and, if necessary, putting the sign on a weekly basis and sending a collector to collect the bill on Monday morning before the banks are open.

The general sign rate is about one-half the regular gross rates for current, and when the current is used in an entirely new field and in a new demand it is well worth getting at that price.

You will find many sign companies ready to make signs on their own or your designs, but we have found that we can build a sign, or have it done by local supply houses, cheaper than we can ship it in. The matter of sign design and construction will not take very much work to stand up, and the sign catalognes will show you what other cities are doing in the way of signs.

Many central station managers, representing both large and small plants, who have taken time to analyze the value of sign advertising, have come to the conclusion that it is a good thing to boost, and as the original cost of a sign often stands in the way of a merchant installing one, they have reached the conclusion that it is well worth the money spent to furnish free signs and make a two-year contract with the merchant

How many of your line extensions will give you the return that the investment in a sign will bring? The sign that brings you in $15 a month means $180 a year. The sign will cost you not to exceed $60. It is worth hustling for, and is usually not so hard to land as a residenial extension that will give you $60 income for a $180 line cost.

Don't overlook your window lighting, but boost it along the lines of advertising and not lighting. A merchant will sometimes pay $100 a month for newspaper advertisements and kick at a five-dollar bill for lighting his windows, when his windows well-lighted will bring him more business.

On decorative lighting sets and stringers there is a small or large field, according to the size and progressiveness of your town. If you want to sell a few of these sets it may take a long time to dispose of them. For special sales or Christmas decorations have a few of these sets and rent them out. The decorative sets will sell in the residence districts, especially at Christmas time, and if bought then the consumer can be induced to use them at other times of celebration.

To get into the residence possibilities for new business, I believe that one of the good fields that can be worked in practically any town is the electric laundry iron. A good laundry iron of from five to six pounds can be brought now for from $4 up, and manufacturers are now working along the

1. A paper read before the Colorado Electric Light, Power and Railway Association at Glenwood Springs, Colo., September 19, 1905. Mr. Goodale is connected with the Colorado Springs Electric Company.

lines of heating units that can be renewed without sending the iron back to the factory.

The laundry iron can be used for general laundry work in a residence, and for a family of from two to four will only use from 10 to 14 units per month. They appeal at once to the men, as well as the women, as an economy—not an expense, and they will sell rapidly if put out right.

If you have a showroom, you may find it rather difficult to get people to come and look at an iron; but just take the iron out on ironing day and install it, and tell the people that you want them to try it for 30 days. Explain to them the economies of an electric laundry iron, and at the end of the 30 days show them their bill, and unless it has gone up more than a couple of dollars you will find that you won't have five per cent of your irons returned. Sell them at cost and install them at cost, but get the irons out in commission. They will be used the year 'round, and any single appliance that you can put out that will bring in from $18 to $24 worth of income a year is a good thing.

I think the one feature that has stood in the way of the general use of the electric laundry iron is the renewal of the heating unit when it burns out; and as I have said before, this matter has been overcome, and there is an iron on the market that is reasonable in price and which can be renewed at a small cost and small expenditure of time by anyone familiar with electrical or even mechanical contrivances.

I know of a town in this state where the company had sold a good many small motors for family washing machines, but had not sold an electric laundry iron. It would seem that you could sell more laundry irons at five dollars than washing machine motors at $20 to $40, and I think the iron would bring in more income in a year.

There is the sewing machine motor that should have a small field of usefulness to the consumer and add its part to your welfare.

Keep trying new lines and new appliances, and you will find that you will hit the right thing if you will only keep everlasting at it.

There is only one more matter that I wish to bring up, and that is "Publicity." Keep your business before the people as much as you can, and in as many ways as you can afford. Don't let your newspaper advertisements get dead, but change them frequently. They may not be all of the best quality, but you will find that the contrast between the good and the poor will draw attention to them.

As this is not a paper on advertising methods, I cannot go into the matter of advertising, but I want to impress the fact on your minds that if you want new business and more business you must give it as much publicity as you can. Business don't come to many of us; we have to go out and get it.

Electrical Publicity.

Before the Seattle convention of the Pacific Coast Advertising Men's Association Mr. B. I. Dasent delivered an address on "Electrical Publicity" which contained many points of interest to central-station men. Mr. Dasent has had a wide advertising experience. He is at present connected with the advertising department of the Portland General Electric Company of Portland, Ore. Following is an abstract of his address:

That well-recognized principle in publicity that the best advertising is that which makes a direct proposition to the reader, inviting him to act, is peculiarly applicable to the requirements of companies furnishing electric light and power. The advertising of the electric-light and power company is properly more in the nature of a bid for investigation, an incitement to curiosity, a spur to the propounding of questions. It requires a personal interview to secure a contract; hence, in the advertisements of the Portland General Electric Company we do not attempt to tell the whole story as do those gifted gentlemen who describe the merits of breakfast foods or tempting arrays of dress goods. Our end is attained if we have succeeded in arousing the interest (and I may say curiosity) of readers of our advertisements, to the degree that eventually leads them to ask questions which it will be the business of our representative to answer.

Advertising with the direct purpose of selling electricity must primarily be "class advertising," for those to whom electricity may be sold are in number comparatively limited, and therefore general publicity, which, in the case of the cereal or other popular commodity, would manifestly be the advertiser's procedure, would in this instance be entirely too expensive, and would in fact entail a waste of ammunition, reminding one of the hunter who from lack of skill, perhaps, resorts to a Gatling gun to bring down a couple of birds that could just as easily have been picked off with two shots of a rifle in the hands of an experienced marksman.

The electric-light and power company does not sell electric current in popular packages by mail; hence direct returns from advertising are not expected. Our advertising is therefore primarily educational and aimed at those who are perhaps unaware that electric current is the summum bonum which is required to transform an uncomfortable city home into an earthly paradise. This class of readers, however, is not so important as that important clientele of every electric-light company—its customers—who must be educated in the use of this potent power, which runs silently through their homes, who must be taught how best to train this amiable genii to the multitudinous purposes of twentieth-century domesticity. Who must be shown by vivid object lessons that where electricity is used in the home for lighting there are numerous electrical appliances possible which double and quadruple the value of the central station's service to the household.

Just a word in regard to that somewhat widespread and equally untrue chimera with reference to the domestic applications of electricity, that it is a luxury—and an expensive luxury! That the domestic application of electricity is an "expensive luxury" is not true in the sense that the expression is commonly understood. For example, it is true that it costs more for electric light than for oil or candles—yet which do you use? The highway is free! But no one begrudges the nickel that is required for a ride!

The money directly paid for an article of service frequently represents very imperfectly its cost or value, and this applies with especial force to the use of electricity in its various applications.

In reference to the advertising campaign of the Portland General Electric Company it is perhaps necessary to call attention to the fact that so far as the supplying of electricity for light and power is concerned the field comprising Portland and its suburbs is controlled by the company. The question of competition does not therefore enter largely into the mode of operation—from an advertising standpoint. It is true there is a company selling gas in Portland, and steam is still used in certain manufacturing plants that are manifestly behind the times. But so far as our experience goes it has not been difficult to win converts from among those who used gas for illumination or steam for power. No business-getting campaign which appeals firstly, fifthly and finally to the interests, personal, sentimental, practical and financial of your public can fail.

An important and interesting feature of our campaign of education in Portland is the Bulletin, a monthly illustrated journal published by the company and sent to a selected list of customers, actual and prospective.

The Bulletin or house publication has become in these days an almost necessary adjunct to newspaper publicity. The advertising qualities of the Bulletin must be aggressive in tone, positive in quality and educational in its nature without being pedantic. The public at large is still greatly ignorant of the possibilities and advantages of electricity and it must be educated.

In a recent number of our Bulletin there is a paragraph which reads as follows: "The Portland General Electric customers in some respects resemble a great association, the high object of which is to secure to its members the greatest measure of happiness and prosperity to be gotten out of life." With the pertinent question, "Are you a member?" The purpose here is to establish, if possible, the sense of personal relationship with our customers, which is, perhaps, the most valuable asset of any successful business.

Keep in sympathetic touch with your customers. Show them that it is to your mutual interests to establish and exchange friendly relations. Impress on their minds that you desire their friendship and make the appeal as personal as good taste and judgment will permit. Try to meet the needs and conditions of the various classes of your customers. To fulfill adequately its mission the Bulletin should contain material of specific interest: To the merchant who needs electric light in his store and electric signs over his doors; to the manufacturer who is striving to solve the problem of cheap power; to the architect who may be one of your chiefest allies; the engineer, the contractor, the family man who pays the bills and the good housewife whose divine right it is to create the bills. She it is who requires the fullest knowledge of the multitudinous possibilities of the electric current for lightening her labors.

"Follow the Wires."

Under the above title a well-illustrated booklet prepared by the Denver Gas and Electric Company tells the story of how electricity can play an important part in the daily routine of the average business man. The writer follows a man from the time he arises until he again retires at night, illustrating each incident.

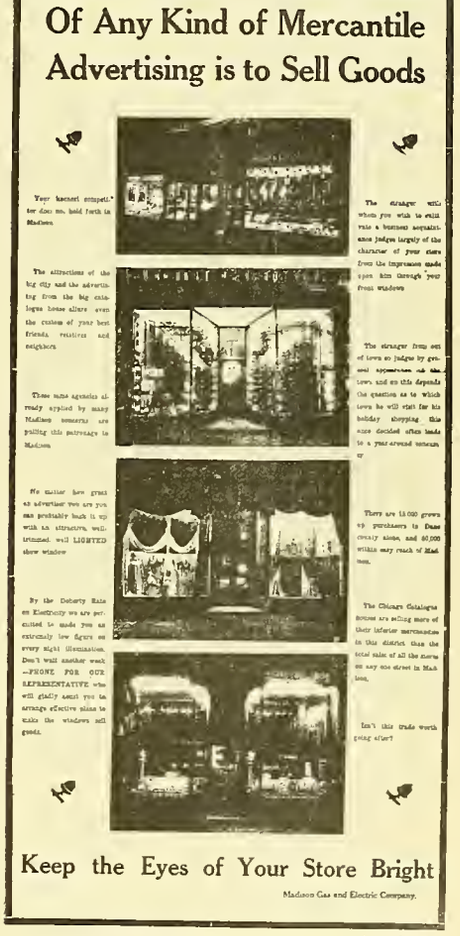
First, an electric bell awakens one in the morning. You want a shave; the little electric heater warms the water in a minute. In your search for a collar you find no choice because they were ironed by electricity; the electric iron gives an even heat, no scorching. By this time the electric chafing dish has boiled the eggs for a hurried breakfast and you are off for the street car operated by electricity. Finding a seat, under an electric light if early in the morning, you read a newspaper printed on a press driven by electric power.

You have now reached the office building. Noiselessly and smoothly the electric elevator lands you at your floor, and, entering the office, you transact in a few minutes over the telephone business which otherwise might take all day. If it's a little warm the electric fan will cool you. Pressing a button will bring a messenger boy, and in a few minutes you have instructed the broker in Wall Street by the electric telegraph. Perhaps you have an appointment with the photographer, and it is a dark, rainy day. If so, he will take the picture by the aid of specially designed electric lamps.

The business day over, the electric automobile takes you for a ride. This over, an electric sign "cafe" directs the way to dinner downtown, and many others tell of the attractions at the theaters. Reaching home it is a bit chilly because the fires have been banked, but the turning of a switch brings electric heat to the ornamental grate. A rarebit, perhaps, in the useful electric chafing dish, and then the faithful electric bulb lights the way to bed and rest.

Electric Signs and Window Lighting.

Many central-station companies have developed a large business in the sale of electric current to merchants for signs and window lighting. After a demand has been created by the lighting companies for their product, various plans are followed as inducements, such as the furnishing of designs for window display, the installing of electric signs free of first cost, etc., but the principal effort is required to create a demand and keep it. In doing this considerable money is spent by some companies in keeping the sign and decorative lighting branch of their business before the public.



FAC-SIMILE OF FOUR-COLUMN AD. IN MADISON (WIS.) DAILY NEWSPAPER.

The accompanying cut is a reproduction of a four-column ad. of the Madison Gas and Electric Company in a local paper of Madison, Wis. The four views of store fronts in Madison, illuminated from the mains of the lighting company, give publicity to the merchants and create a desire on the part of others to have their business equally prominent. The Madison company tells the merchants that "the one purpose of any kind of mercantile advertising is to sell goods," and one way to do this, it says, is to "keep the eyes of your store bright." In small type around the halftones in the advertisement the company tells the merchants how it will pay them to use electricity in making their stores bright.

That the Madison company's efforts have been successful in selling current to storekeepers for advertising purposes is evident from a large poster which it is distributing and on which is printed in halftone many pictures of every-night illuminations in Madison. In the center of the group of pictures a few words call attention to Madison as "the ideal shopping center of Wisconsin," and the fine pictures are intended, no doubt, to prove the assertion. The poster is 25 by 38 inches, and 36

halftone cuts of store interiors, show windows, signs and other illuminated decorative effects show how thoroughly the merchants believe in the use of electric lights as a means of advertising their wares.

Wisconsin Independent Telephone Association.

The annual meeting of the Independent Telephone Association of Wisconsin was held in Milwaukee on December 20th and 21st. Richard Valentine of Janesville, president of the association, presided at the meetings, which were well attended. The Wisconsin association was organized in 1900 with 18 members. It has grown to 16 active and 29 associate members. Secretary H. C. Winter of Madison reported that the growth of the Independent movement in the state is continuing steadily. Forty-one new companies were incorporated in 1902, 49 in 1903, 32 in 1904, and up to date this year 39 new companies were organized, with a capital of $415,000. Carefully prepared data give the state 300 Independent companies, with 1,300 toll stations, 375 exchanges, 42,000 subscribers and an investment of $4,000,000.

President Valentine called the first session to order shortly after noon on December 20th at the Hotel Pfister. Twenty-two members were present. In his opening address Mr. Valentine called attention to the fact that several sub-licensee companies of the Bell interests still held membership in the association. He suggested that the resolution passed four years ago depriving such companies of membership in the Independent association be put in effect. This was done at a later session.

A matter of much importance to the Independent telephone interests of the state was then brought up by the president—that of securing a franchise for an Independent telephone exchange in Milwaukee. Those more directly interested in the matter of gaining an entrance to the largest city of the state were enthusiastic over the subject and a long discussion ensued as to what would be the wisest plan for the association in bringing the matter before the City Council. The president appointed a committee composed of G. W. Wilder, A. M. Webb, J. C. Harper, J. M. Baer and E. I. Bates to have charge of this franchise matter.

At 2:30 p. m. the meeting was adjourned with the understanding that the members proceed to the City Hall, there to meet the judiciary committee of the City Council, which has under consideration the franchise matters of the Independent companies. The question under discussion before the committee was whether a measured or a flat-rate system of charge for telephone service was preferable, and President Valentine as representing the Independent Telephone Association of Wisconsin was called upon to express his views.

Mr. Valentine said: "I have yet to find one of our companies that is not opposed to a measured-service system. I have talked with all of those represented at our convention here today, and there are none of them in favor of a measured-service plan. We do not believe it could be successful in any city where the competition is strong. Of course where a company has a monopoly it can do about as it has a mind to; there is no doubt but that a measured service is a good thing for the company. There is more money in it. If there was not they would not have adopted it as they have in Chicago, and I presume more or less in Milwaukee, but where we have competition I do not think any of us could compete with the Bell company for a month."

The judiciary committee of the Common Council held a long session, during which the question of the relative advantages of a flat rate and measured rate for telephone service was considered. Among those who presented arguments on the matter were Don J. Farnsworth, Max Zabel, H. D. Stroud and Mr. Hoffman.

The committee apparently was favorable to granting an Independent franchise, but was not ready to decide between the various systems and franchises offered, and being unable to reach an immediate agreement, and having been in session for three hours, adjourned subject to the call of the chairman, the chairman stating that the next meeting would be called in about two weeks, when the various franchises offered would be considered.

When the convention reconvened at 10:45 a. m. on the second day Mr. J. C. Harper reported that the committee to which was entrusted the matter of franchise negotiations with the City Council of Milwaukee did not think it wise to hurry the matter. The committee suggested that a broad resolution be drawn embracing the association's claims for a franchise in the city and setting forth its views and wishes, and that this resolution be given to one of the aldermen and by him presented to the City Council. This plan was adopted by the convention.

The subject of telephone rates was then taken up. Attention was called to the wide range of rates alleged to be in force by the Bell companies in towns of the same class. President Valentine called attention to the fact that a year ago Independent telephone men succeeded in having passed by the Legislature a bill providing that the same rate must be charged for telephone service in all towns of the same class. The Independent companies were urged to co-operate in bringing this law to a test, hoping thereby to do away with unfair competition.

Mr. J. Shirley Eaton of New York, who represents the new telephone device known as the Poulsen automatic telegraphone, happened to be in Milwaukee and was at the meeting. At the request of the members he gave a description of the device, which records automatically on a steel wire any conversation over the telephone. The members were greatly interested in the device, many of them having never heard of it before. Mr. Eaton stated that there are in this country only 15 telegraphones, all made in Denmark. The manufacture of them has begun in this country and in a few months, he said, the American product will be ready for delivery.

Taking up the business of the association, the president stated that the association was in need of more money. He recommended that the assessment to members of one cent per telephone be increased to two cents. After some discussion the motion of W. F. Goodrich that the assessment for the coming year be placed at two cents per telephone and two cents per mile of toll line was adopted.

The Chippewa County Telephone Company of Chippewa Falls and the Deerfield Telephone Company of Deerfield were admitted to membership in the association.

The nominating committee, composed of W. J. Bell of Deerfield, G. N. Hidershide of Arcadia and Charles Shernecker of Sun Prairie presented the following nominations, all the gentlemen named being unanimously elected as the officers of the association for the coming year:

President—Richard Valentine of Janesville.

Vice-president—J. C. Kuoni of Sauk City.

Secretary and treasurer—W. F. Goodrich of La Crosse.

Executive committee—William Van Middlesworth, Racine; Philip Sheridan, Green Bay; J. C. Harper, Madison; E. I. Bates, Chippewa Falls; John M. Baer, Appleton; W. J. Bell, Deerfield; J. C. Crowley, West Superior.

President Valentine made a short address in which he thanked the association for repeatedly honoring him with the election to the presidency of the association. His well-chosen remarks were pleasing to the members.

Mr. S. A. Dinsmore of Chicago was present and extended a hearty invitation to the association to attend the electrical exhibition to be held in the Coliseum, Chicago, beginning January 15th. The association was especially pleased with the invitation, inasmuch as a Wisconsin man, Thomas R. Mercein, is manager of the electrical show.

The time and place for holding the next convention was left in the hands of the executive committee.

The following-named representatives were in attendance at the convention:

Harper, J. C., Dane County Telephone Company, Madison.
Bell, W. J., Deerfield Telephone Company, Deerfield.
Forbes, C. W., United Telephone and Telegraph Company, Chicago.
Sipperly, E., Badger Telephone and Telegraph Company, Milwaukee.
Valentine, R., Rock County Telephone Company, Janesville.
Goodrich, W. F., La Crosse Telephone Company, La Crosse.
Teasdale, H., Monroe County Telephone Company, Sparta.
McKinney, F. W., and Andrew MacIntosh, Edgerton Telephone Company, Edgerton.
Slater, Alfred, Beloit Telephone Company, Beloit.
Richmond, R. M., Evansville Telephone Company, Evansville.
Willitz, H. C., Rock County Farmers' Telephone Company, Janesville.
Wilder, G. W., Cambridge Telephone Company, Cambridge.
Bates, E. I., Chippewa County Telephone Company, Chippewa Falls.
Wells, B. H., and A. D. Burdick, Milton and Milton Junction Telephone Company.
Hidershide, C. N., Western Wisconsin Telephone Company, Arcadia.
Webb, A. M., Jefferson County Telephone Company, Fort Atkinson.
Baer, J. M., Fox River Valley Telephone Company, Appleton.
Farnsworth, Don, W. Bills and J. W. Wagner, West Shore Telephone and Telegraph Company.
Rosenheimer, John, Jr., Cedar Lake Telephone Company, Schleisingerville.
Stroud, H. D., Peoples' Postal Telegraph Company, Milwaukee.
Mintzlaff, Fred, Grafton Telephone Company, Grafton.
Fisher, C. N., Plymouth Telephone Company, Plymouth.
Baster, D. L., Mazomanie Telephone Company, Mazomanie.
Grave, H. B., W. F. Pinnow and A. A. Paulson, Eastern Wisconsin Telephone Company, Kiel.
Rosenow, H. E., Badger Telephone Company, Oconomowoc.
Penhallegan, R. J., Mineral Point Telephone Company, Mineral Point.
Hyland, W. P., and Fred M. Cole, Ashland Home Telephone Company, Ashland.
Slater, A. G., and C. R. Clausen, Waupaca Telephone Company, Waupaca.
Schernecker, Charles, Interurban Telephone Company, Sun Prairie.
Schmidt, J. U., Troy and Honey Creek Telephone Company, Sauk City.
Weirich, J. J., Monroe Telephone Company.
Colonius, Mrs. C. A., Central Wisconsin Telephone Company, Portage.

Following is a list of the exhibitors and their representatives at the convention:

Julius Andrae and Sons Company, Milwaukee, J. C. Schmidtbauer and H. P. Andrae; Frank B. Cook Company, Chicago, F. W. Pardee, P. M. Chamberlin and R. E. MacDuff; Kellogg Switchboard and Supply Company, Chicago, Frank Rotchka; Vought-Berger Company, La Crosse, P. W. Goodman; American Electric Telephone Company, Chicago, M. W. Zabel and J. C. Henderson; Illinois Electric Company, Chicago, E. A. Quarfot and N. G. Harvey; Standard Telephone and Electric Company, Milwaukee, H. M. Eldred and H. C. Biester; Stromberg-Carlson Telephone Manufacturing Company, Rochester, J. J. Nate; Milwaukee Telephone Manufacturing Company, Milwaukee, F. J. Whittemore and A. Geiger; Independent Telephone Manufacturing Company, Madison, A. L. Bureh and Frank Quinn; Sterling Electric Company, Lafayette, Ind., H. T. Doolittle; Monarch Telephone Manufacturing Company, Chicago, L. Q. Trumbull and A. Duncombe; Electric Appliance Company, Chicago, S. A. Dinsmore and J. B. McMullen; Miller Anchor Company, Norwalk, Ohio, G. H. Miller; North Electric Company, Cleveland, Ohio, I. J. Kusel; John A. Roebling's Sons Company, Chicago, A. Wissler; Automatic Electric Company, Chicago, C. L. Fisher; Standard Underground Cable Company, Chicago, James E. O'Neill.

Indiana Telephone Items.

The Dilsboro Telephone Company, Dearborn County, has been incorporated to establish a telephone system in Dilsboro. Fred L. Lubber, C. W. Wilson and H. P. Long are the incorporators.

The Citizens' Telephone Company of Terre Haute has reincorporated and increased its capital stock to $1,000,000. It was announced that this would be done at the time the Kinloch company of St. Louis bought the controlling interest. The officials deny that the company will be merged with any other. The officials state that $150,000 will be spent in improvements at once. S. R. Hamill, F. B. Smith and W. P. Ijams are among the directors.

The Brownville Co-operative and the Bell Telephone companies have agreed to exchange service in Hamilton and Fayette counties.

The Central Union Telephone Company has decided upon plans for the erection of a building for a local telephone exchange in Columbus. O. P. May, the resident manager, says that bids will be asked for immediately and that the improvement will be in keeping with a general plan of the company to rebuild all of the company's exchanges in the state. The Citizens' Telephone Exchange in Columbus has announced an increase in rates for January 1st. The patrons of the latter company are protesting against the increase. At North Vernon the effort of the Independent Telephone Company to raise rates may result in giving the Bell company the same kind of a franchise.

The Board of Safety has made a contract with the Indianapolis Telephone Company for telephones to be used in the Department of Safety in 1906. The department has added two telephones to the list, but the price for 1906 will be the same as for 1905—$1,250. The City Council allowed $2,500 for telephones for the department and a similar contract has been made with the Central Union Telephone Company. This contract embraces the private exchanges at police and fire headquarters.

In Indianapolis a decided stand has been taken voluntarily by the citizens generally against the proposed increase in telephone rates by the Indianapolis Telephone Company. The members of the new council are reticent, but three of the number are known to be advocates of the increase, and it is supposed there are others. Merchants as a whole are against the movement toward raising the rates, although no action has been taken. S.

Southeastern Telephone Developments.

A merger of telephone interests has been announced at Tampa, Fla., where the Southern Bell Telephone Company abandons its plant, etc., to the Peninsular Telephone Company, an Independent concern operating in Tampa for some years. The amount of money involved is not announced.

The North State Telephone Company of High Point, N. C., has been granted a franchise to do business in Greensboro, 20 miles distant, and operate a long-distance service touching several counties of the state.

The town of Thomason, Ga. is one of the first in the South to lease a telephone system, having taken charge of the local exchange, with privilege of buying the same at the expiration of a stated time. Many improvements will be made and the capital stock increased in line with the city's views on municipal ownership of public utilities.

The Southern Bell Telephone Company is rebuilding its system in Spencer, N. C., and a thoroughly up-to-date exchange will be the result.

The Roseboro and Fayetteville Telephone Company has been chartered to operate lines between these two North Carolina towns, and in other sections, with $10,000 capital. A. M. Brittain is among the stockholders.

The Carthage (N. C.) Telephone Company has been chartered with a capital of $5,000 by W. C. Petty and associates.

The Sumter (S. C.) Telephone Manufacturing Company has established an apprenticeship service to instruct new men in the work, a salary being offered to those who are accepted by the company to begin work in the factory. L.

Telephone News from the Northwest.

The Russell (N. D.) Telephone Company has been incorporated by G. F. McKnight and others with a capital of $5,000. A local exchange will be put in.

The Durand Light and Power Company has purchased the Pepin Telephone Company's line from Durand to Arkansaw, Wis.

A franchise has been granted at Ardoch, N. D., to the Northwestern Telephone Exchange Company.

Citizens at Montrose, Minn., have formed a company for a telephone system.

A leading barber shop in Minneapolis has in-

stalled a set of portable telephones, so that patrons may be called or call while in the barber shop.

The Tri-state Telephone Company, which seeks admission to Foley, Minn., for a local exchange, is said to have offered free service until connections are possible with St. Cloud, which is promised in three months.

It is stated that the Northwestern Telephone Exchange Company is planning to make Crookston, Minn., a district headquarters for toll-line connections covering the Red River Valley, and reaching east to Duluth, Minn., and west through all North Dakota.

The Hammond (Minn.) Telephone Company has recently been incorporated. The company has an established exchange.

The Red River Lumber Company will extend its telephone line at Akeley, Minn., to connect with the Solway line at Squaw Lake.

The Mutual Terminal Telephone Company has installed a new switchboard in its offices on Locust Street, Des Moines, Iowa, at a cost of $10,000.

L. R. Olson and others have organized a rural telephone company near Radke, Iowa.

The Bell telephone company will join with the farmers' company at Traer, Iowa, in operating a joint exchange.

The Nebraska Telephone Company has installed a new switchboard in its exchange at Oakland, Iowa.

The Madrid (Iowa) Ice and Telephone Company will put in a new switchboard at its exchange.

A franchise has been granted the LaMoure County Telephone Company for a telephone line from Adrian to Jamestown, N. D. R.

Ohio Telephone Notes.

President F. S. Dickson of the Cuyahoga Telephone Company has denied that the property was optioned by the St. Louis capitalists, as was reported and published in Cleveland last week. The story was to the effect that options had been secured on several of the other Federal properties also. J. B. Hoge was in St. Louis last week conferring with these gentlemen upon a number of matters, and this gave rise to the idea that the deal was almost ready to be closed up. That some important plans are being worked out relative to the Independent companies is certain, but not definite announcement has been made as to what they are.

The Jefferson Citizens' Telephone Company has been organized at Jefferson, and a franchise will be asked of the council at once. The company proposes to install a modern plant and seek connections over the Independent lines to all parts of Ashtabula County. It is also stated that more favorable rates will be offered than the old company has been giving.

At a meeting of the directors of the Newark Telephone Company of Newark a few days ago, a semi-annual dividend of three per cent. was declared on the preferred and a quarterly dividend of two per cent. on the common stock.

The capital stock of the Lancaster Telephone Company has been increased from $100,000 to $150,000.

Under the name of the Central Telephone Company, the Bell interests have secured a franchise at Willoughby, a village east of Cleveland.

The Queen City Home Telephone Company of Cincinnati has been incorporated with a capital stock of $10,000 by Harry B. Gates, George W. Beers, Calvin Voss, C. B. Matthews and Max Silberberg. This is the corporation that will take the place of the Queen City Telephone Company, which was declared not properly incorporated by the Supreme Court recently, and the decision of the Probate Court giving it a franchise in Cincinnati reversed. The company will apply to the new City Council for a franchise.

Frank L. Beam and Cyrus Huling of Columbus attended the meeting of the board of directors of the Charleston Home Telephone Company at Charleston, W. Va., last week to discuss the improvements being made on the various properties that have been combined with this company. The Galipolis Telephone Company has been reorganized and lines built connecting that town with Columbus, Pomeroy and other places. It is said that a company with $5,000,000 capital stock in Kentucky will take care of a number of Independent plants and probably lap over into West Virginia to meet the lines that the Charleston organization will control. C.

Central Union Telephone Club.

Members of the newly formed Central Union Telephone Club met at their rooms in Indianapolis, Ind., on December 22d for a business meeting to perfect the organization and discuss plans for the Friday night school, which will be one of the features of the movement. The club is composed exclusively of the employes of the Central Union Telephone Company, the Western Electric Company and the American and Illinois District Telegraph companies. Commodious and comfortable quarters have been fitted up and will be maintained at the expense of the Central Union Telephone Company. The club has 87 charter members. In the assembly hall a school of instruction for all classes of telephone employes will be installed with models of every piece of apparatus used in telephone construction. Regular tuition will be given free to members of the club.

The officers are: President, E. T. Busselle; vice-president, E. F. Bates; secretary, C. M. Wells; treasurer, Gustavus Green; sergeant-at-arms, Frank Kerns. There will be two social evenings each month, according to the present plans. The first will be in the nature of a smoker or similar entertainment, for members only, and the second will be an open meeting to which the members may bring ladies.

Bell Telephone Output.

The comparative statement of the instrument output for November, and 11 months, just issued by the American Telephone and Telegraph Company, while showing a falling off in the matter of gross output from the record-breaking figures of October, of approximately 10,000 instruments, more than makes this decrease good in the lessened number of instruments returned. So that, the net output, 134,395 instruments, was the largest ever reported by the company, exceeding by 196 the returns for October. The figures for the month and for the 11 months of the current year to November 30th make the following comparisons:

November:	1905.	1904.	1903.	1902.
Gross	183,470	103,922	96,963	93,487
Returned	49,075	39,934	32,297	36,838
Net	134,395	63,988	64,666	56,649
Jan. 1 to Nov. 30:				
Gross	1,677,800	1,094,291	1,020,941	994,422
Returned	566,553	465,631	441,013	420,682
Net	1,111,247	628,660	579,928	573,740
Outstanding:				
November 30	5,591,811	4,408,177	3,307,248	3,099,346

GENERAL TELEPHONE NEWS.

The Pioneer Telephone Company has purchased the automatic system in Waukomis, Okla.

The Mansfield (Tex.) Telephone Company has been extending its line, and has increased its capital from $8,000 to $16,000.

Grylls & Gies are receiving bids for a telephone-exchange building for the Michigan State Telephone Company to be erected in Woodmere, Mich.

H. J. Pettengill, president of the Northwestern Telephone Exchange Company of Minneapolis, has returned from a trip through the Southwest.

The girls employed at the factory of the Automatic Electric Company in Chicago celebrated Christmas with a tree decorated with colored electric lights. Enough baskets, containing presents and candy, were provided for each of the 50 girls present at the close of work on December 22d.

Among the recently incorporated telephone companies are the following: Hand County Telephone Company, Miller, S. D.; Dutton Telephone Company, Dutton, Okla.; Johnson County Home Telephone Company, Tecumseh, Neb.; Surprise Telephone Company, Surprise, Neb.; Alton Mutual Telephone Company, Alton, Kan.; Douglas Home Telephone Company, Douglas, Kan.

The Nebraska Independent Telephone Association will hold its annual convention in the Lindell Hotel, Lincoln, Neb., on January 23d and 24th. Much enthusiasm among the Independent telephone operators of Nebraska is reported and a well attended and profitable convention is expected. W. E. Bell of York, Neb., is president and R. E. Mattison of Lincoln acting secretary of the association.

The directors of the Bell Telephone Company of Philadelphia at a recent meeting decided to recommend to the stockholders that the capital stock of the company be increased from $16,000,000 to $30,000,000. The stockholders will vote on the proposition on February 20th. If the recommendation is approved the new stock will be offered to stockholders from time to time, in proportion to their holdings, in such amounts as the requirements of the business may demand.

The stockholders of the American Telephone and Telegraph Company at a special meeting approved by more than a two-thirds vote the resolution authorizing the directors to issue $150,000,000 convertible bonds from time to time as they may see fit. The total number of shares represented at the meeting was 1,438,136, of which 1,234,613 voted in favor of the proposition and 3,522 against it. President Fish said: "We have no plans in view at present, no negotiations under way for the sale of any part of these bonds. All we ask is the authority to do so whenever in the judgment of the directors it seems wise."

At the annual meeting for the award of distinctions gained the last year at Harvard College, Frederick P. Fish, president of the American Telephone and Telegraph Company, was the principal speaker. Dean Hurlbut explained the purpose of the meeting, saying that it was to do honor to those who seek to honor the college by maintaining the high standard for which it has ever been famed. The old adage, he said, was that the high man in college was soon passed in the world. To refute this statement, he introduced Mr. Fish as one of the best scholars in his class, that of 1875. Mr. Fish delivered an excellent address.

Work of the National-Interstate Association.

Official bulletin No. 6 has been issued from the headquarters of the National Interstate Telephone Association at Cleveland. It gives an outline of the progress of the association and a report of the meetings of the executive council and the committee on litigation and legislation.

Independent telephone companies which have not done so are again urged to send in data concerning their systems, so that official state maps showing the Independent telephone lines can be completed.

At the meeting of the executive council James B. Hoge, Theodore Gary, J. D. Powers, Ed. L. Barber, C. O. Deering and George W. Beers were present; also J. G. Splane, treasurer of the association. A review of the Independent situation showed great progress since the last national convention. New capital has entered the field and new territory is being developed. Three permanent committees were created—standard forms of accounting, standardization of equipment, and standard operating rules and regulation.

After considering invitations from a number of cities, St. Louis was selected as the place for the next national convention, to be held some time in June, 1906. The president is to have charge of the details and the exact date will be announced later. A fitting memorial upon the death of William D. Barnard, a member of the council, was adopted. A committee was appointed to carry out plans for raising the necessary funds to continue the work of the association.

The committee on litigation and legislation completed plans for settling territorial disputes between companies, and discussed many other matters. Dwight E. Sapp, Breckinridge Jones, J. B. Ware and E. E. Clement were present.

Motors in Argentina.

Interesting facts relating to the use of various types of motors in Argentina and suggestions that will prove profitable to manufacturers of those machines, are contained in a letter written by Special Agent Hutchinson at Buenos Aires. The United States already has a large and growing trade in these machines, being double that of its two principal competitors—England and Germany. Mr. Hutchinson declares that the present favorable position can be maintained only by persistent effort and vigilant attention to the needs of the market. English and German agents are constantly in the field, and American manufacturers should also have agents in Argentina to improve the opportunities that are constantly presenting.

The labor troubles which have been disturbing Argentina for some time past, says Mr. Hutchinson, have drawn new attention to the country's need for small labor-saving machines, and recently he has received inquiries which indicate that the purchases of such machines from the United States may be considerably increased. The country must economize labor in every possible way, and the producers, large and small alike, are more than ready to welcome the introduction of labor-saving machinery. They naturally look toward the United States as the chief source of supply. Attention has been turning, in the past few years, particularly toward one class of labor-saving machines—small motors for the farm, the ranch and the workshop—and abundant evidence of the importance of the new development is furnished by the official figures of the foreign purchases of such articles. The total imports of motors, operated by electricity, wind power, water power, gas, petroleum or naphtha, for the five years from 1895 to 1899, averaged $157,000 per annum; for the five years from 1900 to 1904 the average was $406,000. In 1904 the imports were $754,000. This large increase has been due mostly to increased purchases from the United States.

The reason for the commanding position held by the United States seems to lie in the fact that its manufacturers excel in the production of small and inexpensive motors, these kinds being in strong demand. The average value of motors imported from the United States in the five years 1900-1904 was only $99 per motor; those from Germany averaged $209; Italy, $275; England, $419; Belgium, $939, and Switzerland, $2,000. There is every reason to believe that the principal demand will continue to be for these small motors, and it is in this direction that exporters are urged by Mr. Hutchinson to continue their efforts.

The motors wanted are of all kinds, from electric fan motors up to four or five horsepower gasoline engines for use on the estancias. In the towns there is steadily increasing use of electric power for small industries. Not only is Buenos Aires well supplied with electric service, but many of the interior towns have their electric lighting plants, and wherever persistent efforts have been made to introduce small motors they have met with success. The Germans are particularly active in the matter, and there are recent instances in which their goods have been pushed so energetically in new fields as almost to exclude the American. There are openings at present at many interior points, notably Rosario, Santa Fe, Parana, Concordia and Corrientes. At the last-named town an electric plant is now in nrocess of construction and will be completed in a few months. It is being built by a German company.

On the ranches, or estancias, electric power is, as

a rule, not available, and the motors needed must be operated by kerosene, gasoline, naphtha, etc. They are put to a multitude of uses, the principal ones being the pumping of water (as supplemental to windmills), the shearing of sheep, the chopping of fodder, etc.

While the United States has a large and increasing share in the motor trade in Argentina, Mr. Hutchinson says that it is a position which can be maintained only by continued alertness to the needs of the market. It would be a mistake for American manufacturers to rely too exclusively on the superior excellence of their machines. Agents should be constantly in the field on the outlook for opportunities.

The Influence of Electricity on Power Engineering.[1]

By W. B. Esson.

The early seventies saw the inventions of Gramme and Von Hefner Alteneck and the beginning of the electric-lighting era. From those early days till now progress has been continuous. In 25 years the size of electric generators has increased from five horsepower to 5,000 horsepower, from the machines which fed the Jablochkoff candles in the Avenue de l'Opera in Paris, to the magnificent triumph of engineering realized in the generators at Niagara.

It was not until 1880 that the first incandescent lamp factory was started on a commercial basis.

From 1880 onward power transmission made progress. Arc-lighting work had taught manufacturers how to make machines for higher pressures, and the demand consequent on the invention of the incandescent lamp gave the necessary stimulus to development.

There was no such thing as transmission of power in the sense that we now understand it until the electric motor made its appearance.

About 1889 engineers on the Continent were faced with a very important problem. They saw in their waterfalls thousands of horsepower running to waste. They knew that by adopting electric transmission, this power could be utilized and distributed to great advantage among manufacturers scattered over a wide area, but they also recognized that success could only be obtained by the use of a pressure considerably higher than the 2,000 or 3,000 volts then in use. The problem required a considerable amount of study, the position being: For alternating currents, pressure all right, but no motor available; for continuous currents, motors available, but pressure not high enough. As the supply of power was the leading idea, the system which possessed the motor had to be chosen, and continuous current was consequently adopted, with the brilliant device, however, of joining up all the motors in series and spreading the high pressure over the lot, while connecting the generators in series to keep down the pressure on the commutators of individual machines. In this system the current is kept constant, the pressure varying according to requirements, and at the date I am speaking of it does not appear that there was any other way of providing a general power supply. It says much for the engineering of the installations on this system, that they are in most successful working today, and what is more, they are being added to in competition with the three-phase system. A considerable number of installations on similar lines have been laid down, some of them of great importance. Among these is the Brescia transmission of 700 horsepower at 15,000 volts over a 12-mile line, and the larger installation for supplying La Chaux-de-Fonds with 2,400 horsepower at 14,400 volts over a 32-mile line. Another installation is at work transmitting 4,000 horsepower at 22,000 volts over a 34-mile line from St. Maurice to Lausanne, and there is in course of construction the largest of all, designed to transmit 6,000 horsepower at 60,000 volts over a line 114 miles long from Moutiers to Lyons.

Now a system showing such strong vitality, though working on what nine-tenths of our engineers would call antiquated lines, cannot be dismissed in a sentence. The facts are, that the system is going ahead in the face of the three-phase alternating system and is successful on a scale commensurate with many of the larger three-phase installations. The Americans say that the success of such a system would be impossible in their country, because the motors would not there get the careful and skilled attention given to them on the Continent. This may be so, but with a large plant and sub-stations the objection need not hold. In any case it is certain that every engineer will look forward with the greatest interest to the completion of the large scheme now in progress.

It was at the Frankfort Exhibition of 1891 that the problem of long-distance transmission was satisfactorily solved. A tremendous impetus was given to power transmission in Europe, and soon a large number of installations were working on the new system, transmitting power to distances up to about 15 miles, at pressures in the vicinity of 5,000 volts or so.

It was not until 1897 that any increase over the Frankfort pressure was made, but in that year the South California Power Company transmitted power over 80 miles at 33,000 volts. Several plants were installed at this pressure with the object of finding out whether a still higher voltage could not be successfully employed. These experiments culminated in the Telluride company adopting, in 1893, a pressure of 40,000 volts for their Provo transmission, and at the present time there are several installations in the States working at this pressure. The Shawinigan Water and Power Company is operating over a line 84 miles long with 53,000 volts. The Washington Power Company, the California Gas and Electric Corporation and the Guanajuato Power and Electric Company are all operating at 60,000 volts, while the Kern River Power Company is busy with a line on which the pressure will reach 67,500 volts. This is for the time being the highest pressure in the world, but two companies are making provision for their apparatus to be capable of working at 80,000 volts, so that whenever suitable methods of insulation for this pressure are devised they will be able to adopt it.

In Europe the pressure on transmission lines does not rule high. The distances are not great, and under these circumstances it is preferred to keep the line pressure down to a figure which is possible to the generator armatures and does not require the use of step-up transformers. A most interesting example of a power installation in the Far East is furnished by the Mysore transmission of 4,000 horsepower from the Cauvery River Falls to the Kolar goldfield, a distance of 92 miles, at 30,000 volts. In North Wales a pioneer hydro-electric transmission installation is close upon completion which will be supplying current very soon. The power is derived from Llydaw, on Snowdon, and there will be transmitted in the first instance 4,000 horsepower at 11,000 volts for the working of light railways in the district, and for power purposes generally. A scheme which the Scotch Waterpower Syndicate has in view is the transmission of 5,000 horsepower to the Vale of Leven from a hydro-electric power station, 22 miles distant, supplied with water from Loch Sloy, which is situated 750 feet or so above Loch Lomond. Here the pressure proposed on the overhead transmission line is 40,000 volts. But the scheme is at present in the air, and whether the conductors will ever get there I would not like to say.

Unless the power transmitted is very large the lower the pressure the better, provided that it is high enough to allow of the transmission being carried out economically. It would be folly to assert that there are no greater risks with the higher pressures, for, as a matter of fact, with pressures of 40,000 to 60,000 volts, "the highest intelligence, vigilance and excellence must be employed to avoid accident and insure success." These pressures are not to be used indiscriminately or when they can be avoided. A large number of plants are operating at pressures between 10,000 and 20,000 volts, and of these it may be said that the overhead lines give very little trouble. The latter figure represents a voltage which can be produced in the armatures of machines of moderate size without difficulty, so this pressure may be considered a limit below which step-up transformers may be dispensed with. When we get much above this we enter a zone where we begin to experience the line troubles which very high pressures bring, without obtaining all the corresponding advantages they confer. It is very questionable, therefore, whether there should be any halting place between 20,000 and 40,000 volts. At 33,000 volts Dr. Perrine tells us that the special difficulties due to capacity, insulator size, erratic lightning-arrester effects and switching begin to make themselves seriously felt, and it is just as well, if we have to re-design the apparatus with special reference to these difficulties, that we carry the pressure to the other extreme of the zone referred to, and so get the full return for our trouble. If high pressures are ever standardized, the figures for the standards will be probably 20, 40, 60 and 80 kilovolts.

With pressures of the order of 40,000 volts, quite a new set of phenomena is brought to our notice. In the first place, the insulators, in order to prevent flashing over to the supports, must be very much larger, and an increase of pressure from 20,000 to 40,000 volts necessitates their diameter being increased by 50 per cent. or more. A usual size of insulator for the former pressure is six-inch diameter, while the latter should not be less than from nine to 10 inches, with the addition of at least one intermediate bell between the outside dome and the inside cup. When these high pressures are used the phenomenon of brush discharge has to be provided against. This results from the breakdown of the air as an insulator, owing to electrostatic strain set up in the space between the wires, and it was very thoroughly investigated by several leading engineers in America in 1893. Their experiments showed that while the loss of power due to this cause at 40,000 to 50,000 volts was, with the usual line construction, inconsiderable; after the higher figure was reached the loss increased rapidly. Professor Ayrton has lately worked out the distance wires of different diameters have to be placed apart to insure that with certain pressures there shall be no brush discharge. The cure of the evil is, of course, to keep the wires far enough apart, and keep them large enough in diameter; for it is common knowledge that in the vicinity of a sharp point or a sharp edge less pressure is required to break the air down than in the vicinity of a knob or well-rounded edge. A thin wire presents along its whole length a comparatively sharp edge, and while with wires of one-tenth-inch diameter 40,000 volts will discharge through about 10 feet, if the wire is one-fifth-inch diameter discharge will only take place when the distance between the wires has been reduced to 15 inches. As it is usual to space the wires on a 40,000-volt line about 48 inches apart, and as in no lines requiring such high transmission voltage are wires likely to be less than one-fourth inch in diameter, it will be seen that there need be no loss from this cause. But there is enough trouble with switches, lightning arresters and high-pressure surges in the line without brush discharge.

It is not the high pressure that makes the trouble last mentioned; indeed raising the pressure reduces surging, since the current is reduced with the increased pressure. Experience has shown that if a large amount of power is transmitted it is easier to operate lines at a pressure of 60,000 volts than at a pressure of 30,000 volts, because in the former case the current flowing is only about half. Suppose we are transmitting 5,000 horsepower to a distance of 50 miles at 30,000 volts. Roughly, the current in each wire will be 80 amperes, and it is possible that if this be suddenly interrupted the surge pressure would rise to 20,000 volts. If it happened that the line was momentarily short-circuited by a lightning discharge, and that during the short-circuit four times the working current passed, the surge voltage on the removal of this short-circuit might rise to 60,000 volts, which pressure would be superposed to the working pressure. With 30,000 volts between the conductors, the pressure between any conductor and earth is 17,300 volts, so in this case the surge voltage makes the possible nearly 4½ times the working pressure. If we worked at 60,000 volts, however, the rise on breaking the short would only be 30,000 volts, and this superposed to the working voltage gives a possible pressure of rather less than twice the working pressure. The momentary strain, which insulators, transformers and other apparatus should be capable of standing is, in the case of the 30,000-volt transmission, 77,300 volts, while in the 60,000-volt transmission it is 64,400 volts. The higher working pressure has, therefore, the advantage, and if the power transmitted were increased the advantage would be more pronounced. It is probable that on account of this rise in pressure due to circumstances, the occurrence of which the greatest precaution will not always prevent, the current to be transmitted through each wire of long-distance transmission lines will not, as a general rule, exceed 100 amperes.

There is no hard-and-fast rule for pressures to be used, but 1,000 volts per mile is recognized as good practice. This is subject to limitation on the one hand by the highest pressures of which we have commercial experience, and, on the other hand, by the condition that the current in any wire shall not be excessive, a point which has just been dealt with. According to Mr. C. F. Scott, a distance in miles equal to three times the number of thousands of volts may be covered without incurring an excessive annual charge per horsepower for copper. This means that 5,000 volts would cover 15 miles, 10,000 volts 30 miles, and 20,000 volts 60 miles. That 10,000 volts has reached 28 miles, and 30,000 volts 92 miles is shown by the installations at work. But the solution to all engineering problems lies in compromising, and the pressure is eventually settled by striking a balance between the cost and the risks undertaken. In this country the necessity for a higher pressure than 20,000 volts is unlikely to arise, at least for some considerable time.

Up to the present I have referred to hydro-electric plants only, and it is not easy to estimate the total of the waterpower which has been utilized all over the world by their erection. I believe I am well within the mark in placing the total capacity of the hydro-electric power houses at work and under construction on the American continent alone at a million horsepower. In Italy, Lombardy alone accounts for 88,000 horsepower in hydro-electric power houses at work and under construction, while Switzerland, the home of hydro-electrics, accounts for 220,000 horsepower. Taking the whole world, the waterpower utilized in the hydro-electric stations must lie somewhere between a million and a half and two millions of horsepower, a vast force, the greater part of which might have run to waste for all time, had it not been for the invention of the dynamo.

All these schemes cannot be placed in the same category. Cases are numerous in which electricity is employed merely as a means whereby the power of water can be conveniently parceled out to various industrial undertakings in the immediate neighborhood. Such cases furnish an example of power distribution rather than of power transmission.

It is difficult to realize what electricity has done for the mining industry. I am not thinking of its use for power distribution in and about coal mines, though, on the Continent, this has now attained gigantic proportions, but of the reduction in operating costs effected by the utilization of distant waterpower through the medium of electricity. Mines which, under the old régime, could

1. Abstract of presidential address to the Civil and Mechanical Engineers' Society of England, delivered October 5, 1905.

not have been made to pay, have been opened up, while those that previously had just been clearing expenses have been enabled to pay dividends. It is estimated that the Sheba mine saved £10,000 per annum by introducing electric transmission, owing to the ore being then crushed in the mine instead of transported by aerial ropeway to a mill on the bank of a river 2¾ miles away. At the Burma ruby mines, before the installation of the electrical transmission plant, the cost of fuel for power and lighting was £500 per month. The hydro-electric plant saved all this—£6,000 per annum—and enabled the company to begin paying dividends. By the installation of their three-phase plant, the first in the Rocky Mountain regions, the Silver Lake group of mines looked to save £7,200 per annum. These are a few instances out of many. The same tale is told in all cases.

The carrying out of power schemes in this country does not demand a fraction of the resource and originality demanded of engineers carrying out power schemes in some of the American states. Here a trench is made in the ground, an insulated cable is put in, with or without bitumen around it, and so the transmission line is laid. Nothing could be simpler, but it is a very different matter carrying a pole line over the mountains in Colorado. The construction of the pole line often presents much difficulty, though many points of interest. Until recently wooden poles only had been used, but there is a growing tendency to employ for high pressures a steel-pole construction with the spans made intentionally long, so as to reduce the number of points of support. With proper care, steel poles should last at least four times as long as wooden ones, so that the sum to be set aside for renewal is much reduced, while the maintenance is also less. We shall very likely use steel poles for our power lines in this country, because we produce, not wood, but steel, and have a preference for things solid and lasting; but we have easy country to negotiate compared with some of the country over which power lines run abroad, a factor which is of considerable importance.

Mr. Semenza, who has done a large amount of important work in connection with this subject, has quite rightly contended that, as in a straight line with equal spans the only strain to be borne by the line is exerted by the wind, it is unnecessary to employ poles of equal resistance in all directions, and he has accordingly designed a pole which presents great resistance in the direction of the wind, but low resistance in the direction of the line. This pole is elastic, and can deflect over 16 inches without exceeding the limit of elasticity, the consequence being that, if one or two of the wires break, the two nearest poles will bend, which will relieve the strain on the spans following, so that as a whole the line will stand, and no damage be done to the supports.

Needless to say, turbine construction has been influenced to a very large extent by electric power development. The design of turbines has not received much study in this country, possibly because here the sphere of their usefulness is comparatively narrow. On the other hand, the subject has been studied exhaustively on the Continent, and it is to books written in another language that we must go for our information.

But if we are backward with respect to water turbines, we make up for this as regards the steam turbine, for if Britain is not exactly the birthplace of the latter, it is the country which has seen its greatest development. Today there are 600,000 horsepower of turbines of the Parsons type at work, and in 21 years the machine has grown from a 10-horsepower infant to a 10,000-horsepower giant. When it is remembered that the great success of the turbine has been due to the ability, energy and enthusiasm of one man, it is felt that he deserves the greatest and the best rewards that engineering has to offer.

The influence of electricity on the design of steam engines other than the turbine, is undoubted. When the dynamo first made its appearance there was no high-speed engine in the market, and it was the persistent call of electrical engineers for an engine to which their machines could be coupled direct that led the late Mr. Willans to persevere and achieve such remarkable results.

Dowson, by his introduction of a heat gas, did much in the early '80's to encourage the use of gas engines, and considerable progress resulted from his work. When the possibility of burning blast-furnace gas direct in the cylinder of an engine and the economy resulting therefrom were realized, a great impetus was given to gas-engine construction. At the present time there are probably not less than 100 engines of over 500 horsepower working with cheap power gas to drive electric generators, and more large engines are made for this purpose than for any other. Already engines of 2,500 horsepower have been constructed for electrical work, and I understand that the designs are completed for the 5,000-horsepower size. Undoubtedly, engines using gas produced from cheap bituminous coal will figure largely in the electric power stations of the future.

I have not touched upon that department of power engineering which concerns itself with railways. It is only 24 years since the first commercial electric railway was laid down, and today the capital invested in street-railway undertakings is something in the vicinity of £200,000,000 sterling. In this country there are about 1,800 miles of electric tramways, and about 280 miles of electric railways, of which in London alone 150 miles are opened or under construction. These figures indicate great progress, but there are many fields of enterprise as yet untilled, and, in closing, I feel that I have but touched the fringe of a great subject. In the application of electricity to power work, engineering finds its mission of civilization as well as its greatest triumph, and the power lines disappearing in the jungle, climbing to the mountain tops, spanning the torrent and descending to the fertile valley, bear to distant points, no less than telegraph and telephone, a message of peace and progress.

Electric Smelting of Magnetic Iron Ore.

As a result of experiments in the concentration of black sands, which he conducted at the Lewis and Clark Centennial Exposition in Portland, Ore., during the last summer, Dr. David T. Day of the United States Geological Survey makes the noteworthy statement that conditions for the production of steel by electricity are fully as good in Oregon as they are in Germany, where pig iron has been obtained in similar electric furnaces at slightly lower cost than in ordinary blast-furnace practice.

A preliminary report on the subject of smelting by electricity the magnetic iron ores obtained from various points on the Pacific beach have been submitted to Dr. Day to the director of the Geological Survey.

After considerable correspondence with the patentees of various forms of electric furnaces, arrangements were made with the Wilson Aluminum Company of New York for the services of Mr. C. E. Wilson, its expert in electrical smelting. Mr. Wilson arrived in Portland on October 11th, and at the end of one week had erected a small but efficient electric furnace and was making steel. He had procured in the East 25 carbon electrodes, each 48 inches long and four inches square, such as are ordinarily used in electric furnaces. The rest of his equipment was obtained in Portland from materials kept in stock or easily made at a foundry.

In building the furnace a course of ordinary Carnegie firebrick was laid upon the ground. Upon this single course was laid a cast-iron plate, five-eighths of an inch thick, three feet long and three feet wide. On this was placed an oval sheet-iron drum of No. 16 iron, three feet long by three feet high. The sides of this drum were lined with firebrick to form a crucible 18 by 18 inches and 24 inches high. The bottom of the crucible was covered from the cast-iron plate up to the tapping hole with broken carbon electrode. The carbon electrode to carry the current was suspended by a pulley above this furnace and connected with a balanced axle and wheel by which it could be readily raised or lowered. The top of the furnace was covered with two double plates of riveted wrought iron, between which cold water was run. In the center of this water-jacketed cover an opening was left sufficient to allow the free play up and down of the carbon electrode. This furnace is referred to as "small furnace," or "furnace A."

Through the co-operation of the Portland General Electric Company, a special wire carrying 2,300-volt alternating current was run from the city supply to the smelter. This was carried into a series of six transformers and yielded current varying from 1,000 to 2,000 amperes at 50 to 20 volts.

On the afternoon of October 17th a current of 57 volts and 1,000 amperes was passed through the furnace and the arc established. The furnace was then fed with a mixture of magnetite, coke and lime. This consisted of 200 pounds of magnetite, obtained from the sand at Hammond Station, near Astoria, Ore., at the mouth of Columbia River, 44 pounds of Fairfax coke, which contained about 25 per cent. of ash and 24 pounds of lime. About 50 pounds of this charge was slowly introduced into the furnace, and within an hour there was tapped from the furnace 70 pounds of steel and slag which contained eight per cent. of iron and 53 per cent. of titanic acid.

On the following day the furnace was again heated and filled with a mixture similar to that used on the first run, except that it contained less lime. Steel was successfully cast twice, making for that days run of two hours a product of 90 pounds of steel from 300 pounds of iron ore. This gives the furnace a capacity on a continuous run of 1,440 pounds in 24 hours.

The iron ore fed to the furnace showed the following percentages of magnetic oxide, titanic acid, manganese and undetermined matter:

Fe_3O_4	79.06
TiO_2	16.00
MnO_2	2.45
Silica, moisture and undetermined matter	2.49

It will be noted that the heat was sufficient to keep the entire slag in a fluid state whether much or little titanic acid was present. It is evident also that no titanium went into the iron. Instead of the steel usually obtained the charge of October 20th, as shown by the analysis of that day, gave what was practically pig iron.

Slags first obtained consisted of fused iron silicates, fused oxide of iron and silicate of titanium. Later in the experiments these slags grew lighter in color and in specific gravity. It became possible also to lessen the quantity of slag produced, which was unduly large, owing to the great quantity of ash in the coal. The coke used showed on analysis 41 per cent. of ash. It is difficult to procure in this locality coke that is well adapted to metallurgical needs.

Experiments with the small furnace having been successful, it was thought desirable to build a larger furnace, with thicker walls, in which higher temperatures might be obtained and maintained. An iron plate two inches thick, five feet wide and six feet long was therefore procured and laid upon two courses of firebrick to form the base of a furnace, on which was set a wrought-iron cylindrical shell one-quarter of an inch thick, five feet in diameter and four feet high. This was lined with firebrick, the bottom having the usual lining of one course of carbon electrode bricks four in diameter. Two carbons clamped together with a water-jacketed head or clamp formed the electrode for introducing the current. The voltage was run up as high as possible—that is from 75 to 90 volts, the limit of the current obtainable over the wires. In all respects except these mentioned this second furnace was identical with the first.

Iron ore from Aptos, Bay of Monterey, California, was smelted in this furnace on November 10th. This iron ore is very fine grained and contains a notable percentage of manganese, much of which goes into the steel. It is not so rich in titanium as the other sands that had been used. From the start this furnace made a satisfactory run, maintaining easily a high temperature and turning out a very smooth product. After a few trials the slag became as light in color as that from any well-regulated blast furnace. The later products of steel were much denser than those first made, which would seem to indicate that at the higher temperature the process of reduction is complete, even in the short time that elapses between the beginning of reduction and the tapping. In every case, however, small blow holes were observable in the steel. These were due to gases which formed wherever grains of magnetite were still entangled in the steel in process of reduction. The capacity of this furnace with a current of 125 volts, 1,200 amperes, would be 2,000 pounds in 24 hours.

220-volt versus 110-volt Lamps.

The commission in Paris appointed to examine the future regime of electrical concessions in Paris has just concluded a series of comparative tests on ordinary carbon-filament lamps of 110 and 220 volts. The tests were made by Mr. Janet at the Laboratoire Central d'Electricité, and he concludes that the 110-volt lamps showed a marked superiority over the 220-volt lamps. The tests covered 260 lamps of five different French manufacturers and the 110-volt lamps showed a consumption at the commencement of the test of 3.62 watts per candlepower and 3.87 watts per candlepower at the end of the test. The 220-volt lamps showed 4.4 watts per candlepower at the commencement and 5.19 watts per candlepower at the end of the test. The demand in Paris and France generally is met, it is said, by a very cheap grade of inferior lamp, and the market does not contain any makes of the better class of lamps. The average price of French lamps is six to eight cents apiece for the ordinary 16 candlepower 110-volt lamps. Import duty on foreign lamps of the same description varies from two to three cents a lamp.

Unique Evidence in a Damage Suit.

One of the heaviest verdicts against the Boston Elevated Railway Company on account of damage to a building on the line of the road was returned by a jury in the Superior Court last week. It was in the case of an assessment of damages for injury to what is known as the Albany Building in Boston, occupying an entire block. The amount awarded was $56,167.50. The petitioners put in evidence a phonograph to reproduce the noise caused by operating the trains. A photometer to measure the diminution of light and an oscillometer for photographing air waves were also put in evidence.

An Electric Sign.

"A glint from every angle," says the Denver Gas and Electric Company, "is the chief characteristic of an electric sign. If that glint means a flash of business talk for your establishment it's a good advertisement—one that pays. An electric sign is designed solely for an advertisement, because that which is merely ornamental cannot be offered with any degree of persuasion to any busy business man. Any man or firm using an electric sign will tell you about its value as an advertisement. We have the men who can design a distinctive sign for you. Let them submit one at once."

CORRESPONDENCE.

Great Britain.

London, December 13.—It is unlikely that the change of ministry will have any appreciable effect upon the private-bill business of the coming session. It is anticipated in political circles that a general election will take place between January and March, and that the session will commence as usual, toward the end of March. Thus it is that there is no diminution of the efforts of the promoters of electrical bills. As has been pointed out before, the piece de resistance of the session will undoubtedly be the numerous proposals to supply electric power in London. While the promoters of the companies' bills are able to lie low, prior to the deposit of their bills, the proposal by the London County Council continues to fill the eye. The present stage of this proposition is that the consent of the full council is now being sought by the committee which has charge of the matter to the introduction of a bill in Parliament. The officials of the council have prepared a scheme which has been laid before Sir William Preece, Robert Hammond and J. F. C. Snell. The former is well known as the late chief engineer to the Post Office; Mr. Hammond is an avowed champion of municipal trading and has an extensive consulting practice, while Mr. Snell is the chief electrical engineer to the large undertaking of the Sunderland corporation, which comprises lighting, power and tramways. These three experts have expressed themselves satisfied that the scheme of the council is practicable, and accordingly permission to introduce a bill is being sought, and will without doubt be granted. The experts make much of the fact that the council has a generating station in course of erection, which could be largely extended to meet the additional requirements of a bulk-supply load.

Bearing on the same question, it is interesting to note that the promoters of the $25,000,000 scheme have again approached some of the local authorities with whom it came to agreements last year, and offered them similar terms.

The Charing Cross and Strand Electric Supply Company, one of the competing companies in the city of London, has opened a permanent exhibition of electric-light fittings and apparatus with the object of enabling professional men and potential consumers to view free on presentation of their cards the latest developments. This is a purely business venture and is in no way a popular exhibition.

Sir Clinton Dawkins, the English manager and partner in the house of Messrs. Morgan, died here last week. In electrical circles he is chiefly known for his guarantee of $80,000,000 for tube-railway schemes in 1902, but owing to internal difficulties the scheme did not materialize.

There is much heart burning in Torquay in consequence of the action of the Local Government Board. The history of this corporation in its dealings with the Dolter Tramway Company has been several times repeated. It has now reached the stage in which sanction has been received to borrow $40,000 to provide the necessary plant for the tramways supply. In giving its sanction to this loan the Local Government Board makes a pertinent reference to the electricity undertaking and warns the corporation not to extend public electric lighting, and that, in view of the fact that the generating station would almost certainly have to be removed a few years hence, the financial resources of the corporation should be carefully husbanded

The movement having for its object the abatement of the smoke nuisance has gone ahead with great strides in Great Britain. To station engineers the matter is of great importance, and many smoke-consuming devices have been put on the market. The Smoke Abatement Society has recently organized a conference, of which Sir Oliver Lodge is president, to thoroughly investigate this matter, and one branch of this will deal with "factory and trade smoke abatement." Many electrical engineers are identified with this conference and the results should prove of practical utility to all those seeking to avoid the penalties attaching an infraction of the local smoke regulations and the ever-watchful inspectors. Delegates from almost all parts of the country will attend.

A report has been issued dealing with the work of the engineering standards committee. When this committee originally came into existence only a few years ago there was one committee; today there are 35 sectional committees and sub-committees, and the whole is supported by the five leading technical societies of the country, while it also receives the support and countenance of his majesty's government.

A few days ago a portion of the Charing Cross railway station roof collapsed, causing several deaths and many injuries. The mass of debris was enormous, huge iron girders blocking the way. At this time of the year, when the days are exceedingly short, great difficulty was experienced in continuously working at the scene of the disaster to clear away, but this was greatly facilitated by the ready help of the Electrical Engineer and Volunteer Corps, which mounted a number of searchlights on temporary supports and thus enabled the work and rescue to be continued night and day. G.

New York.

New York City, December 23.—A new unloading platform was used for the first time on Monday at the Manhattan end of the Brooklyn Bridge, so that the discharge of passengers during the morning rush hours is greatly facilitated. New loading platforms are nearly completed, and the present 55-second headway will probably be accelerated early in the new year.

The Board of Estimate and Apportionment on Tuesday referred back all bridge terminal plans to the bridge department after hearing details of a suggestion for a system of moving platforms across the new bridges. The board was shown kinetoscope views of the moving platform in operation. Chief Engineer O. F. Nichols, of the bridge department, addressed the Brooklyn Institute on Friday evening on "The New Manhattan Bridge and Its Terminals." He explained, by means of lantern slides, the engineering difficulties, and outlined the proposals for trolley loops.

The McAdoo Tunnel Company has been again enjoined by a New Jersey court from proceeding with the construction of its tunnel to connect New York and Hoboken.

The Long Island Railroad is now operating an eight-mile track from Sea Cliff to Glen Cove dock, and is thus the first to operate an alternating-current single-phase system of traction in New York state. This line was recently acquired by the Long Island Railroad, having been previously operated by direct current from the local lighting company, but now the power is transmitted from the Long Island Railroad central generating station at Long Island City, 30 miles away. There is a sub-station at Glen Cove. Five cars are at present in operation, each equipped with two 50-horsepower Westinghouse single-phase motors. L. S. Wells, as chief electrical engineer for the railroad, is taking a keen interest in the new system.

The Pennsylvania Railroad has purchased a 200-foot strip of land to widen its tracks across the Jersey Meadows to the Passaic River. Work on a new tunnel under this river has been commenced.

The New York Edison Company has placed an order amounting to a large sum with the General Electric Company for additional substation apparatus, switchboards and cable for 60 miles of extensions.

The Society of Illuminating Engineers organized at a dinner at the Hotel Astor on Thursday evening, has for its purpose the promoting of scientific study of the art of illumination. A. D. Page of the Edison Lamp Works was one of the speakers.

The state lighting commission is still considering the affairs of the local gas companies, and the cost of gas production. It appears that the Consolidated company makes gas at a cost of 56 cents per thousand feet, and that fixd charges add another 14 cents. Some of the gas witnesses have been reluctant to answer questions.

The Paul Smiths Electric Light and Power Company of Saranac Lake, N. Y., is asking for permission to build a storage reservoir, flooding 400 acres of land belonging to the state, and to issue stock to the amount of $100,000.

Isaac Bloom has been committed to seven years' imprisonment for commiting perjury in an action brought against the Metropolitan Street Railway Company for alleged injuries. This is the first of a series of prosecutions brought by the Accident Alliance, in which all the traction companies of the United States are interested.

A Supreme Court decision in the case of the West Side Electric Company against the Consolidated Telegraph and Electrical Company sustains the contention of the defendants that the control of conduits has been vested since 1887 with the Board of Aldermen and not with the Board of Electrical Control.

The coils devised by Professor Pupin of Columbia University to facilitate long-distance telephony are being tested at Boston, and although no very definite results are announced, it is hoped to be able to speak through from Boston to Kansas City. The New York Telephone Company has also been experimenting for the last year, and has used the Pupin coils on the Chicago and New York cables.

The Reliance Telephone and Telegraph Company of Jersey City, N. J., has been incorporated with a capital of $125,000.

I. T. Madsen and associates have incorporated the Telephone Carbon Company of New York city, with a capital of $1,500.

The National Switchboard Company, with offices in this city, has been chartered at Albany, with a capital of $50,000. The directors are J. F. McGuire, T. V. Devins and G. B. Garrison. D. W. W.

Southeastern States.

Charlotte, N. C., December 23.—Work on the Washington and Winchester (Va.) electric railway is progressing rapidly, and the dam across the Shenondoah River is nearing completion. President S. H. Hansbrough proposes to have the city of Winchester lighted by power furnished by the company, which also proposes to furnish power to manufacturing enterprises.

The Board of Trade of Carrolton, Ga., has met the demands of the Chattahoochee Valley Railroad Company (electric), the line being projected into Carrolton from Columbus, via the million-dollar electric power dam of the North Georgia Electric Company to be built on the Chattahoochee River. The demands for a $500,000 factory were also met and committees put in charge of both undertakings.

On December 15th the electric current was turned on from the Shenandoah River plant of the Harper's Ferry Light and Power Company in Brunswick, Md. The company expects soon to sell power to manufacturing concerns

The Consolidated Gas, Electric Light and Power Company has filed its answer in Baltimore to the bill of complaint of the Maryland Telephone Company for an injunction restraining the Consolidated from interfering with the wires of the Maryland company. The answer alleges that the Maryland company is restricted to the use of certain poles in the city for telephone purposes only and not for lighting or heating.

The Etowah and Little River power companies have been granted a franchise by the town of Rome, Ga., to bring electric power into the city. The first plant is to be located on Lookout Mountain and the second near Cartersville.

The Southern Power Company of Charlotte has, it is announced, added to its extensive properties the "Ninety-nine" Islands, a fine waterpower on Broad River, S. C., where about 11,000 horsepower is available and for which $1,000,000 will be required for development, making this one of the largest power concerns in the entire Southern states. The company already has developed or started work on a number of other valuable waterpowers in North and South Carolina. L.

Ohio.

Cleveland, December 23.—The contest for a natural gas franchise in Cincinnati will be interesting, from the fact that there will probably be competition in the matter of price for the fuel. The Cincinnati Gas and Electric Company is using every effort to secure the franchise and has arranged to secure a supply of gas from a Kentucky field. This company now operates the artificial gas plants and the lighting plants of the city.

Louis A. Ireton, attorney for the Cincinnati Trust Company, has applied to the Common Pleas Court at Cincinnati for a receiver for the Miami and Erie Canal Transportation Company. The receivers appointed some time ago will probably file their final report within a short time and be discharged, but the bondholders feel that their interests will be better taken care of in the hands of a receiver.

J. T. Harrigan, general manager of the Columbus, Buckeye Lake and Newark and the Columbus, Newark and Zanesville roads, was in Cincinnati a few days ago in conference with the representatives of the Randall Morgan interests. It is said that a uniform arrangement for operation and management is being mapped out for all of the roads owned by the syndicate.

The Pomeroy, Athens, Nelsonville, Logan and Wellston Tramway Company of Nelsonville has been incorporated with a capital stock of $1,500 by Albert E. Boone, F. J. Terry, M. E. Boone, E. O. Boone and J. W. Marquand.

Reports are now to the effect that all the creditors of the Springfield, South Charleston, Washington C. H. and Chillicothe road have agreed to the plan of reorganization and that it will be bought in by three Cleveland men for the new company.

Directors of the Cincinnati, Newport and Covington Traction Company have declared a quarterly dividend of 1¼ per cent on the preferred stock, payable January 15th.

According to a news dispatch the municipal lighting plant at Galion has proved a complete failure. The machinery has been allowed to run down until the street lines will not work and the town is in darkness. The commercial lines are very poor and the lighting unsatisfactory. It is said that it will take at least $15,000 to put the plant in condition to be operated as it should be. There is a possibility of damage suits in addition to the repair expenses. The council and board of public service have been holding meetings to formulate some plan to put the plant in order.

The East Liverpool Traction and Light Company has placed an order with the Lorain Steel Company for 20,000 tons of steel rails to be used in building a double track on the line between the Pennsylvania and Ohio state line and the Columbiana-Jefferson county line, a distance of 14 miles. A survey is being made for the extension of the road from Wellsville to Empire, where it will connect with the Steubenville and Ohio Valley traction line.

At Xenia the Citizens' Light and Power Company has been incorporated with a capital stock of $20,000 by P. H. Flynn, F. B. Dues, Walter L. Koch, J. M. Dillon and A. W. Tresise.

At the annual ball of the Electrical Workers' Union in Gray's Armory on New Year's night, a handsome display of electrical pieces will be made. The word "welcome" will contain 250 lights, and extra letters 312 more. The emblem of the union will contain 164 lights and the set pieces will include an old mill, old-fashioned fan and the Liberty Bell. There will be four revolving pieces. The electrical workers have spent spare time for almost a year on this dishplay.

Three electrical machines have been consigned to the use of the University of Cincinnati by the

Bullock Electric Manufacturing Company of that city.

J. G. Schmidlapp of Cincinnati, projector of the Cincinnati Rapid Transit Company, says that he will continue his endeavors to secure a franchise in the city. This company proposes to build an elevated road to relieve the congestion of cars in the city. He denies that he has placed the financing of the company in the hands of the Electric Securities Company.

It is said that an effort will be made to secure legislation this winter to provide for a state franchise commission of five men who will pass upon all applications for franchises for public utilities in municipalities.

The Cleveland Electric Railway Company has increased the annual dividend on its stock from 4 to 5 per cent. The annual meeting of the board of directors will be held on January 17th. At the meetings a few weeks ago it was decided to increase the wages of motormen and conductors, over 2,000 in number, one cent an hour. This change will take effect the first of the year. The officers said that the company had been more prosperous than usual the last year and they wanted their employes to share in the gain.

Regular service was commenced on the Avon Beach and Southern line Thursday morning. Cars run over the Lorain Street Railway lines from Elyria to South Lorain and then over the new road to Avon Beach. From there to Cleveland they run over the Lake Shore Electric.

The Chagrin Falls Electric Company has received a 15-year franchise to do business in Chagrin Falls and has entered into a 10-year contract to furnish arc lights for the streets at $50 a year for each light. O. M. C.

Indiana.

Indianapolis, December 23.—Following the selection of Hugh J. McGowan as president of the Indiana and Ohio consolidated traction companies, Charles Murdock of Lafayette has been made vice-president and C. C. Reynolds of Lebanon general manager.

The promoters of a plan to build a belt trolley line around the city of Indianapolis have filed articles of incorporation. The road is to be known as the Capital Circuit Traction Company, and the initial capital stock is $10,000. The plan of the promoters is to build an interurban line between the cities of Greensburg, Greenfield, Noblesville, Lebanon, Danville, Martinsville, Franklin and Shelbyville. The circle of these cities is about 25 miles out from Indianapolis, and the new line will connect at all of these places with interurbans that run out from Indianapolis. The directors are James M. Crabb, C. E. Worth, C. E. Averill, A. R. Tucker and I. W. Trotter.

The official announcement is made of the sale of the Northern Traction Company to the Indiana Union Traction Company, the consideration being a little over $500,000. The road was opened for traffic in September, 1904. J. A. Barry, general manager, will continue in the company's employment and superintend the construction of the extension from Wabash to Warsaw.

The Toledo and Chicago Traction Company has completed its line between Ft. Wayne and Auburn, except the crossing of the Baltimore and Ohio tracks near Auburn. Here the company is confronted with a temporary restraining order. The powerhouse is completed and the machinery placed.

The Fort Wayne Construction Company of Ft. Wayne has been awarded a contract to build the large new powerhouse of the Cincinnati Northern Traction Company at Lindenwald. Work was begun last week.

The cars being built for the Terre Haute and Sullivan electric line are 51 feet six inches long and equipped with four 75-horsepower motors, capable of developing a speed of 45 miles an hour. An automatic release, connected with the controller, will throw the power off automatically and apply the air brake the instant the motorman removes his hand.

The Ft. Wayne and Wabash Valley Traction Company shows an increase of $86,835 in earnings for the 10 months ended November 1st. The gross earnings were $781,697 as against $694,862 in the corresponding months of 1904. The operating expenses were only increased $39,230 over the corresponding period of 1904, and this was due to numerous improvements to roadbed, rolling stock and general equipment.

The Indianapolis and Cincinnati Traction Company has begun the construction of a large freight and express house at Rushville, with side tracks on both sides of the building. There will also be a large room for the employes in the building. The employes of this line have organized a sick benefit association. A weekly assessment of 15 cents and a weekly benefit of $5 to $7.50 a week has been adopted. The association was organized at the instance of Superintendent A. A. Anderson, and encouraged by President Henry.

The Indianapolis and Cincinnati Traction Company is offering the Shelbyville power house, boilers, engines and electrical equipment for sale. The line will be operated from power derived from the Rushville powerhouse.

The light freight and express departments of the Indiana traction lines are being taxed severely to take care of the business during the holidays. In a few days a general plan for the transportation of the through inter-line traffic and long-distance shipments will be adopted. This plan will obviate the transferring of much freight as through cars will carry it to its destination.

The government has established a trolley mail service between Lafayette and Battle Ground over the Ft. Wayne and Wabash Valley Traction Company's line. Next year the line will be extended to Brookston and Monticello.

Municipal electric lighting is receiving considerable attention again in Richmond. The advocates of a municipal plant have been rejoicing over the facts that for the last few months the receipts of the plant exceeded the outlay a few thousand dollars, but now an outlay of $40,000 is necessary at once for new machinery and equipment. The plant cost $144,000 and $18,000 was spent on "new construction" within the first 10 months of the plant's existence. This with other improvements makes the plant cost up to date $215,891. And now the call of the commissioners for $40,000 more to make the plant adequate to furnish light to Richmond, with a population of 20,000, is astonishing to the taxpayers. Municipal lighting is not proving popular in Richmond. S. S.

Northwestern States.

Minneapolis, December 23.—M. W. Fitzgerald and others have filed articles of incorporation for the West Side Power, Heat and Light Company, which will build a power plant in West St. Paul to develop about 2,500 horsepower. The company is capitalized at $50,000.

The Twin City Rapid Transit Company will begin work at once on alterations and improvements to the car barns on East Seventh Street, St. Paul, which are to be made thoroughly up-to-date in every particular. About $30,000 will be expended.

The new municipal electric-light plant in Menasha, Wis., has been completed.

The municipal electric-light plant at Langdon, N. D., has been sold to Liebeler & Finerty for $9,000.

The bonds which were issued at Aberdeen, S. D., for a municipal electric-light plant have been sold, and plans for building the plant will be considered at once.

P. S. Briggs and others of Cincinnati, Ohio, are having articles of incorporation prepared for a company which proposes to put in a street-railway system at Beloit, Wis., at a cost of $750,000.

A franchise was granted at Indianola, Iowa, to R. V. Gray and others for an interurban line from that place to Des Moines.

Work on the dam to be constructed near Black River Falls, for the LaCrosse (Wis.) Hydro-electric Light and Power Company has been started and will be continued throughout the winter. R.

Michigan.

Grand Rapids, December 23.—Manager Lawrence Manning of the Owosso and Corunna Electric Company says his company cannot accept the new franchise recently granted it in Owosso, and until satisfactory changes are made the extension of the road to Durand will not be made. He says the new franchise would require the expenditure of about $7,000 on the West Main Street paving.

Following litigation between the city of St. Joseph and the Benton Harbor and St. Joe Street Railway Company over a question as to what kind of rails should be used on Main Street, the council has passed a resolution to have forfeited the franchise of the company. The franchise provides for the use of the girder rail on Main Street, but a T rail was laid instead. An injunction was granted by Judge Coolidge and sustained, demanding that the company live up to its franchise.

A movement to consolidate the street-railway systems of Lansing, Jackson, Kalamazoo and Battle Creek under one control is on foot. Milan W. Mills of Port Huron and J. E. Elliott of Lansing, owners of the Lansing lines, are said to be back of the project. Besides other electrical interests, Mr. Mills and his associates recently acquired control of the Jackson and Battle Creek interurban roads.

Stockholders of the Detroit, Ypsilanti, Ann Arbor and Jackson Electric Railway Company have authorized an issue of $600,000 new five-per cent. bonds for the purpose of building a spur from the main line to Dexter a distance of about two miles. In addition to the building of the spur the proceeds of the bonds will be used to provide equipment.

The Common Council of Grand Rapids has passed an ordinance which makes it necessary for a telephone or electric company to secure consent of the Board of Park and Cemetery Commissioners before it can trim trees for the purpose of stringing wires.

At a meeting of the Schwartz Electric Company of Adrian it was voted to increase the capital stock from $25,000 to $100,000. The company will erect a larger building in the spring.

The new power house of the South Bend and Southern Michigan trolley line is in operation. The plant costs about $30,000, including the building and machinery. It is located at Scotdale, about 20 miles north of Niles. Power will be transmitted into Niles.

The Electric Light and Water Board of Lansing has awarded the contract for 150 enclosed alternating-current arc lights to the Adams-Bagnall Electric Company of Cleveland, Ohio, for $3,801, and the company has offered $2,500 for old machinery. It is expected that the new system of lighting will be in use in about three months.

The council of Fairview has given the contract for lighting the village to the Peninsular Electric Lighting Company of Detroit at $67.60 a light annually. There will be about 30 lights used.

A preliminary injunction has been served on the members of the village council of Iron River restraining them from issuing the $30,000 of bonds recently voted at a special election for the purpose of rebuilding the waterworks station and installing an electric-light plant. Five citizens are the petitioners, and it is asserted that upward of $50,000 worth of their property would be affected.

The Bay City Traction and Electric Company takes the position that under its charter Bay City, as a municipality, has no authority to do commercial lighting on the east side of the river. The Traction company proposes to test the matter in the courts. It has been decided that a friendly suit be instituted to decide the question. The company once made the city an offer of $60 a lamp a year. It is alleged that the actual annual cost a lamp under the city system is over $80. B.

Pacific Slope.

San Francisco, December 22.—The latest move between the Southern Pacific railroad interests and the interests of the California Gas and Electric Corporation is the organization of the Peninsula Railroad Company by persons closely allied with the Southern Pacific. The incorporators of the company are O. A Hale, F. E. Chapin, Gus Lion, W. C. Andrews and A. E. Wilder. The capital stock of the company is placed at $5,000,000, of which $205,000 has been subscribed. The purposes of the new company are to build an electric road from San Jose to San Francisco by way of Stanford University, Palo Alto and San Mateo, with a branch line to Los Gatos and another to the State Sempervirens Park. The route closely parallels that of the Santa Clara Railroad Company.

The Pacific Light and Power Company of Los Angeles is reported to have awarded the Allis-Chalmers Company the complete contract for its steam-driven electric plant, the price being $800,000. There will be two twin vertical-horizontal cross-compound Reynolds-Corliss engines of Manhattan type, direct connected to two Bullock 5,000-kilowatt three-phase 16,500-volt 50-cycle generators of the flywheel type. Stirling water-tube boilers aggregating 10,000 horsepower, a salt-water condensing system and all the latest steam refinements will be included. Fuel oil will be supplied by a short pipe line from steamers. Electric power will be supplied to the sub-stations of the Huntington system for lighting and railway purposes.

The Standard Electric Construction Company of San Francisco has the contract for the electric wiring in the new warehouse building of W. P. Fuller & Co. of San Francisco for $2,784.

The city authorities of Santa Ana, Cal., have issued a call for an election to be held on January 10th for the purpose of voting on the proposition of issuing bonds to the amount of $140,000, of which amount $60,000 is to be devoted to the establishment of a municipal electric-light plant.

The California Gas and Electric Corporation has purchased a site at Antioch, Cal., on which it will erect a sub-station.

The Spreckels electric street-railway system at San Diego, Cal., is to increase its power plant from 500 to 1,500 horsepower. As soon as the new equipment is ready a 10-minute service will be established on all the company's lines.

E. W. Sutcliffe has been put in charge of the construction of the new transmission line running from the Shingletown plant of the Northern California Power Company to the Chico sub-station of the California Gas and Electric Corporation. This connecting line will be about 70 miles in length and will carry 5,000 horsepower at the unusually high voltage of 66,000.

The American River Electric Company has begun work on a new storage reservoir near Mosquito, Cal. This reservoir will cover 40 acres and will reach a depth of about 35 feet. It is intended to store water sufficient to run the power plant 36 hours and will be used in case of breakages in the ditch or flume which conveys water to the company's plant.

Rhodes, Sinkler & Butcher of Philadelphia have purchased the entire plant of the Albany Electric Light and Water Company in Oregon. At the present time it is said they own practically every electric-light and power company in the Willamette Valley outside of Portland and vicinity. A.

The Telegraph Signal Company, incorporated recently with a capital of $1,000,000, will, it is said, soon begin the manufacture in Rochester, N. Y., of a device by which semaphores at various points along a railroad may be operated from the dispatcher's office in case of accident or omission of any operator along the line to attend to his duty. The device is the invention of S. A. Write of Morton, N. Y., and has been tried in a crude state on several railroads.

PERSONAL.

Charles T. Yerkes is again reported to be very ill in a hotel in New York city. On December 26th the newspapers said his doctors gave him but a few more days to live.

William H. McGrath has been appointed to succeed A. W. Leonard as general manager of the Houghton County Street Railway Company and the Houghton County Electric Light Company at Houghton, Mich. Mr. Leonard, as stated last week, has gone to Minneapolis to assume the management of the Minneapolis General Electric Company.

Robert I. Todd of Providence, R. I., general manager of the Rhode Island Company, which operates the street railways in Rhode Island, has tendered his resignation and will be succeeded by Albert E. Potter, the present superintendent of transportation, who in turn is to be succeeded by Samuel Riddle. Mr. Todd is to be the general manager of the Indianapolis Traction and Terminal Company, which operates lines in Indiana and Ohio.

ELECTRIC LIGHTING.

A municipal electric-light plant to cost $20,000 is proposed for Belleville, Kan.

The Bluff City (Tenn.) Electric Light and Power Company has been incorporated with a capital stock of $2,000.

William E. Fowler has applied for a franchise to construct and operate an electric-light plant in Bluefield, W. Va.

The Bartlett Electric Light and Motor Company has been incorporated at Bartlett, Tex., with a capital of $10,000.

The Pryor Creek (I. T.) City Council has granted an electric lighting franchise to D. E. Little of Wagoner.

During the recent fogs in London the superior penetrating power of the flame arc lamps as compared with the ordinary arcs and the incandescent gas lamps was very evident.

The Philadelphia and Reading Railway Company will construct a plant at Rutherford, Pa., from which to provide its own electricity for the lighting of its yards and offices at Harrisburg.

J. P. Rouels, M. E. Rouels and O. C. Doster, Jr., have incorporated as the Enterprise (Ala.) Power and Light Company, with a capital stock of $20,000, to operate electric-light and power plant.

At South Bend, Ind., the city electrician is reported as still doing good work, and the new wiring being installed is of good character. The few minor infractions of Code requirements will be prohibited in future. Old and defective equipments are being gradually improved. The overhead wiring which has long disfigured the business district is now almost entirely removed. The telephone and telegraph companies are completing arrangements for taking down the last of the pole lines, and the street-railway company is to install iron poles for supporting trolley wires.

The Waterloo and Cedar Falls (Iowa) Gas and Electric Light Company has sold, through President George McLean, its property to Rufus C. Dawes and associates of Chicago. The property has been developed by Mr. McLean in the last five years and is one of the finest in the state. It includes the gas and electric light plants of Waterloo, the electric transmission line between Waterloo and Cedar Falls, the electric system of Cedar Falls and the new gas works at Cedar Falls. Mr. Dawes, who represents a syndicate owning other similar properties throughout the country, will move to Waterloo, it is said, and become head of the new company.

ELECTRIC RAILWAYS

The Chicago City Railway Company has issued an illustrated booklet setting forth the points of the new standard car recently placed on some of its lines and described in the Western Electrician. One interesting feature is a comparative statement of the cost of heating a car. Engineers estimate that it costs 73 cents a day to heat a car of the Indiana Avenue type by electricity and 80 cents by hot water.

W. K. Vanderbilt inspected the Ontario Power Company's plant on the Canadian side of the river recently, and left Niagara Falls, following the transmission line of the Niagara, Lockport and Ontario Power Company from Niagara Falls to Syracuse. Mr. Vanderbilt confirmed the report that the New York Central had contracted with the Niagara, Lockport and Ontario Power Company for electricity to be used in the electrification of the New York Central lines in Western New York.

The Erie railroad proposes to build an electric railway from Binghamton to Corning, N. Y., a distance of 76 miles. The line under contemplation will parallel the present tracks and will be used to care for local passenger traffic. The line will be so constructed that it will be available for the use of the company's regular trains should the occasion arise, and it is expected that a fourth track will be added if future requirements warrant the expenditure. There will be considerable local traffic on the electric line, which, it is hoped, will relieve the congestion on the main tracks, leaving them to be used by through trains and freight. It is thought that an hourly schedule will be maintained. By building this line the Erie road will probably forestall competition from an interurban road, which otherwise would be likely to be built.

In view of the continued overcrowding of the railways owned by the city of Berlin, Germany, the city has decided to immediately place on the principal routes served by these railways a service of express motor buses, as an auxiliary service. This measure has resulted in a popular movement for a new underground electric railway running north and south and east and west in the city. Schemes for these lines have been in hand for the last two years, but the continual increase of traffic has forced the matter to the front as an urgent measure.

L. J. Wolfe of Cleveland, president of the Aurora, Elgin and Chicago Railroad Company and the Elgin, Aurora and Southern Traction Company, has announced that the plans for consolidating the two roads have been completed. The new company will be called the Aurora, Elgin and Chicago. It will, according to the recommendation of Mr. Wolfe, have outstanding $3,100,000 preferred stock bearing for the first three years from date of consolidation fixed quarterly cumulative dividends at the rate of five per cent. per year, and thereafter at the rate of six per cent., together with the same amount of common stock. These roads are known as Mandelbaum properties, and are controlled by Cleveland men. They are valuable roads and pass through one of the most populous sections of Illinois, serving the people of 20 towns. The former is a third-rail line with a good connection with the city lines in Chicago.

PUBLICATIONS.

The Allis-Chalmers Company, of Milwaukee has issued an appropriate bulletin upon the Reliance friction clutch, a self-adjusting device which is a product of the flouring-mill department.

A handsome embossed calendar for 1906 from the Northern Electrical Company of Duluth, Minn., bears the figure of a woman representing winter. The picture is a reproduction from the original painting, "Winter," by Philip Boileau.

The Westinghouse Machine Company has issued a pamphlet containing a list of the users of Westinghouse-Parsons steam turbines for 1905. In rated capacity the list as printed in the pamphlet reaches over 126,000 kilowatts. There are also three illustrations showing large turbine installations.

A comparatively new publication devoted to the interests of steam, water and gas turbines and the centrifugal pump is being published at Munich, Germany, by Wolfgang Adolf Müller. The name of the publication is the Zeitschrift für das Gesamte Turbinewesen, and it is another indication of the growing importance of turbine practice in general.

"In Vaudeville"—this rather uncertain title is given to a little booklet issued by the Buckeye Engine Company of Salem, Ohio. The reason for so calling the booklet is this: About two years ago the Buckeye company began the manufacture of electric blue-printing frames. At that time the company felt, it says, like a vaudeville actor about to present a new "stunt." It confesses to having felt a little shaky. But, luckily, the "stunt" took, and the company began climbing up in the profession. How far it has climbed and how it feels on looking back over the two years it has been before the footlights are told "In Vaudeville."

The first comprehensive catalogue relating to hydraulic products issued by the Abner Doble Company of San Francisco, Cal., has appeared, entitled "Doble Tangential Waterwheels." The first portion of the catalogue contains general matter descriptive of the essential features and parts entering into the construction of Doble tangential waterwheels, special attention being paid to the needle-regulating nozzles, ellipsoidal buckets, ring oiling, nickel-steel shafts, etc. Designs are shown in accordance with which several hydro-electric units of large capacity have been erected. There are descriptions of the 8,000-horsepower wheels recently constructed for the De Sabla and Electra power houses; also of a 9,000-horsepower wheel now being built. The latter portion of the book contains Doble waterwheel tables, covering all conditions of waterpower up to a head of 2,250 feet and in capacities up to 5,000 horsepower. There are also other mechanical tables of value. The company will be pleased to send copies of this publication, which is known as Bulletin No. 7, to those interested in waterpower development.

SOCIETIES AND SCHOOLS.

Both day and evening courses in electrical wiring will be given by the Young Men's Christian Association in Detroit, Mich., beginning January 1st. The course includes arithmetic, plan reading, electricity (illustrated with dynamo and motor) and electrical wiring. The last gives the student practical experience in house wiring, connecting two and three-point switches, connecting fixtures, etc. The electrical work is to be in charge of Mr. James B. McCarthy, for 11 years city electrical inspector of Detroit, and Mr. A. J. Crane, B. S., of Purdue University. The work is also offered by correspondence.

The December meeting of the Ohio Interurban Railway Association were scheduled to be held in Columbus at the Chittenden Hotel December 28th. The subjects for discussion were: "Advertising—the Proper Methods," "Shop Records," and "Transportation—Employes and Their Dependents." The matter of a permanent salaried secretary and the consolidation of the Ohio and Indiana associations were scheduled for discussion.

The programme of the New York Electrical Society for 1906 shows a list of papers upon interesting subjects which will be prepared by men of recognized authority, including Peter Cooper Hewitt, O. S. Lyford, Jr., J. M. Waldron, William Marconi, Melville E. Stone, C. G. Curtis, Robert McAllister Lloyd and C. F. Scott. The society has also issued a little booklet containing the constitution and by-laws and a list of members for 1904-05.

The Hartford Electrical Society of Hartford, Conn., at its semi-annual meeting recently elected the following-named officers: President, Prof. Henry A. Perkins; vice-president, Charles A. Hovey; recording secretary, A. G. Steele; financial secretary, S. W. Harney; treasurer, Frederick C. Hedrick; lecturer, T. H. Day. "Electric-light and Power Economics" was the subject of a lecture by Prof. Perkins before the society at a subsequent meeting.

The foundation stone of the new building of the Engineers' Club, on West Fortieth Street, New York city, opposite Bryant Park and the new Public Library, was laid on Christmas Eve at 2:30 p. m. by Mrs. Andrew Carnegie, whose husband declared the task well and truly done. The ceremony was quite informal, but the club was well represented by its officers and committees, including President W. H. Fletcher and Past-President John C. Kafer.

MISCELLANEOUS.

The formal opening of the Acme Spinning Mill at Pendlebury, Manchester, England, the first electrically equipped spinning mill built in England, took place recently. A large number of electrical experts, mill and colliery owners and managers and others interested in electrical developments were invited.

Chatham has the distinction of being the first city in Canada to build a public heating plant. The exhaust steam from a railroad company's power house is used by the heating company. About a mile of mains has been laid, and several churches, schools, hotels and office buildings, as well as business houses and private residences are connected with the mains.

One of the interesting exhibits to be made at the Chicago Electrical Show will be the "theaterphone," which will be operated by the Chicago Telephone Company, by which visitors will be enabled to hear the programmes of various downtown theaters. Efforts are also being made to get Professor E. L. Ovington to give his high-potential high-frequency tests at the show, they having been a source of much interest at the New York show.

An elaborate test of the space-telegraph system of the American Navy was made on Christmas Eve between the stations along the Atlantic coast. At eight o'clock the Washington Navy Yard station flashed out the message, "Merry Christmas." This was repeated at 15-minute intervals until 10 o'clock. According to instructions which were sent out two weeks ago by Rear Admiral Manney, chief of the Bureau of Equipment of the Navy Department, all stations receiving the message immediately relayed it on. In this way it was hoped to reach Cape Elizabeth, Me., Key West, New Orleans, Colon, Guantanamo, San Juan and Culebra. At 10 o'clock Cape Elizabeth and the stations at New Orleans, Colon, San Juan, Culebra and Guantanamo flashed back a message, repeating it every 15 minutes up to midnight.

Prof. A. K. Huntington, in a "Note on the Crystalline Structure of Electrodeposited Copper," read before the Faraday Society in London, showed that in Mr. Cowper-Coles' process for making copper wire electrolytically a spiral scratch or groove on the mandril causes the copper deposited on it to part so easily that a long ribbon can be obtained. Professor Huntington's explanation is that the direction of the lines of crystallization of an electrodeposited metal are the same as in a casting made on surfaces having the same inclination, i. e., the crystals form at right angles to the surface on which the deposit or the casting is made. It follows that when the crystals which form on surfaces more or less at an angle to one another meet, there will be want of continuity in the two sets of crystals, and a line of weakness will be developed. Therefore in castings and deposits when strength

and not rupture is aimed at, it is important to avoid sharp angles.

TRADE NEWS.

Mr. F. Ludikar, Jurusalemska ulice, 14, Prague, Bohemia, commission agent and merchant in general electrical supplies, desires to communicate with firms manufacturing electrical specialties for power, light, heat, etc.

The Stanley Electric Manufacturing Company, says the Pittsfield (Mass.) Journal, is to build a new iron foundry in Pittsfield, a building 400 by 200 feet, on recently purchased property embracing some 25 acres. It will be a modern structure in every particular, and will be the largest iron foundry in Massachusetts, with the exception of one.

The Chicago Pneumatic Tool Company of Chicago announces that it has been awarded the gold medal at the Liège Exposition, covering pneumatic tools and appliances, and the silver medal for Franklin air compressors The gold medal was the highest award for pneumatic tools and appliances. This is evidence that its line is the most complete and of a high grade. The company says that it has always received the highest honors since its first exhibit, made at the Cotton States Exposition at Atlanta, Ga., 1895.

The Navy Department, through the Bureau of Supplies and Accounts, is inviting sealed proposals until January 9th for furnishing eastern navy yards with tape, fuses, arc-lamp globes, wire and miscellaneous electrical supplies, embraced in schedule 294, which can be obtained at the navy pay office in New York or upon application to the bureau at Washington. On January 23d the bureau will open bids for furnishing western navy yards with motor-drive outfits, conduits and fittings, embraced in schedule 300, which can be obtained at the navy pay office in San Francisco, Cal., or upon application to the bureau.

The National Carbon Company of Cleveland says that two Chicago concerns recently began making and selling a dry battery, using the trademark "Columbia," which, the National Carbon Company asserts, is its own property. Suit was brought before Judge Kohlsaat in Chicago, with the result that on December 12th an injunction was issued against the defendants "forbidding them," according to the National company, "from offering for sale any dry batteries not made by the National Carbon Company to which is applied the word 'Columbia' or the words 'Columbia Dry Battery Company. The effect of this injunction is to confirm the National Carbon Company in the possession of the trade-mark 'Columbia.'"

The R. M. Patrick Company, First National Bank Building, Chicago, is the latest to enter the engineering and contracting field. The company has recently been incorporated under the statutes of Illinois. Mr. R. M. Patrick, the head of the company, was formerly connected with a number of Canadian hydro-electric developments. The company is prepared to act as consulting engineers, to make reports, surveys and estimates on all kinds of engineering work. It will have a corps of experienced engineers in all lines. It announces that it has just closed a contract amounting to $50,000 for a municipal water system and lighting plant in Illinois. The company is receiving data from the prominent manufacturers of hydraulic and electrical apparatus and announces that it is prepared to undertake contracts of any size, having ample financial resources to carry out any contract that may be offered.

The Chicago Edison and Commonwealth Electric companies will embody in their exhibit at the Electrical Trades Exposition in Chicago as many as possible of the practical uses of electricity. The exhibit will be arranged to interest the public in general from the smallest power user to the largest manufacturer. The exhibit will contain an inviting reception room, a model dining room, and a model kitchen. Electrical supplies of all kinds will be on exhibit, and a separate department of the exhibit will be given up to the applications of electrical power for various purposes.

BUSINESS.

The F. Bissell Company of Toledo, Ohio, has sold 50,000 lights capacity in Kuhlman transformers in the last four months.

The Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y., says that it is doing a largely increased business in the line of telephone cables and has found it necessary to increase the capacity of its plant fourfold in the last two years. One large shipment of cable made recently was to Bloomington, Ill. The company also reports having closed contracts for telephone switchboards for Leechburg, Pa., Whiting, Ind., Tingley, Iowa, Herrick, Ill., La Grange, Ky., Streator, Ill., Seattle, Wash., and Germantown, Neb.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) December 19, 1905.

807,431. Electric Controlling Mechanism for Railway Appliances. Walter J. Bell, Los Angeles, Cal., assignor of one-half to Leon F. Moss, Los Angeles, Cal. Application filed June 3, 1905.

Controlling apparatus for electric vehicles embodies a trolley wire adapted to be moved by the trolley wheel, a contact on the car and a contact connected with the trolley wire to move into and out of engagement with the car contact.

807,434. Casing and Terminal Block for Electrical Measuring Instruments. William M. Bradshaw, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed March 17, 1905.

A terminal block for electrical measuring instruments has a number of cylindrical sockets, terminal posts in the sockets, triangular recesses adjacent to the sockets and binding screws projecting through the walls of the recesses and into the posts.

807,463. Self-lubricating Trolley Wheel. John Hensley, Huntington, Ind. Application filed July 8, 1905.

Grease-containing cavities, with coil springs therein, are associated with balls engaged by the inner ends of the springs and resting upon the journal. By centrifugal force the balls travel outwardly through the grease during the rotation of the wheel, and are forced inwardly by the springs carrying the grease to the journal bearing surface when the wheel is at rest.

807,477. Trolley. Allen P. Lord, Bradford, Pa. Application filed January 9, 1905.

Combined with a trolley wheel and its axle are a pair of guards loosely hung on the axle, strips secured to the outer side of the guards and spaced therefrom and keys extending through the axle in the spaces between the guards and strips.

807,497. Binding Post. Henry E. Reeve, Brooklyn, N. Y. Application filed March 6, 1905.

A sheet-metal arched portion has a base and also carries a clamping screw for the terminal.

807,510. Organ. Ernest M. Skinner, Dorchester, Mass. Application filed November 4, 1902.

Automatic electrically controlled valves control the connection between the diaphragm chamber and the separate air channels from which the pipe may be sounded.

807,517. Magnetic Work Holder. Walter N. Vance, Chicago, Ill. Application filed July 31, 1905.

A magnetic work holder for holding ironwork to an iron table consists of a movable electromagnet having two polar surfaces, one for engaging the work to be held and the other for engaging the table, in combination with an iron table upon which the work is to be held.

807,518. Recording Instrument. Charles E. Vawter, Jr., Blacksburg, Va. Application filed July 25, 1905.

Combined with a movable index having one point of support and a free end are an armature movably mounted thereon at the free end, a recording point operatively connected to the armature, an electromagnet over which the armature is arranged to travel and a make-and-break device located in circuit with the windings of the magnet. A record sheet is adapted to be engaged by the recording point only when the armature is attracted by the magnet; mechanism being provided to impart movement to the record sheet and to operate the make-and-break device.

807,520. Controller. Ferdinand Volk, Pittsburg, Pa., assignor of one-third to John A. Rogan and one-third to John Murphy, Pittsburg, Pa. Application filed February 4, 1905.

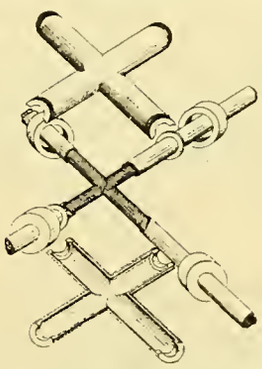
Associated with an operating lever and a handle rotatably mounted thereon are means for stopping the movement of the lever at predetermined intervals in its traverse, and means operated by the rotation of the handle for releasing the lever and permitting its movement to be continued.

807,528. Transmitter and Transmitter-arm Connection. Ernest E. Yaxley, Chicago, Ill., assignor to the American Electric Telephone Company, Chicago, Ill. Application filed March 18, 1901.

A transmitter head or case having an annular boss is carried by a slotted socket support in which the boss fits, means clamping the boss within the socket to provide a good electrical connection.

807,545. Alternating-current Regulator. Giorgio Finzi, Milan, Italy. Application filed February 11, 1904.

Combined with a switch having main and auxiliary keys with an alternating current are a variable voltage and a non-sparking transformer. The winding of the transformer is divided into a number of main divisions, the ends of which are connected to the main keys by means of conductors of low resistance. The ends of the conductor subdivisions are connected to auxiliary keys which have connected also conductors of relatively high resistance. Short-circuit current arising in the manipulation of a brush is diminished by the arrangement.



NO 807,747.—INSULATING CASING FOR WIRE CONNECTIONS.

807,568. Pressure Gauge. William N. Mitchell, Chicago, Ill. Application filed December 3, 1904.

An electric bell is arranged to ring when the pointer of the gauge has reached any predetermined stage.

807,569. Explosion Motor. Barton S. Molyneux, Buffalo, N. Y. Application filed March 3, 1904.

The ignition mechanism is the only electrical feature of the invention.

807,574. Timing Device. Hervey H. McIntire, South Bend, Ind. Application filed August 3, 1903.

A plunger operated by fluid pressure automatically opens and closes an electrical switch at predetermined intervals of time.

807,596. Telephony. Edward A. Buell, DeKalb, Ill., assignor to the Selective Signal and Telephone Manufacturing Company, Sycamore, Ill. Application filed October 6, 1904.

Combined with a party telephone line extending from a number of substations to an exchange are a step-by-step operating selective signaling apparatus at each of the substations and switching mechanism at the exchange for effecting operation of the selective signaling apparatus. Locking mechanism at each of the substations locks the selective apparatus thereat when properly set. Circuit connections are provided whereby the source of signaling current may not only operate a signal receiver of a selected station, but will also operate the locking mechanism at the selected station to maintain the selective apparatus in the position to which it has been set.

807,626. Signal Switch. George H. Manners, Murray, Neb. Application filed March 2, 1905.

A switch attachment for telephones comprises a contact blade connected with the metallic circuit, another contact blade connected with the ground circuit and an interposing switch blade projecting beyond the contact blades and connected to the metallic circuit of the telephone and normally in engagement with the contact blade of the metallic circuit, thereby completing the circuit.

807,645. Railway Signaling. Samuel D. Strohm, Philadelphia, Pa. Application filed August 29, 1891.

Combined with a semaphore are an annunciator and actuating mechanism controlled by a leading train to set the semaphore to danger position and lock it in the position. The mechanism also separately actuates the annunciator by following trains. Means are provided whereby the semaphore and annunciator are restored to normal position when the last train of the following trains passes off the block controlled by the devices.

807,653. Trolley for Electric Railways. Walter J. Barron, Brooklyn, N. Y. Application filed June 6, 1900.

Details are described.

807,656. Rail Bond. Leonard B. Buchanan, Woburn, Mass. Application filed November 30, 1904.

The attaching device which passes through a hole in the rail has an auxiliary bond for electrically connecting the attaching device of the rail bond to the rail. This comprises current conducting material attached by solder to the rail and to the exposed end of the attaching device of the rail bond.

807,671. Combined Socket and Plug for Incandescent Lamps. Henry W. Gremmels, Denver, Colo., assignor of one-half to Martin J. Jackson, Denver, Colo. Application filed January 3, 1905.

A combined socket and plug for incandescent lamps comprises an insulating body bifurcated at one extremity and surrounded by a metal sleeve at the opposite extremity. A bolt connects the socket with the plug, a U-shaped contact being mounted between the arms of the bifurcated part.

807,673. X-ray Tube. Emil Gundelach, Gehlberg, Germany. Application filed December 16, 1904.

In a Roentgen tube is a water-cooled hollow platinum body forming an anticathode and having a solid metal rod united to its front face and projecting into the cooling liquid. The rod is spaced from the inner wall of the hollow platinum body and of a size to permit free circulation of water between it and the wall.

807,684. Circuit-controlling Device. Gwynne E. Painter, Baltimore, Md. Application filed July 18, 1903.

Circuit-controlling mechanism consists of a circuit-closing switch, an electromagnet within the circuit controlled thereby and adapted when energized to hold the movable member of the switch in its closed circuit position, and timing mechanism adapted to automatically short circuit the magnet at the expiration of a predetermined interval of time after the circuit has been closed by the switch.

807,707. Electric-railway Signal. Henry A. Ammann and Albert D. Campbell, Spokane, Wash Application filed October 1, 1904. Renewed October 4, 1905.

In an electric railway signal are combined with signaling mechanism a swing plate or pendulum having means for normally positioning it in the path of a trolley wheel, an opening in the lower end of the swing plate through which the trolley wire extends and a removable wear plate on the lower end of the swing plate.

807,708. Electromagnet Recording Appliance. Henry A. Ammann and Albert D. Campbell, Spokane, Wash. Application filed February 17, 1905.

The device is operated by a series of pairs of electromagnets.

807,718. Thermostat. Peabody A. Brown, Denver, Colo. Application filed March 20, 1905.

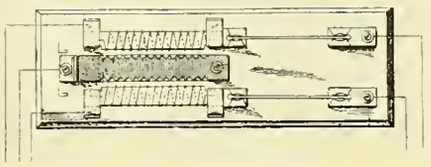
Electrical connections are made by the unequal expansion of two metal bars clamped together, the bars when affected by a rise of temperature bending in the form of a curve and moving a pointer.

807,747. Insulating Casing for Wire Connections. Louis A. Kling, Elizabeth, N. J. Application filed May 27, 1904.

An insulating casing for wiring connections comprises semicircular halves formed with rabbet joints and with externally screw-threaded extremities and provided with screw-threaded caps, adjustable upon the extremities of the halves, and gaskets fitting within the caps and seating against the extremities of the halves. (See cut on preceding page.)

807,774. Automatic Electrical Measuring and Recording Instrument. Paul Rasehorn, Friedenau, Berlin, Germany, assignor to Siemens & Halske Aktiengesellschaft, Berlin, Germany. Application filed November 22, 1904.

Apparatus for automatically and continuously measuring and recording the value of a number of electrical quantities comprises a single measuring instrument, means to connect the instrument at regular time intervals with the circuits of the electrical quantities to be measured, and means for recording the measurements in time instants which bear a fixed relation to those in which the instrument is connected.



NO. 807,847.—LIGHTNING ARRESTER.

807,781. Fuse Plug. Joseph Sachs, Hartford, Conn., assignor to the Johns-Pratt Company, Hartford, Conn. Application filed December 19, 1903.

A fuse plug comprises a casing having a portion provided with screw threads, a disk of insulating material secured in the screw threaded end of the casing, an electrical contact secured centrally in the disk and a yoke integral with and extending across the opposite end of the casing. A cap of insulating material fits over this end of the casing.

807,800. Electric-railway Signaling Appliance. Henry A. Ammann and Albert D. Campbell Spokane, Wash. Application filed April 6, 1905.

A signal box having two electric circuit making and breaking mechanisms includes make-and-break wheels of different form, a lever operatively connected to each mechanism and a swing plate or pendulum in the path of a car trolley arranged to move the levers successively in opposite direction.

807,805. Railway Signaling System. Henry Bezer, New Rochelle, N. Y. Application filed May 25, 1895.

Combined with a signal and lock therefor are a local battery for energizing the lock, means including a line circuit for operating the lock through the local battery when the signal is at danger, under the joint control of the signalmen at both ends of the block, and means for operating the lock through the local battery when the signal is at safety, under the control of a train.

807,822. Trolley Harp. Charles L. Hooper, Rochester, N. Y. Original application filed December 15, 1903. Divided and this application filed April 16, 1904.

Parallel arms having oppositely arranged openings are mounted on the harp, a hollow shaft passing through the openings and having open ends. The shaft has an elongated longitudinal opening intermediate its ends, cork plugs being compressibly forced within the ends of the shaft. Other mechanical features include a transverse pin passing through one arm of the harp and through the shaft and cork plug, the opposite arm of the harp having recesses in its outer face communicating with the opening, and a pin passing through the shaft on the outside of the plug and having its ends extended beyond the shaft and resting in the recess in the outer face of the arm.

807,829. Railroad Signaling. Isidor Kitsee, Philadelphia, Pa. Application filed October 14, 1905.

One of the rails is divided electrically into independent sections, the second of the rails retaining normal conductivity throughout its length. Each of the sections of the first-named rail is provided with two stationary contacts, contacting means being carried by the moving vehicle in advance of any of its wheel pairs. Means dependent on the contacting between the stationary and traveling contacts annunciate that the vehicle has entered a new section and also annunciate if the new section is occupied by a second vehicle.

807,847. Lightning Arrester. Ernest S. Moorer Anderson, S. C. Application filed May 9, 1905.

In a lightning arrester are a ground plate provided with teeth and a discharge strip disposed adjacent to the ground plate. The discharge strip consists of a metallic plate, insulating material encircling it, a bare wire mounted upon the insulating material, surrounding definite portions of the wire and in juxtaposition with the teeth of the ground plate, and electrical connections for the ground plate and for the discharge strip. (See cut.)

807,858. Controller for Electric Motors. William A. Paris, Edgewood Park, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed April 3, 1905.

An inclosing casing contains a contact carrying member. A handle operates the member, and means for disconnecting the handle and member and for operatively connecting the handle to the casing to lower and raise the latter are provided.

807,859. Annunciator. James Patten and William Patten, New York, N. Y. Application filed April 5, 1905.

An annunciator having a double solenoid magnet and core has also an indicating device in connection with the core. Means close the circuit of either coil of the magnet, and means simultaneously close the circuits of both coils, to cause the core to take either of three distinct positions under the positive action of the magnet.

807,860. Electric Hand-lamp Contact. George L. Patterson, New York, N. Y., assignor to Alice C. Patterson, New York, N. Y. Application filed December 30, 1904.

A small hand lamp containing a battery and incandescent lamp is described.

807,870. Pole-changing Device. Harry O. Rugh, Chicago, Ill., assignor to Edward C. Hennis, Sandwich, Ill. Application filed June 2, 1902.

Details are described.

807,871. Electric Self-playing Violin. Henry K. Sandell, Chicago, Ill., assignor to the Mills Novelty Company, Chicago, Ill. Application filed March 27, 1905.

The fingering and sounding devices of a mechanically played violin are operated by electromagnets whose circuits are controlled by a perforated music roll.

807,885. Thermal Cut-out. Theodore Varney, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company. Application filed January 3, 1905.

Combined with a cylinder having an internal screw thread that extends substantially throughout its length are end contact terminals and a screw-shaped member provided with a helical fusible conductor and with end contact terminals therefor which are adapted to engage the corresponding terminals of the cylinder when the member is in operating position.

807,987. Electric Motor Controller. Henry D. James, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed April 3, 1905.

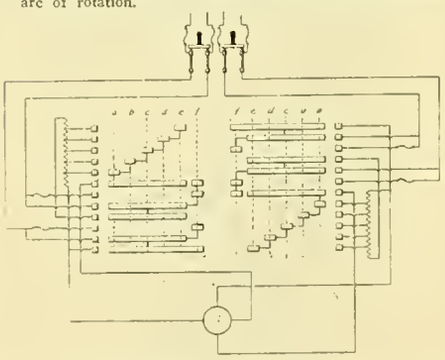
Co-operating with an electric motor are an interlocking device and protective means that are operative at certain predetermined current values when the controller occupies a number of starting positions and that are operative at certain other predetermined current values when the controller occupies a predetermined running position from which the controler is limited by the interlocking device to a single direction of motion, and is permitted an indefinitely progressive motion in the direction.

807,938. Control System for Electric Motors. Henry D. James, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed April 3, 1905.

In combination with a dynamo-electric machine are cut-out devices that are operatively connected in service only while the controller is maintained in a certain predetermined position corresponding to normal operation of the machine. (See cut.)

807,939. Controller for Electric Motors. Henry D. James, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed April 3, 1905.

In a controller are combined a rotatable contact carrying member and an operating handle therefor. An interlocking device permits movement of the rotatable member progressively in only one direction from the "off" position and from the "running" position, and limits the motion of the operating handle to a certain predetermined arc of rotation.



NO. 807,938.—MOTOR-CONTROL SYSTEM.

807,943. Regulating Means for Systems of Electrical Distribution. Benjamin G. Lamme and Charles F. Scott, Pittsburg, and Frank Conrad, Edgewood Park, Pa., assignors to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed February 1, 1905.

An alternating-current supply system is provided with a rotary converter feeding a direct-current distributing system, a regulator being located between the alternating current system and the rotary converter by means of which the voltage of the current supplied to the direct-current system may be caused automatically to vary approximately inversely as the load upon the system varies. A storage battery supplies current to the direct-current system when the direct-current voltage falls below a predetermined value.

807,949. Magneto-alternator. Leon J. Le Pontois, New Rochelle, N. Y., assignor to the Polyphase Ignition System Company. Application filed October 20, 1904.

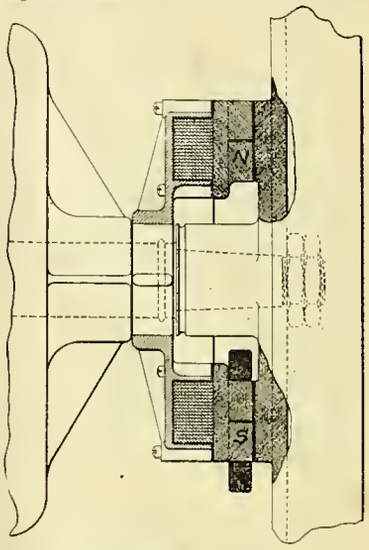
An alternating-current generator having a field magnet consists of a permanently magnetized ring formed of a continuous steel ribbon, pole pieces located at opposite ends of the same diameter and coils supported thereon. An inductor is mounted to rotate in close proximity to the pole pieces. (See cut.)

807,960. System of Electrical Distribution. Roderick M. Palmer, Cambridge, Mass., assignor of one-third to Lester R. Wiley, Bangor, Maine, and one-third to Charles D. Shaw, Greenville, Maine. Application filed December 22, 1904.

An incandescent-light circuit, a bell circuit connected therewith, an electromagnet included in the circuits and a branch circuit controlled by the electromagnet and adapted to be connected with the incandescent-light circuit in shunt relation to the bell circuit make up the apparatus.

807,962. Carbon Plate for Protective Devices. Greenleaf W. Pickard, Amesbury, Mass., assignor to the American Telephone and Telegraph Company. Application filed April 14, 1904.

Making a terminal or electrode for electrical protective devices is done by immersing a porous carbon block in a liquefied binding material, then drying the block to harden or set the binding material and then removing the binding material from one face of the block to leave a rough carbon surface.



NO. 807,949.—MAGNETO-ALTERNATOR.

807,963. Protective Device. Greenleaf W. Pickard, Amesbury, Mass., assignor to the American Telephone and Telegraph Company. Original application filed April 14, 1904. Divided and this application filed December 21, 1904.

In an electrical protective device are two terminals or electrodes separated by a narrow open space, the terminals consisting of porous carbon blocks impregnated with a binding material, the adjacent faces of the blocks being exposed carbon surfaces.

807,973. Process of Obtaining Marketable Electrolytic Deposits. Pierre Steenlet, Brussels, Belgium, assignor to Marcel Perrew Lloyd, Brussels, Belgium. Application filed November 7, 1903.

Marketable metallic electrolytic deposits are produced by charging a diaphragm with an organic substance, treating the organic substance to render it insoluble, interposing the charged diaphragm between a metallic anode and the cathode and the corresponding portions of an electrolyte containing a metal and causing an electric current to flow from the anode to the cathode through the charged diaphragm and form a metallic deposit on the cathode.

807,984. Electric Railway. Frank Adams, North Adams, Mass. Continuation of application filed August 13, 1902. This application filed January 30, 1904.

In an electric-railway system are combined a sectional rail, a feed circuit and means for controlling the circuit comprising a switch, and a trip device adapted to be engaged and moved by a car wheel. Means actuated by the trip device set the switch for action when the trip device is engaged and moved by the car wheel. Means set into action by the operation of the trip device throwing the switch when the trip device is released by the car wheel.

808,016. Electric Clock. Loren C. Cox, Quincy, Ill. Application filed July 6, 1905.

Details are described.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on December 25, 1905:

394,951. Telephone Apparatus. Upton H. Balsley, Philadelphia, Pa.

394,952. Overloading and Slack Cable Stop for Electric Hoisting Machines. William Baxter, Jr., Baltimore County, Maryland.

394,958. Battery Cell for Electric Belts. Simeon Colling, Oakland, Cal.

394,960. Electric Telegraphy. Mark W. Dewey, Syracuse, N. Y.

394,961. Telegraphic Printing Code. Mark W. Dewey, Syracuse, N. Y.

394,964. Electric Switchboard. Isaiah H. Farnham, Malden, Mass.

394,978. Core for the Armatures of Dynamos. David J. Hauss, Cincinnati, Ohio.

395,018. Electric Meter. Elihu Thomson, Lynn, Mass.

395,019. Dynamo-electric Machinery. Friederich Von Hefner-Alteneck and Carl Hoffmann, Germany.

395,028. Flexible Sealed Cell for Secondary Batteries. Mark Bailey and John Warner, London, England.

395,111. Fire-alarm Annunciator. William A. Barnes, Bridgeport, Conn.

395,112. Electrical Alarm. William A. Barnes, Bridgeport, Conn.

395,116. Rheostat. Sigmund Bergmann, New York, N. Y.

395,123. Circuit Controller for Dynamo-electric Machines. Thomas A. Edison, Menlo Park, N. J.

395,157. Dynamo-electric Machine. Frank L. Loomis, Akron, Ohio.

395,207. Electric-cable Support. Charles H. Bowen, Washington, D. C.

395,215. Toll Apparatus for Producing Electric Light. Dixon H. Davies, Leeds, County of York, England.

395,251. Annunciator. Albert Rosenberg, Baltimore, Md.

395,260. Armature for Dynamo-electric Machinery. Warren S. Belding, Chicago, Ill.

395,299. Electric Motor. Daniel F. Sweet, Grand Rapids, Mich.

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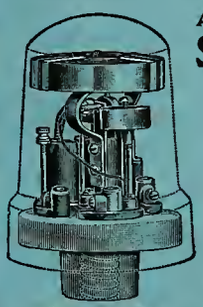
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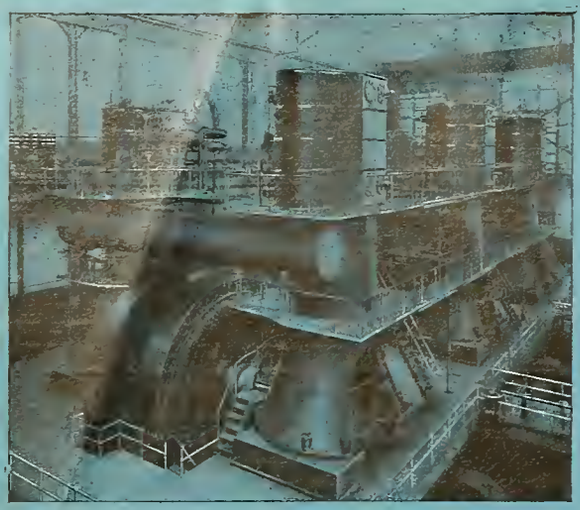

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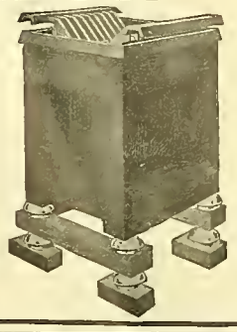

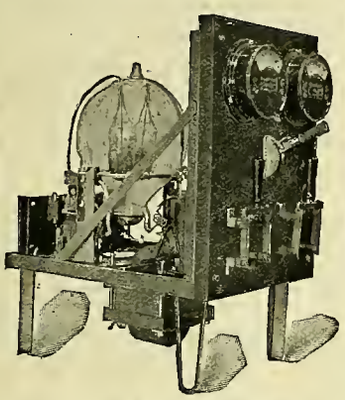

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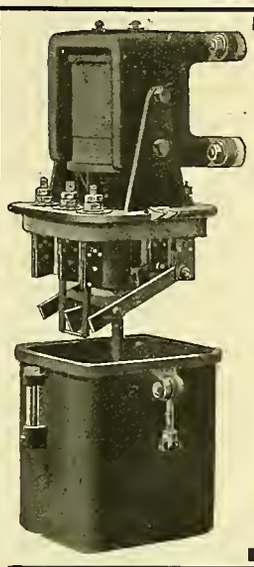

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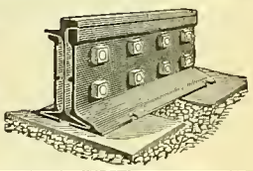

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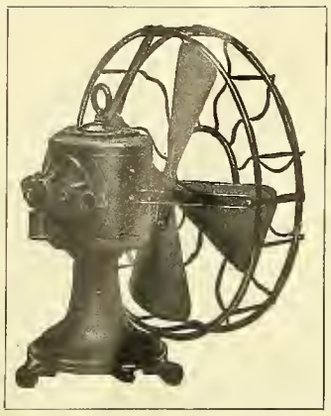

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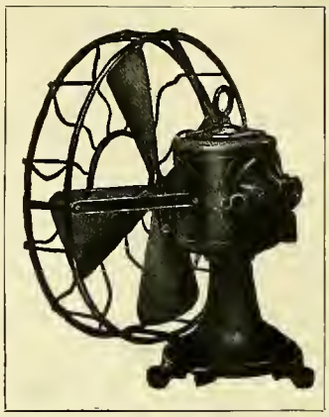

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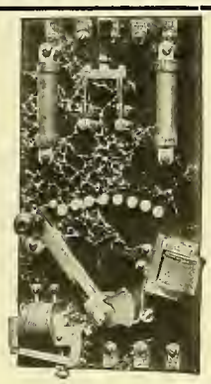

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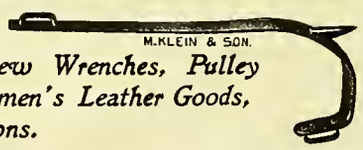

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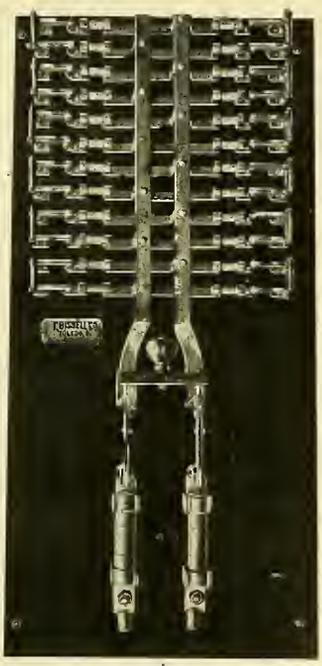

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Westinghouse El. & Mfg. Co

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Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co
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Wesco Supply Co.
Western Electric Company.

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Telephone Woodworking Co.

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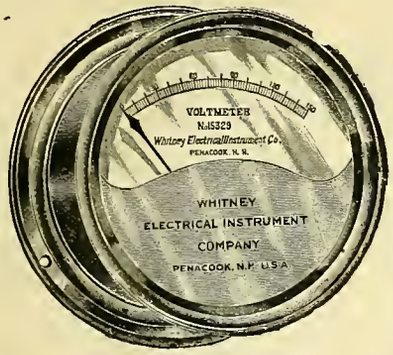

Diam. of body, 6 in., of base flange 7½ in.

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DIRECT-CURRENT INSTRUMENTS

Are winners. Scales are equally divided, indications are dead beat, high range ammeters have separate shunts and the cases are of heavy polished brass.

Prices are right, the list figure for the meter illustrated, for instance, being $16.50.

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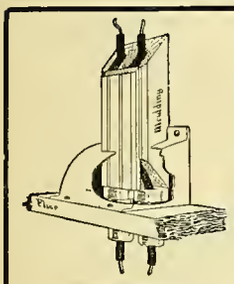
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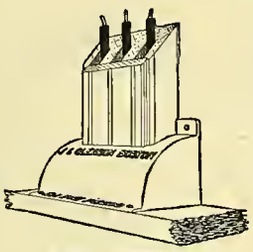
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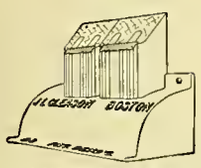
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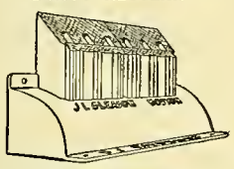
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The Accelerator is the Sole Exception

Every clutch ever made with the sole exception of the Accelerator depends entirely on friction for a starting torque.

The Accelerator gets most of its starting torque from induction—a magnetic drag that exerts its greatest strength at the start, thus using the least friction at the point where every other clutch experiences the most friction and consequently receives the most wear.

There is an elasticity to this drag. Just enough give to it to make a smooth, easy start.

The wearing surfaces of the Accelerator consist of a face of cast iron against a composite face of steel and babbitt. These faces are entirely immersed in oil which is not squeezed out until induction has fallen off. Wearing friction does not set in, until the two faces are revolving at almost the same speed.

These are the reasons why the Accelerator will last for years and years without any adjustment of faces.

Book One tells of the other qualities of the Accelerator which make it the ideal clutch. Why not send for it today?

Cutler-Hammer Clutch Co.

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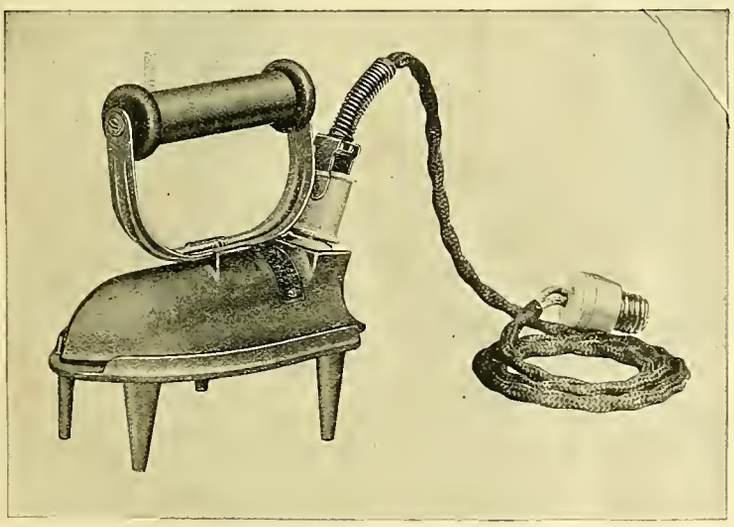
General Electric Company

New Electric Heating Devices



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Have distinctive merit

They are durable
simple
safe
efficient
convenient

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Principal Office: Schenectady, N. Y. Chicago Office: Monadnock Block
Sales offices in all large cities

626

General Electric Company

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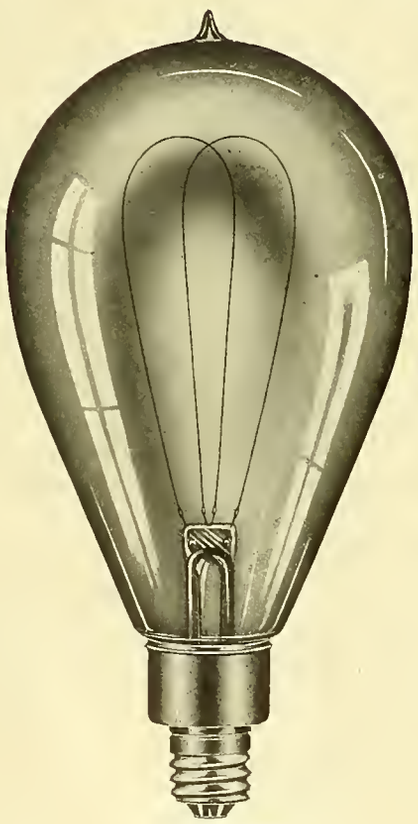
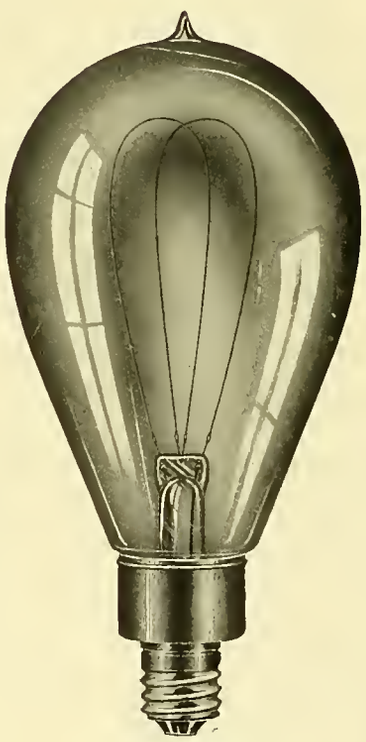
High Efficiency Lamps

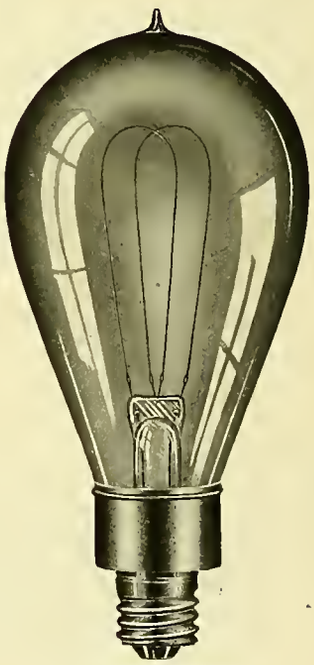
2½ Watts per mean horizontal candle power



100 CANDLE POWER
250 WATTS



75 CANDLE POWER
187.5 WATTS



50 CANDLE POWER
125 WATTS

SUPPLIED IN THE ABOVE CANDLE POWER SIZES. ILLUSTRATIONS ONE-HALF ACTUAL SIZE

Useful life equal to the present standard 16 C.P. 3.1 W.P.C. Edison Lamp

General Electric Company

MAIN LAMP SALES OFFICES

Harrison New Jersey

602

General Electric Company

NEW

High Efficiency High-Candle-Power Incandescent Units

Fitted with Pagoda Reflectors of the Holophane Glass Company

Specially adapted for General Illumination in Competition with Gas Arcs and other High-Candle-Power Illuminants.

Higher efficiency and lower lighting costs than any other commercial electric illuminant except the arc

New 125 watt 50 C.P. Lamp with Form D Reflector, giving 70 useful C.P. (See curve D1).

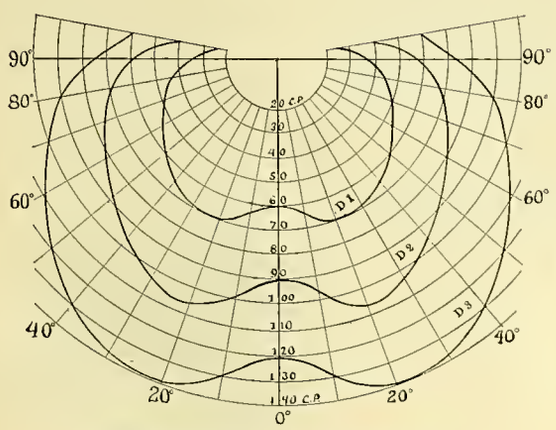
New 187½ watt 75 C.P. Lamp with Form D Reflector, giving 105 useful C.P. (See curve D2).

New 250 watt 100 C.P. Lamp with Form D Reflector, giving 140 useful C.P. (See curve D3).

New 125 watt 50 C.P. Lamp with Form C Reflector, giving 120 useful C.P. (See curve C1).

New 187½ watt 75 C.P. Lamp with Form C Reflector, giving 180 useful C.P. (See curve C2).

New 250 watt 100 C.P. Lamp with Form C Reflector, giving 240 useful C.P. (See curve C3).

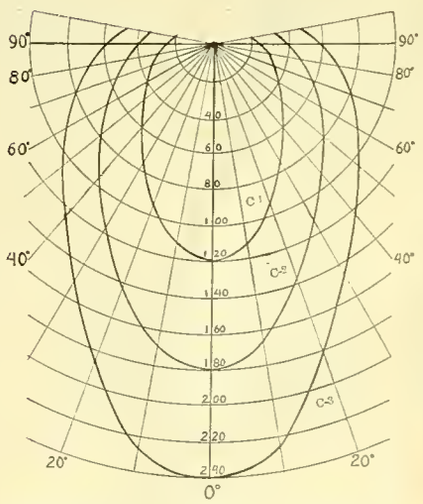


Distributed downward Candle-power with Form D Reflector-D^1 125 watt lamp-D^2 187½ watt lamp-D^3 250 watt lamp.

General Electric Company

MAIN LAMP SALES OFFICES

Harrison, New Jersey



Concentrated downward Candle-power with Form C Reflector-C^1 125 watt lamp.C^2 187½ watt lamp-C^3 250 watt lamp.

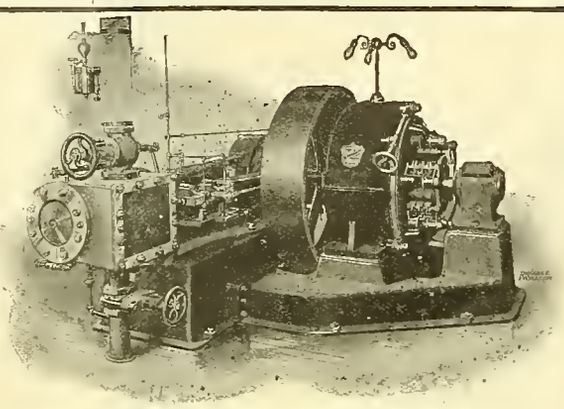
603

CLEAN BOILERS

Dearborn Water Treatment made to suit the case takes off the scale, keeps it off, stops corrosion and foaming. Send gallon of water for analysis. :: :: ::

DEARBORN DRUG & CHEMICAL WORKS,

227-234 Postal Telegraph Building, CHICAGO, ILL. WM. H. EDGAR, President. Telephone: Harrison 3930 and 3931.



The Brownell Direct-Connected Outfit.

THE BROWNELL CO., Dayton, O.

Manufacturers of Boilers, Engines, Heaters and Sheet Iron Work.

THE MOST EFFECTIVE OF ALL BELT DRESSINGS.
Stops Slipping Without Fail.
SEND FOR FREE SAMPLE BAR.
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JEFFREY Elevating, Conveying, Power Transmission, Screening, Crushing Dredging, Rock and Coal Drilling, Coal Cutting, Hauling and Washing Machinery.
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DIESEL ENGINES

Operating on CRUDE or FUEL Oil

Guaranteed Fuel Consumption
on variable load, ranging from ¼ to full load
12½ Gals. per 100 Kw. Hours

SUITABLE FOR ALL STATIONARY POWER

For further information address

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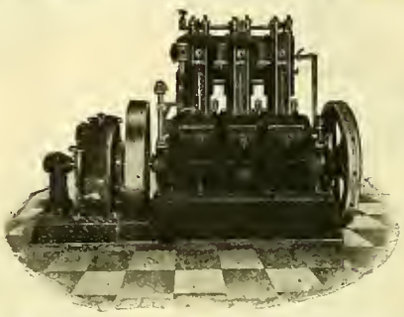
Especially adapted to Electric Service, either belted or direct connected to generators

COMPLETE POWER PLANTS FURNISHED



If you want the most reliable, cheap power known, write for Catalog "W."

MARINETTE GAS ENGINE CO.
CHICAGO HEIGHTS, ILL., U. S. A.

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"Phosphor Bronze" DELTA

THE PHOSPHOR BRONZE SMELTING CO. LIMITED,
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"ELEPHANT BRAND PHOSPHOR-BRONZE"
INGOTS, CASTINGS, WIRE, RODS, SHEETS, ETC.
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ORIGINAL AND SOLE MAKERS IN THE U. S.

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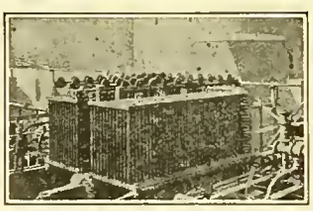
GREEN'S ECONOMIZER

Saves 10 to 20% In Fuel



Increases Boiler Capacity 20 to 40%

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FANS BLOWERS EXHAUSTERS PRESSURE BLOWERS ETC.

Locations for Industries

Erie Railroad

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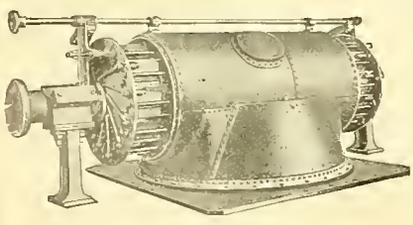
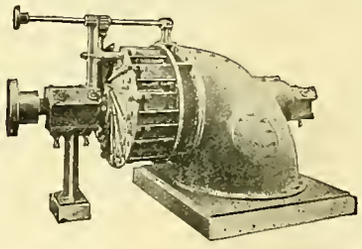
The Erie Railroad Company's Industrial Department has all the territory traversed by the railroad districted in relation to resources, adaptability, markets and advantages for manufacturing, and can advise with manufacturers in relation to the most suitable locations. For full information address

LUIS JACKSON
Industrial Commissioner, Erie Railroad Company
21 Cortlandt Street, New York



SAMSON TURBINE



In constructing the SAMSON we use only the BEST MATERIAL that can be purchased, furthermore, we employ only skilled labor in their erection. It is necessary to use HIGH-GRADE MATERIAL so that all wearing parts will have a LONG LIFE. The SAMSON operates continously.

THE JAMES LEFFEL & CO. 307 Lagonda Street, Springfield, Ohio, U. S. A.

Cords, Cables, Wires

We Manufacture

Cords for Telephones and Switchboards. Cables and Wires for Switchboards. Cables for Interior Purposes.

Write us concerning our No. 100 Switchboard Cord

Secure Our Prices

RUNZEL - LENZ ELECTRIC MFG. COMPANY
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JOHN A. ROEBLING'S SONS CO.

Insulated Wire of All Kinds

Bare Copper Wire

MAIN OFFICE AND WORKS **TRENTON, N. J.**

AGENCIES AND BRANCHES

New York Chicago Cleveland San Francisco Philadelphia Atlanta

MOULDED MICA SOCKETS

WEATHERPROOF

No. 1143

These sockets are made of Moulded Mica and are absolutely waterproof on top. They are suitable for street decorations, parks, domes, paper mills, furnaces, laundries, tunnels, packing houses and other damp places. They are practically indestructible and will withstand considerable rough usage. Furnished in several forms, the No. 1143 being threaded for screwing to brackets.

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H. W. JOHNS-MANVILLE CO.

Manufacturers Electric Railway Supplies, Asbestos and Magnesia Pipe and Boiler Coverings, Roofing and Packings

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FRES-KO

Fres-ko Soldering Paste

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GUARANTEED TO BE THE BEST

For Prices and Samples write to

FRES-KO CHEMICAL CO.

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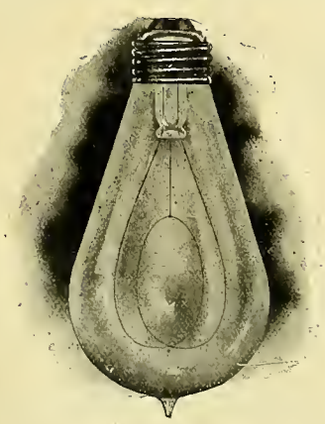

"Nature Smiles Through Sunbeams"

THE SUNBEAM

THE LAMP OF QUALITY

LOOK FOR THE LICENSE LABEL IN THE STEM

Sunbeam Incandescent Lamp Co.

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VOLT - AMMETERS
POCKET SIZE
For testing Batteries and Battery Circuits, Locating Faults, Grounds, etc.
RELIABLE. - ACCURATE.
Send for Circular.
L. M. PICNOLET
78-80 Cortlandt St., NEW YORK, N. Y.

CENTURY ELECTRIC CO.
MANUFACTURERS OF
SINGLE-PHASE SELF-STARTING MOTORS AND CEILING FANS
ST. LOUIS, MO.

WANTED

You Who are Troubled with Sparking and Cutting of Commutators to Use

The only article that will PREVENT SPARKING. Will keep the commutator in good condition and PREVENT CUTTING.

Absolutely Will Not Gum The Brushes . . .

It will put that high gloss on the commutator you have so long sought after.

50 Cts. per Stick. $5.00 per Dozen
For Sale by all Supply Houses, or
FREE, Sample Stick.

K. McLENNAN & CO.,
Sole Manufacturers,
909 Title and Trust Bldg., CHICAGO, ILL.

WORKS QUICK AND EASY. KEEPS ITS LUSTER. HOLDS OLD TRADE AND MAKES NEW. DOES NOT DETERIORATE. ESTABLISHED 16 YEARS. SOLD BY AGENTS AND DEALERS ALL OVER THE WORLD
U.S. METAL POLISH 3 OUNCE BOX 10 CENTS SAMPLES SENT FREE GEO. W. HOFFMAN
POLISHES ALL METALS. BRANCHES: NEW YORK, CHICAGO, SAN FRANCISCO. 295 E. WASHINGTON ST. INDIANAPOLIS, IND.
HIGHEST AWARD. CHICAGO WORLD'S FAIR, 1893. LOUISIANA PURCHASE EXPOSITION 1904.

SET A STANDARD
OF
Brilliant and Efficient Lighting
By using
EDISON LAMPS

Used in larger quantities than all other American makes combined.

All types and varieties. Regular Multiple Lamps, Street Series Lamps, Miniature Lamps.

LOOK FOR THE LABEL IN THE STOCK

GENERAL ELECTRIC COMPANY
Main Lamp Sales Office, HARRISON, N. J.
(476)

FANS-FANS-FANS

WESCO

QUICK SHIPMENTS
FROM FT. WORTH OR ST. LOUIS STOCK,

WESCO ALTERNATING { CEILING AND DESK. ALL VOLTAGES. ALL FREQUENCIES.
PEERLESS DIRECT CURRENT { CEILING AND DESK. ALL VOLTAGES. ALL FINISHES.

WESCO

Send Us Your RUSH Orders.
THE WESCO SUPPLY CO.,
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BIJUR "HIGH-DUTY"
STORAGE BATTERIES
GENERAL STORAGE BATTERY CO.
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The insulation is the most important part of your machine—be sure you buy only the best. Cheap insulation cannot be good insulation.
IF IT'S MICABOND YOU CAN BE SURE YOU HAVE THE BEST—OUR GUARANTEE IS BEHIND IT
CHICAGO MICA CO. : : : Valparaiso, Ind.

MICA INSULATION

Of all Qualities, in any Form at Lowest Prices
EUGENE MUNSELL AND CO.
NEW YORK and CHICAGO

That Is.

Micanite, Linotape, M. I. C. Compound, Empire Cloth and Paper. For Years the Standard.

MICA INSULATOR CO., Originators
NEW YORK and CHICAGO

AMERICAN ELECTRICAL SUPPLY CO

Chicago's New Supply House
New and well assorted stock.
New and up-to-date method of handling orders.
New and interesting prices.

IF ELECTRICAL AND GOOD WE SELL IT

83-85-87 FIFTH AVE CHICAGO

National Battery Company

"Unit Accumulator"
PATENT ALLOWED JANUARY 11, 1905

General Offices
Laboratory
and Works
BUFFALO, N. Y.

FOR CENTRAL STATION, STREET RAILWAY, TELEPHONE WORK, ETC., ETC.

Electric Storage Batteries

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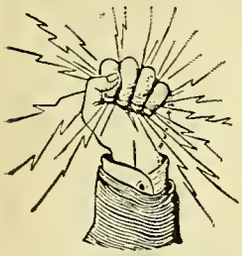
FRANK N. PHILLIPS, Pres. EUGENE R. PHILLIPS, V. P. C. H. WAGENSEIL, Treas. C. R. REMINGTON, Jr., Sec.

AMERICAN ELECTRICAL WORKS,

PROVIDENCE, R. I.



BARE AND INSULATED ELECTRIC WIRE,

ELECTRIC LIGHT LINE WIRE,
INCANDESCENT AND FLEXIBLE CORDS,
Railway Feeder and Trolley Wire,
AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.
CABLES FOR AERIAL AND UNDERGROUND USE.

NEW YORK STORE, W. J. Watson, 26 Cortlandt St.
CHICAGO OFFICE, F. E. Donohoe, 135 Adams St.
MONTREAL BRANCH, Eugene F. Phillips' Electrical Works.
MAIN OFFICES AND FACTORIES, PHILLIPSDALE, R. I.

EXPERT IN ELECTRICITY MECHANICS PATENT CAUSES
SOLICITOR OF U. S. & FOREIGN **PATENTS**
FOREE BAIN, 1652-3 Monadnock Blk., CHICAGO

"AMERICAN" STORAGE CELLS
ARE THE BEST. Send for descriptive Circular.
AMERICAN BATTERY CO.,
ESTD 1887. 171 S. Clinton St., Chicago.

OUR PROPOSITION

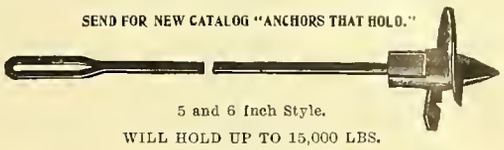
WE WILL SHIP ON 30 DAYS TRIAL
ANY NUMBER OF

STOMBAUGH GUY ANCHORS

OVER TWELVE

IF SATISFACTORY PAY FOR THEM, OTHERWISE, RETURN CHARGES COLLECT
WE PREPAY FREIGHT ON INITIAL ORDERS

SEND FOR NEW CATALOG "ANCHORS THAT HOLD."



5 and 6 Inch Style.

WILL HOLD UP TO 15,000 LBS.

W. N. MATTHEWS & BRO.
MANUFACTURERS
203 N. 2nd St. ST. LOUIS, MO.

NATIONAL CODE STANDARD

WEATHER-PROOF TRADE MARK "O.K." LINE AND HOUSE WIRES

"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Ideal Wire.

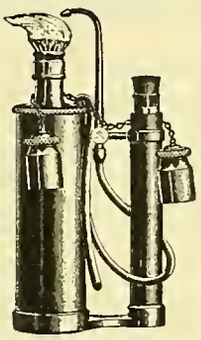
Prices and Samples on Application.

Phillips Insulated Wire Co.

Office and Factory: PAWTUCKET, R. I.

Wilson Alcohol Blow Pipe and Soldering Torch

Patented June 18, 1895.



THIS is one of the most convenient forms of an Alcohol Soldering Torch, combined with a Blow Pipe, on the market, it having been continuously manufactured and sold with great success since 1895. One of its many advantages is the receptacle in the handle for soldering stick or paste. Each tool is equipped, however, with a glass acid bottle, rubber cork and wire spoon, as illustrated, for those that wish to use acid flux. The blowpipe may be raised or lowered by the aid of thumb screw, and a large or small compact flame can be used at will. This tool is made entirely of brass and highly polished, and can be carried in pocket or put in tool bag without danger of breaking. Electricians and wiremen will find this just what they want for house wiring and bench or shop work. Packed one in a cartoon, complete with rubber tubing as illustrated.

Height over all, 7¾ inches
Size, - - 1¾ x 4 inches
Net Weight, - 20 ounces

THE TURNER BRASS WORKS
MANUFACTURERS
23 NORTH FRANKLIN ST., CHICAGO

For Sale by All Electrical Supply Dealers.

Engineering

MECHANICAL, ELECTRICAL, STEAM, CIVIL.

Complete and short courses. Thoroughly equipped engineering shops. Shop work from the beginning. Short courses in Steam and Electrical Engineering. Expenses low. Accommodations the best. School all year. Students may enter any time. Correspondence steam and electrical courses. Send for catalogue. Mention course in which interested.

HIGHLAND PARK COLLEGE, DES MOINES, IOWA.

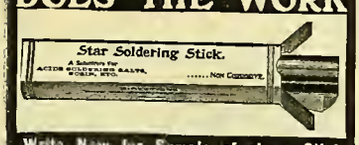
YOST SPECIALTIES.

Sockets, Wall Sockets, Weatherproof Sockets, Rosettes, Receptacles, Cord Adjusters.

Catalogue for the asking.

THE YOST ELECTRIC MFG. CO.
TOLEDO, OHIO.

DOES THE WORK



Write Now for Sample of above Stick

Convenient—Non-Corrosive—Effective

We also make the famous Crolius Commutator Compound; eliminates sparking and all commutator troubles. Send for sample.

E. R. CROLIUS & SON
5419 Peoria Street - CHICAGO, ILL.

Hill Switches

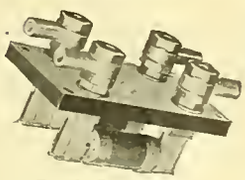
Are Always Up To Date. Get Our Prices on SWITCHES and FUSE BLOCKS

Arrange for NEW CODE FUSES

250.

Front Connection

600.



Back Connection

W. S. HILL ELECTRIC CO.

NEW BEDFORD, MASS.

WESTERN SELLING AGENCIES—Central Electric Co., Chicago, Ill. Western Electric Co., Kansas, City, Mo. California Electrical Works, San Francisco, Cal. American Electric Co,. St. Paul, Minn.

We know a man who is guided in his advertising by the temperature. When the mercury indicates a temperature below zero he is a hot advertiser. When the mercury touches 90 above he is a cold proposition. He might very appropriately be termed a mercurial advertiser.

He is not alone in his class.

There are others.

They have gotten the idea somewhere and somehow that hot-weather advertising doesn't pay. They seem to think that people do not read ads in the "good old summer time." They say it is out of season; that their business falls off during the Summer months and picks up in the Fall. During June, July, and August they make few efforts, or none whatever, to secure orders. In the Fall they hustle for them.

We also know many men who advertise during the twelve months of every year—and they do business all the year 'round.

They do a steady business because they advertise steadily.

The wise man knows that the only seasonable advertising is advertising during the four seasons—Spring, Summer, Autumn and Winter—in the WESTERN ELECTRICIAN.

WANTED, FOR SALE *and similar* **WANT COLUMN** *advertisements (50 words or less), $1.50 an insertion; additional words 3c each.*
POSITION WANTED *advertisements (50 words or less), $1.00 an insertion; additional words 2c each.*

POSITION WANTED

Technical graduate, aged 28. Has had installing, operating and selling experience in electrical work. Now with large company as sales engineer. Desires central station or sales managership position. Best references past and present employers. Address BOX 493, care Western Electrician, 510 Marquette Bldg., Chicago.

FOR SALE

Electric supply and contracting business; growing city of 25,000 people. Only a few thousand dollars required to purchase this excellent business. Address box 414, Greensboro, N. C.

FOR SALE.

An Electrical Contracting and Supply business in the state of New York. Established ten years in present location. Doing profitable business. Good stock on hand. Contracts underway. Immediate possession. Can be bought at very reasonable figure. Small amount cash required. Present owner obliged to devote his time to other interests. Address BOX 492, care Western Electrician, 510 Marquette Bldg., Chicago, Ill.

FOR SALE

Two hundred shares in a completely equipped electric light plant, heating and power plant, incorporated under the laws of Illinois and situated in a city of 2,500 inhabitants. The plant is thoroughly up to date, with complete duplicate equipment, is on a well-paying basis and is constantly increasing its list of customers. This stock is a controlling interest, being two-thirds of the entire stock issue of three hundred shares and the present owners of same wishing to retire from this line of business, will sell for $3,500 on easy terms as follows: $2,500 cash, and balance secured by the stock as collateral. The actual cost of the plant is $20,000 with a bonded indebtedness of $12,000. Inspection of plant invited at any time. Address STEWARD BROS. BANK, Plano, Ill.

FOR SALE

H. P.	220 To 250 Volt Motors
1	7½ Towle, M. P., new.
1	8 Holtzer-Cabot.
1	8 Crocker-Wheeler, series.
1	8 Western Electric M. P., direct connected to Eston & Prince elevator, complete with controller and drum.
1	9½ Crocker-Wheeler, M. P., new.
1	10 C. & C., M. P.
1	10 Keystone, M. P.
1	10 Bernard, M. P.
1	15 Eddy.
1	15 Keystone, M. P.
1	15 Western Elec., M. P.
1	20 Sprague.
1	20 Western Elec., M. P.
1	25 Edison, self-oilers.
1	30 Crescent, M. P.
2	30 Westinghouse, M. P.
1	40 Bernard, M. P.
2	40 Western Electric, M. P.
1	50 E. & C. Multipolar.
2	50 Am. Engine Co., M. P.
1	60 C. & C., self-oiler.
1	60 Maine, M. P.
1	70 Fuller, multipolar.
1	150 Eddy, M. P.
2	200 National, M. P.

Send for our Monthly Bargain Sheet with complete list and net prices.

GREGORY ELECTRIC CO. 54-62 S. Clinton St. CHICAGO, ILL.

PROPOSALS.

Sealed proposals are invited for the purchase or lease for a term of years of the Municipal Light Plant. Bids to be filed with the City Clerk on or before 7 P. M. July 11th, 1905. Council reserves the right to reject any and all bids. Same to be submitted to a vote of the people. By order of the Common Council, Harry J. Steiner, City Clerk, Monroe, Mich., June 19th, 1905.

READ BOOKS

on Electrical Subjects, and think Electrical Thoughts.

We have the books.

Send for a catalogue.

ELECTRICIAN PUBLISHING CO.
510 Marquette Bldg.,
Chicago.

ELECTRICAL MATERIAL FROM THE WORLD'S FAIR, ST. LOUIS, 1904

An opportunity to secure rare bargains in everything used in this line. This material that we are offering has seen but limited service and is practically as good as new for further use.

LEAD COVERED CABLES.

Feet.	Size.	Conductor.	Voltage.
26,500	300 M-C. M.	3	6,600
9,500	4—0	3	6,600
4,700	3—0	3	6,600
7,500	2—0	3	6,600
14,500	1—0	3	6,600
18,500	No. 1	3	6,600
11,500	No. 2	3	6,600
4,700	No. 3	3	6,600
7,100	No. 4	3	6,600
11,500	No. 6	3	6,600
25,000	4—0	1	2,200
1,900	2—0	1	2,200
11,000	1—0	1	2,200
9,000	No. 1	1	2,200
1,000	No. 2	1	2,200
18,000	No. 4	1	2,200
48,000	No. 6	1	2,200
1,900	No. 8	1	2,200
25,000	500 M-C. M.	1	500
50,000	4—0	1	500
11,000	3—0	1	500
1,000	2—0	1	500
3,700	No. 1	1	500
2,900	No. 6	1	600
180,000	No. 6	1	8,000
14,500	No. 14	6	Fire Alarm
39,000	No. 14	4	" "
39,000	No. 14	3	" "
9,500	No. 14	2	" "

Weatherproof and Rubber Covered Wire.

All sizes from No. 14 to 600,000 C. M.

INCANDESCENT LAMPS

200,000 Lamps, used a short time, and in good condition for further service. Have been tested. They are 104 voltage, Edison base, 8 candlepower. In lots of 1,000, each 5 cents.

150,000 brand new Incandescent Lamps in original cases of 200, 250 and 400 Lamps, ranging from 100 to 110 voltage, 8 and 16 candlepower, General Electric make. Price each in case lots, 12½ cents.

20,000 Colored Incandescent Lamps, brand new, never used, General Electric make, 104 voltage, Edison base; colors, Amber, Green, Opal and Ruby; put up 200 in a case. Price each, 22 cents; are worth 35 cents each.

20,000 Incandescent Lamps, voltages 100 to 120, Edison, T. H. and Westinghouse base; 8, 10, 16, 20 and 25 candlepower; put up 250 in a case, second selection. Price each in case lots, 10½ cents.

WOOD CONDUIT.

100,000 Feet, Size 4½ x 4½.

MISCELLANEOUS

300,000 No. 9171 Porcelain, Edison Base Receptacles.
50,000 Weatherproof "Bryant" Sockets.
1,000,000 split glazed B. & D. Wiring Knobs.
300,000 Glazed Porcelain B. & D. Wiring Knobs, sizes 3½, 4½ and 5½.
20,000 No. 8 Standard Porcelain Knobs.
200,000 Single Wire glazed Porcelain Cleats.
15,000 Porcelain Cut-outs.
26,000 Plugs.
2,000,000 Unglazed Porcelain Tubes.
40,000 Glass Insulators.
20,000 Porcelain Cleats.
All kinds of switches and instruments.

Ask for our Special Catalogue No. 567.

CHICAGO HOUSE WRECKING COMPANY, 35th and Iron Sts., CHICAGO.

Northern Grinders Save Bench Work

CUT out lots of vise operations, save time at the bench, save time on the assembling floor, make work better because accuracy is easily attained.

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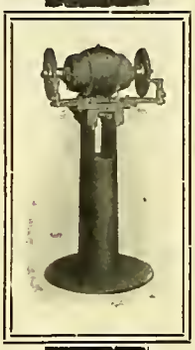

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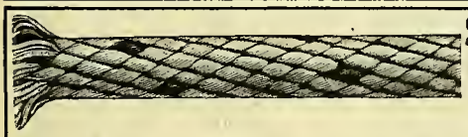

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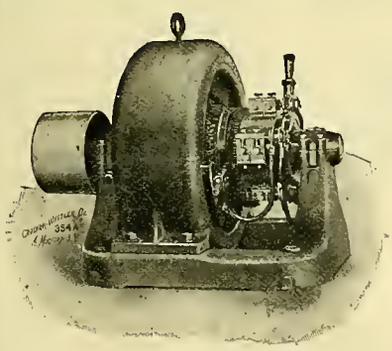

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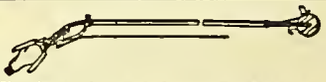
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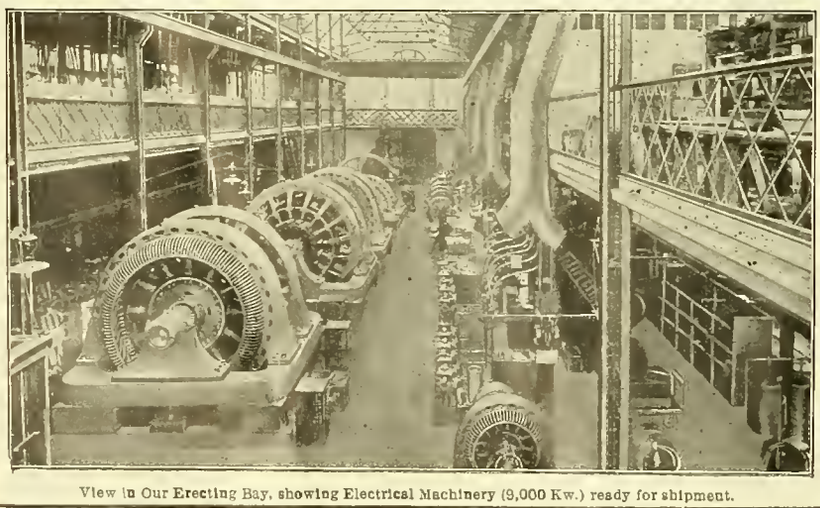
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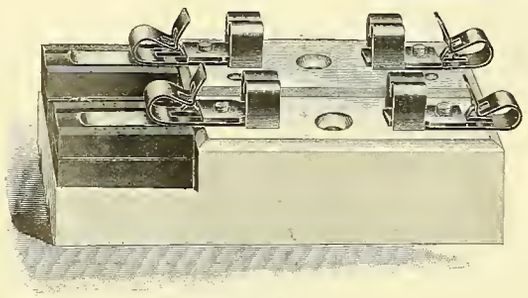

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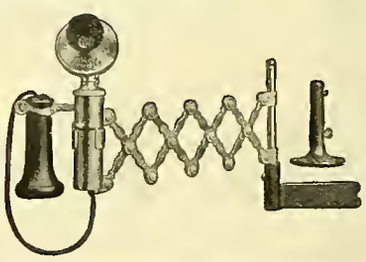

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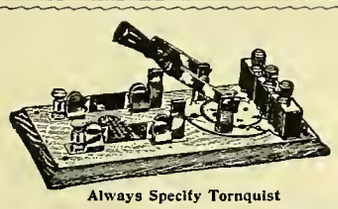

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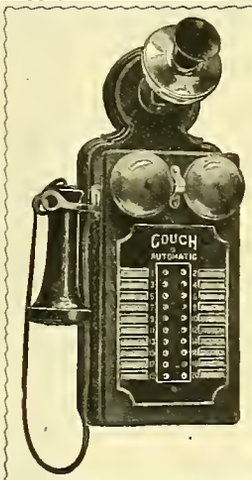

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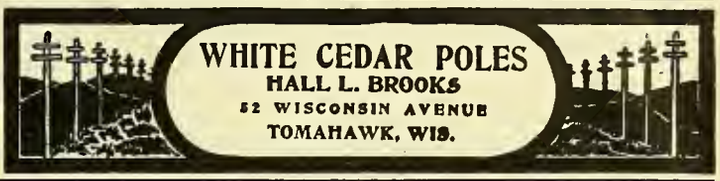

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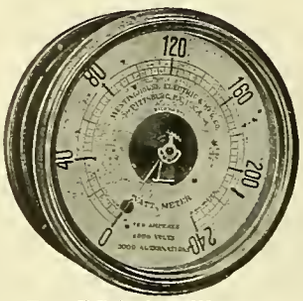

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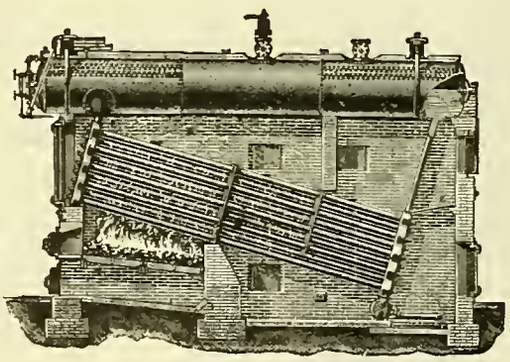

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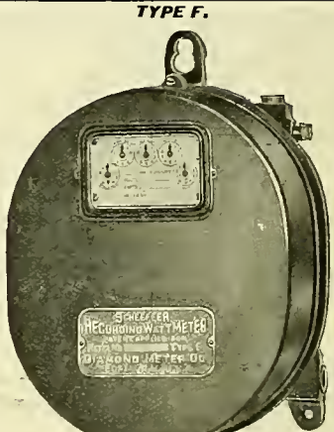

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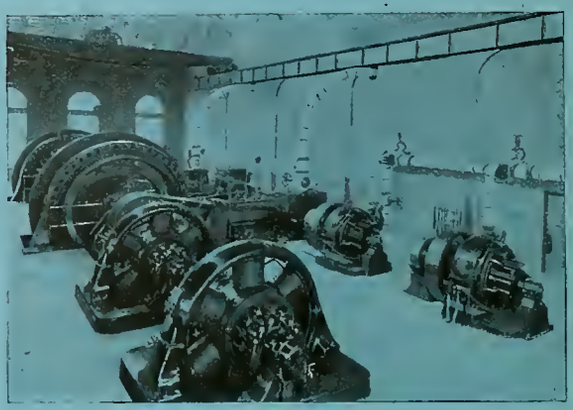

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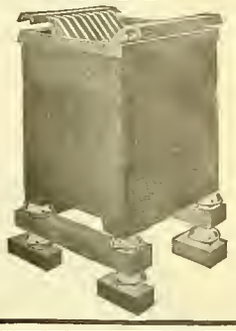

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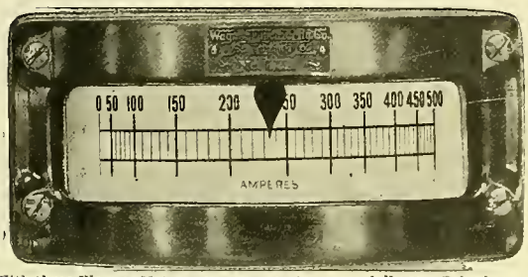

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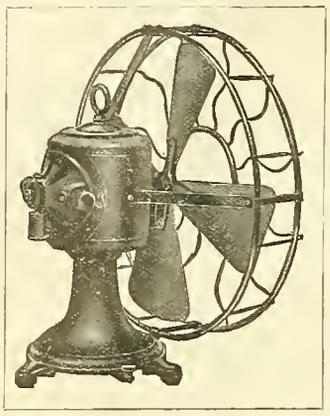

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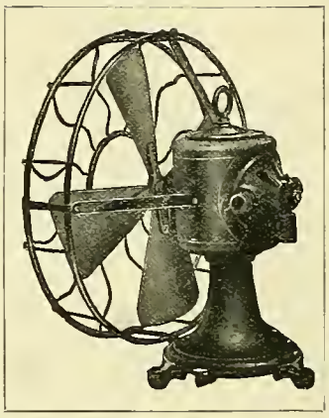
PARAGON FAN MOTORS

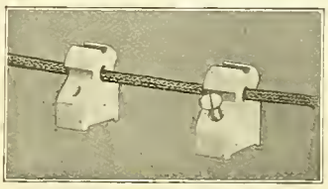
STANDARD FOR YEARS

CALL AND SEE THEM OR WRITE FOR PRICES

CHICAGO EDISON COMPANY,

139 ADAMS ST., CHICAGO.





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WORK IS MADE EASY

No {TIE WIRE / HALF HITCH / WRAP} Saves Money

Safest and Strongest Knob on the Market. Costs only a little more than the 5½ Knob. Saves Twice its Cost.

Or Any Jobber

The SNYDER-HUNT CO., Belle Plaine, Ia.

C H "Universal" Motor Speed Regulator

Both the Motor and Regulator are fully protected by the use of the Cutler-Hammer "Universal" speed regulator.

It also comprises every necessary device for the complete installation of a motor, being equipped with no-voltage and overload release magnets, fuses and knife switch.

In case of cessation of current the operation of the no-voltage magnet will allow the lever to return to "off" position. The overload magnet will act in the same manner for overloads up to 50 per cent increase of the normal current.

In case of heavier overloads, such as produced by short circuits, the fuses can be absolutely depended to blow without any arcing whatever.

Lever is held squarely over each segment. Automatic release from any segment.

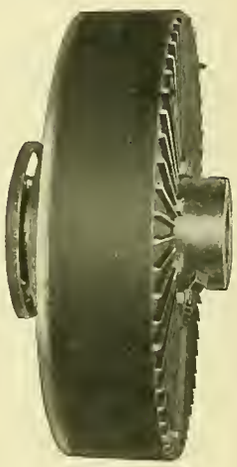
Bulletin No. 42 gives prices and full description.

The Cutler-Hammer Mfg. Co.

MILWAUKEE, WISCONSIN

NEW YORK 136 Liberty St. BOSTON 176 Federal St. CHICAGO Monadnock Bldg. PITTSBURG Farmers Bank Bldg.

One Control Problem The Accelerator Solved



The Accelerator solves many problems of automatic and remote control.

For instance, in our own factory is a blower located on the second floor and which is used to supply blast for gas furnaces on the first, second and third floors. This blower gets its power from our regular line shafting. It was either a case of running it all day, or chasing up from the first or down from the third floors to start it when it was wanted on either of those floors. By connecting the blower to the shaft with an Accelerator it is started and stopped from any floor by means of snap switches. While any of the switches are "on" the blower will continue to run; as soon as all of the switches are "off" it will stop.

The Accelerator is the only Clutch on the market that will gradually accelerate a load from rest to synchronism. It requires no adjustment for wear of faces, and can be operated either by push buttons or automatic devices.

There's a story of interest in our catalogue for the man whose work it is to devise ways for reducing factory costs.

Cutler-Hammer Clutch Co.

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The Highest Possible Award

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Manufacturers of

BARE AND TINNED COPPER WIRE

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AUTOMATIC STARTERS and PROTECTIVE DEVICES

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Sockets, Wall Sockets, Weatherproof Sockets, Rosettes, Receptacles, Cord Adjusters.

Catalogue for the asking.

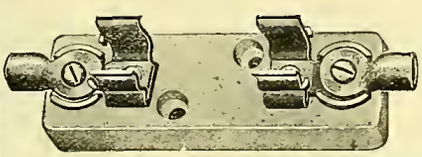
THE YOST ELECTRIC MFG. CO.

TOLEDO, OHIO.

When a man's electrical ideas flow freely; when he discusses electrical subjects intelligently and glibly, you will be pretty safe in assuming that he keeps in touch with electrical progress by perusing the Western Electrician 52 times a year.

"UNION" ENCLOSED FUSES

OLD AND NEW CODE STYLES



New Code Blocks

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Our Trade Mark stands for good goods in all Electrical Fuses and Fuse Wire

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ARE NOW MANUFACTURING AND SOLICIT ORDERS FOR

MODEL H-6 ROTATED JEWEL BEARING STANLEY WATTMETERS

For Alternating Current, Single Phase and Polyphase Service constructed to conform strictly to the suggestion contained in the following language quoted from the opinion filed September 9th, 1904, in the
UNITED STATES CIRCUIT COURT OF APPEALS FOR THE FIRST CIRCUIT:
"If the device stopped with "a metallic rotating body" and some method other than a counting machine operated by it was used for determining the number of its revolutions, we might not be able to charge the respondent with infringing. We might then well apply the proposition of the respondent that a mere meter is in a different art from a motor. * * * * * "Therefore, as it may well be that, if the counting mechanism was of a kind not operated by the "metallic rotating body," we should not be compelled to find infringement, we hesitate in view of the minute amount of energy exerted."
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PRICES CONSIDERABLY LESS TO ALL PURCHASERS THAN HERETOFORE PREVAILING
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Lowest internal resistance of any storage battery in the world.

The weight efficiency is conservatively 14 watts per pound total weight, and electrical efficiency unsurpassed .' .' .'

THE PLATE

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General Electric Company

NEW

HIGH EFFICIENCY

HIGH CANDLE-POWER

INCANDESCENT UNITS

Efficiency superior to all other commercial electric illuminants

New GE Incandescent Unit with
DISTRIBUTING OR "D" FORM OF SHADE

Table of Sizes and Values

Type No. of Lamp	Total Watts	Distributed Candle-Power in Downward Direction
3	125	70
4	187½	105
5	250	140

New GE Incandescent Unit with
CONCENTRATING OR "C" FORM OF SHADE

Table of Sizes and Values

Type No. of Lamp	Total Watts	Concentrated Candle-Power in Downward Direction
3	125	120
4	187½	180
5	250	240

Specially designed Holophane Pagoda Reflectors secure Highly Efficient Lighting in either Distributed or Concentrated form

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Main Lamp Sales Offices HARRISON, N. J.

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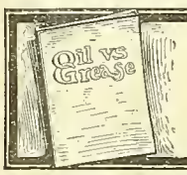

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There's No Friction
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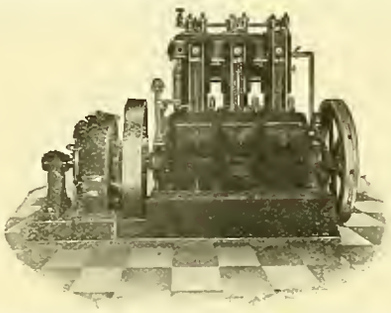

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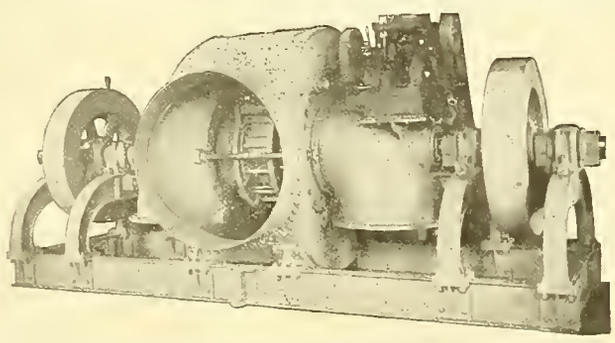

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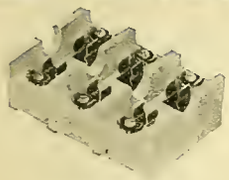

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31 to 60 Amp. 600 V.

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Accessible at any time without opening manhole. Require small space. Fitted with one, two or three bus-bars.

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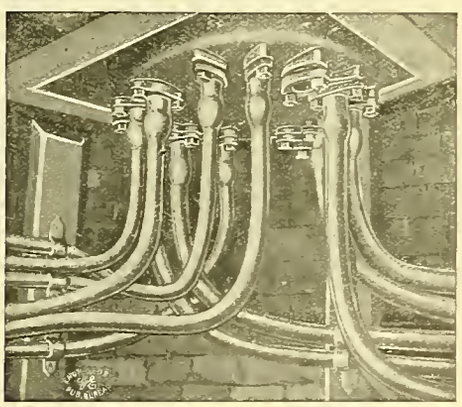
Will carry cables up to 2,000,000 circular mils.



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USE EDISON SERIES LAMPS
For Street Lighting

And Insure Uniform and Reliable Results.

Supplied in All Standard Candle-powers and Amperages.

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For testing Batteries and Battery Circuits, Locating Faults, Grounds, etc.
RELIABLE. - ACCURATE.
Send for Circular.
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Bijur "High Duty" Storage Batteries
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Send 2c stamp for new catalogue No. 6 of
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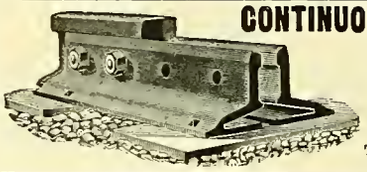

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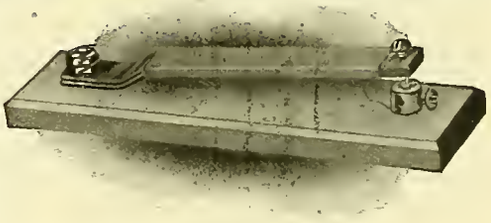

Automatically operates three 16, six 8, twelve 4 c.-p. lamps or less, on either direct or alternating current.

Easily connected. Flash can be regulated. It saves electricity. It requires absolutely no attention and has nothing to get out of order. The contacts are heavy platinum and will wear indefinitely.

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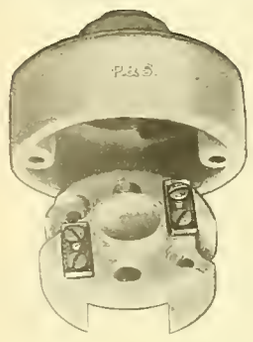

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The recessed base of this rosette permits the tubes to extend from the ceiling, thus complying with the Underwriters' specifications. The cap completely covers the base, and gives a finished appearance to the work.

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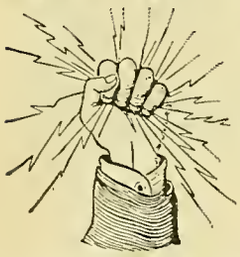

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IF SATISFACTORY PAY FOR THEM, OTHERWISE, RETURN CHARGES COLLECT
WE PREPAY FREIGHT ON INITIAL ORDERS

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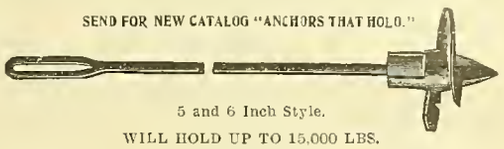

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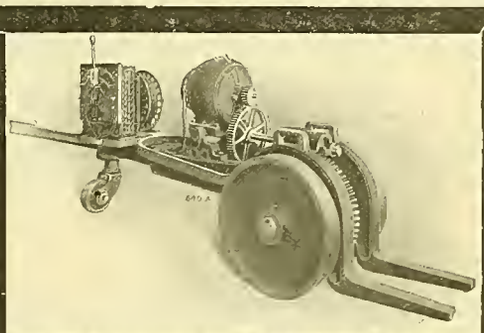

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Our new mechanical governors co-operate with the inertia effect on the water and the momentum of the plant.
They have cut the cost of good government in two. Guaranteed in every particular.

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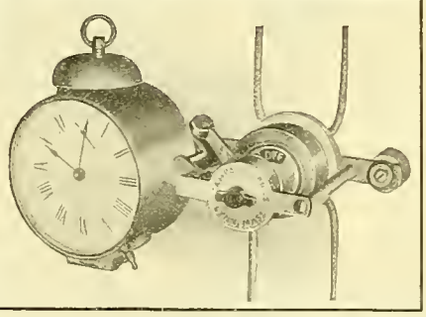
Well-made, reliable, easy to install, cheap in price, quality the best. Have one in stock. Order now.



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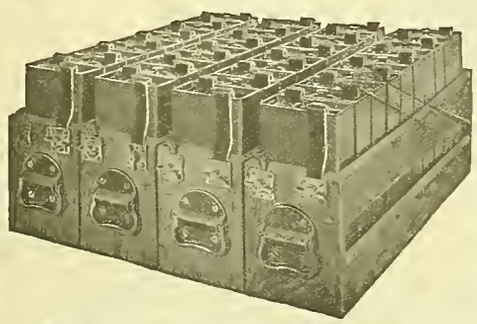

requiring a storage battery with a capacity to supply 25-16 C. P. lamps (or less) for 8 hours (250-Ampere hours) find all needs filled by the *NORTHWESTERN.* Let us figure on your *telephone, police patrol and fire-alarm* storage battery work.

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Now that the smoke and noise of Independence Day have passed away we wish to remark that all your days will be independence days, financially, if you will shoot off a cannon cracker each week (in the Western Electrician) and attract attention to yourself.

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Experienced mechanical draftsman for permanent position with the General Electric Co., West Lynn, Mass. Give age, education, detailed account of experience in shop and office and salary expected. Address ENGINEER in charge of drawing office.

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Two hundred shares in a completely equipped electric light plant, heating and power plant, incorporated under the laws of Illinois and situated in a city of 2,500 inhabitants. The plant is thoroughly up to date, with complete duplicate equipment, is on a well-paying basis and is constantly increasing its list of customers. This stock is a controlling interest, being two-thirds of the entire stock issue of three hundred shares and the present owners of same wishing to retire from this line of business, will sell for $3,500 on easy terms as follows: $2,500 cash, and balance secured by the stock as collateral. The actual cost of the plant is $20,000 with a bonded indebtedness of $12,000 Inspection of plant invited at any time. Address STEWARD BROS. BANK, Plano, Ill.

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We operate the largest repair shops in America and have exceptional facilities for quick work. We repair **all kinds** of electrical apparatus and save our customers **weeks** in time in comparison with sending the work to the manufacturers direct. We have just reduced our prices and ask you to get our quotations on

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Feet.	Size.	Conductor.	Voltage.
26,500	300 M-C. M.	3	6,600
9,500	4—0	3	6,600
4,700	3—0	3	6,600
7,500	2—0	3	6,600
14,500	1—0	3	6,600
18,500	No. 1	3	6,600
11,500	No. 2	3	6,600
4,700	No. 3	3	6,600
7,100	No. 4	3	6,600
11,500	No. 6	3	6,600
25,900	4—0	1	2,200
1,900	2—0	1	2,200
11,000	1—0	1	2,200
9,000	No. 1	1	2,200
11,000	No. 2	1	2,200
18,000	No. 4	1	2,200
48,000	No. 6	1	2,200
1,000	No. 8	1	2,200
25,000	500 M-C. M.	1	500
50,000	4—0	1	500
11,000	3—0	1	500
14,000	2—0	1	500
3,700	No. 1	1	500
2,900	No. 6	1	500
180,000	No. 6	1	8,000
14,500	No. 14	6	Fire Alarm
39,000	No. 14	4	" "
39,000	No. 14	3	" "
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Weatherproof and Rubber Covered Wire.

All sizes from No. 14 to 600,000 C. M.

INCANDESCENT LAMPS

200,000 Lamps, used a short time, and in good condition for further service. Have been tested. They are 104 voltage, Edison base, 8 candlepower. In lots of 1,000, each 5 cents.

150,000 brand new Incandescent Lamps in original cases of 200, 250 and 400 Lamps, ranging from 100 to 110 voltage, 8 and 16 candlepower. General Electric make. Price each in case lots, 12½ cents.

20,000 Colored Incandescent Lamps, brand new, never used, General Electric make, 104 voltage, Edison base; colors, Amber, Green, Opal and Ruby; put up 200 in a case. Price each, 22 cents; are worth 35 cents each.

20,000 Incandescent Lamps, voltages 100 to 120, Edison, T. H. and Westinghouse base; 8, 10, 16, 20 and 25 candlepower; put up 250 in a case, second selection. Price each in case lots, 10½ cents.

WOOD CONDUIT.

100,000 Feet, Size 4½ x 4½.

MISCELLANEOUS

300,000 No. 9171 Porcelain, Edison Base Receptacles.
50,000 Weatherproof "Bryant" Sockets.
1,000,000 split glazed B. & D. Wiring Knobs.
300,000 Glazed Porcelain B. & D. Wiring Knobs, sizes 3½, 4½ and 5½.
20,000 No. 8 Standard Porcelain Knobs.
200,000 Single Wire glazed Porcelain Cleats.
15,000 Porcelain Cut-outs.
26,000 Plugs.
2,000,000 Unglazed Porcelain Tubes.
40,000 Glass Insulators.
20,000 Porcelain Cleats.
All kinds of switches and instruments.

Ask for our Special Catalogue No. 567.

CHICAGO HOUSE WRECKING COMPANY, 35th and Iron Sts., CHICAGO.

"Diamond H" Switches

Trade H Mark

This Trade-Mark guarantees quality.

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Drawn steel. One blow of a hammer gives clean round hole. No filing.

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A SIGN FLASHER WITHOUT A MOTOR

Agents Wanted

A FEW ADVANTAGES OF THIS FLASHER OVER ALL OTHERS:

First.—The Price is lower.
Second.—It has fewer parts and is therefore the simplest flasher on the market.
Third.—It has no motor to cause trouble and consume current.
Fourth.—It costs nothing to operate this flasher.
Fifth.—It only occupies a space of 5 x 8 inches.
Sixth.—It can be regulated to flash any signs or show window lights in any manner desired.
Any combination of lights, without motor or cylinder.
Simplest and best on the market.
Works on any current.
The disadvantage of a flasher was the motor question.
We have overcome this and are putting out an article that meets a long felt want.

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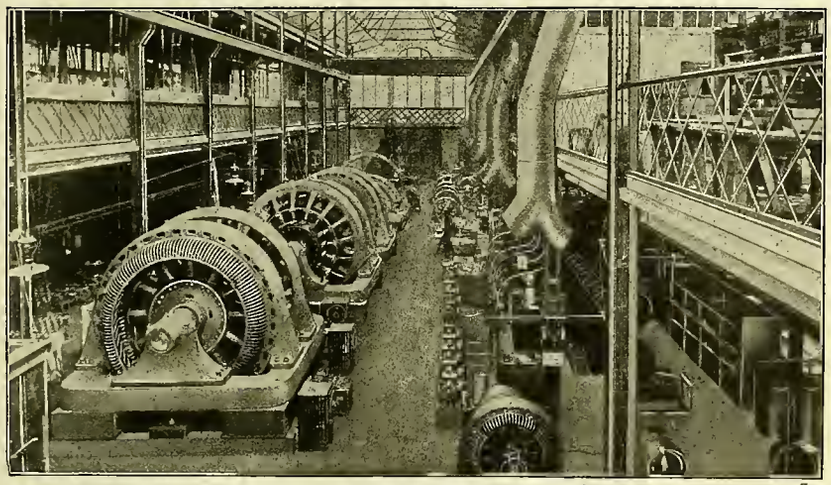

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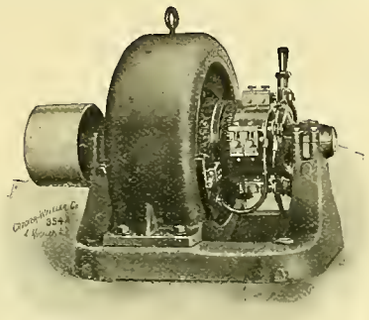

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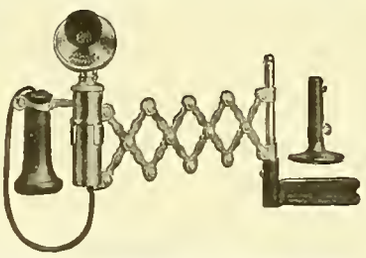

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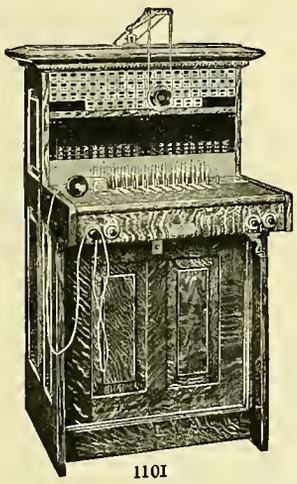

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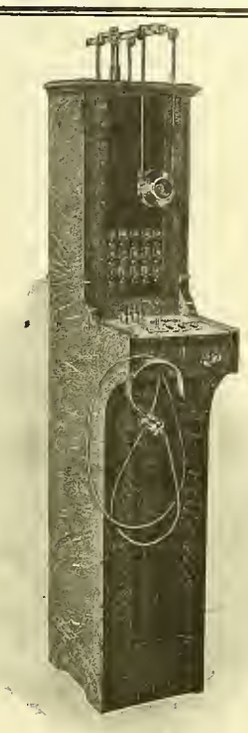

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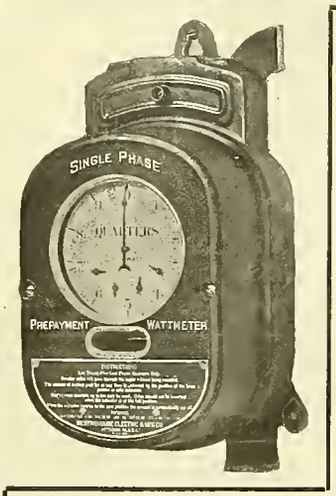

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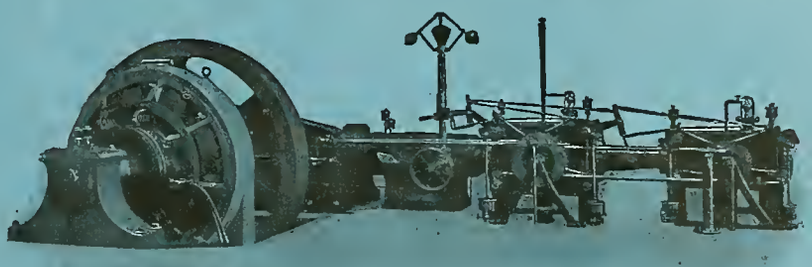

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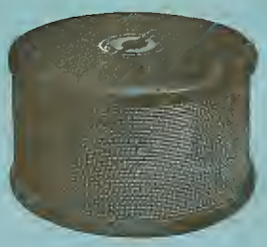

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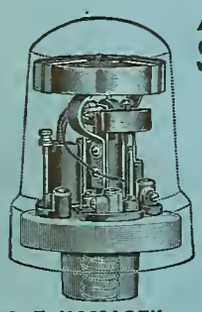

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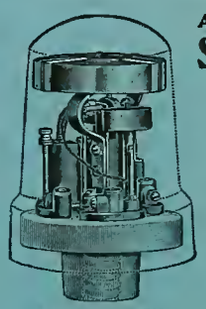
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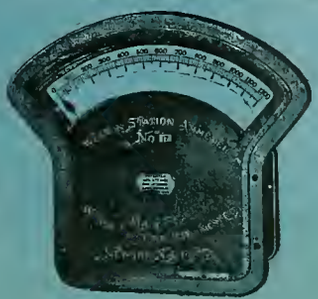
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Our portable instruments are recognized as standards throughout the civilized world.
Our Semi-Portable Laboratory Standard Voltmeters and Ammeters are still better.
They are the most reliable, absolute standards for Laboratory use.
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SELF FLUXING SOLDER

FOR ALL PURPOSES
IN 18-INCH STICKS OR ON REELS
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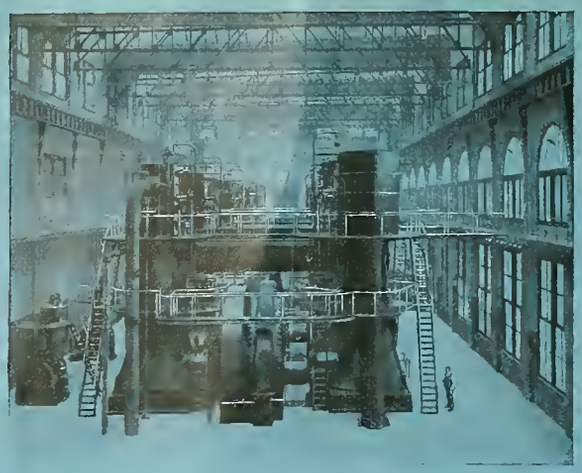

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Installed in the leading large stations of this country and abroad.

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Milwaukee, Wis., U. S. A.

Canadian representatives, Allis-Chalmers-Bullock, Ltd. Montreal

The C-H Rotary Press Controller

In the control of motor driven rotary presses the two extremes of speed are demanded. Very slow speed for setting up the plates and threading in the paper, and "hurry up" speed to make up for delays in going to press.

In most control systems, to obtain slow speeds a second motor is necessary. With the Cutler-Hammer Rotary Press Controller but one motor is required for both the slowest and highest speeds, and it also provides for a large number of intermediate speeds. At any and every speed it gives a steady motion to the press, and prohibits its jumping, no matter how heavy it may be loaded.

This controller is so arranged that there is absolutely no arcing on the segments, the opening of the motor circuit being accomplished by the large solenoid shown in the cut. This solenoid is equipped with a carbon break and blow-out magnets for disrupting the arc. Protective devices are provided to quickly stop the press in case of accident.

Our bulletin No. 65 tells about this type.

The Cutler-Hammer Mfg. Co.

MILWAUKEE, WIS.

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136 Liberty St.	176 Federal St.	Monadnock Bldg.	Farmers Bank Bldg.

BECAUSE of the disturbances on the line incident to starting an induction motor the general practice is to allow it to **run continuously** all day, and the apparatus to which it is connected is allowed to run idle when **not** in actual service.

This is one of the many instances in which the Accelerator will **save** wear and tear on the apparatus and will also **save** current while the motor is running idle. In one installation it is **saving three times its cost** in one year in current alone. Besides this it allows the apparatus **eight hours more rest** a day than it had formerly.

The Accelerator can be energized by automatic devices and will connect the apparatus to the motor **only** when necessary, **doing away** with the necessity of running the machine idle, and **reducing the wear** on the apparatus.

It will always start the apparatus gradually and smoothly **without** any shock or jerking.

If you have a proposition of this or a similar sort, we would like to submit a plan of control.

Our catalog explains how the Accelerator is built and how it operates. If you have not received a copy send for one.

Cutler-Hammer Clutch Co.

MILWAUKEE, WIS.

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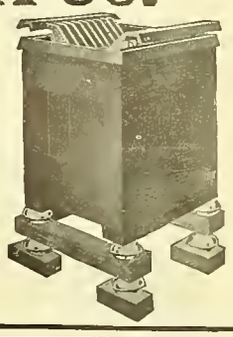

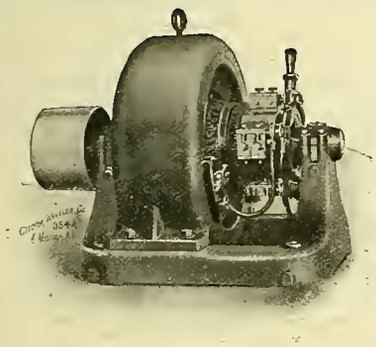

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All forms of electrical contacts.
Grand Prize
Universal Exposition
ST. LOUIS, 1904

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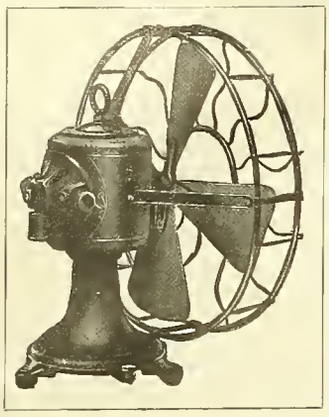

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PARAGON FAN MOTORS

STANDARD FOR YEARS

CALL AND SEE THEM OR WRITE FOR PRICES

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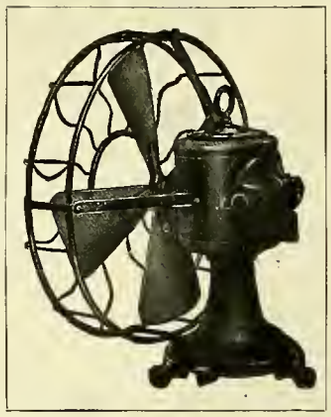

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FLEXIBLE CONDUIT

"Flexduct" the National Code Standard. It does not deteriorate, always usable to highest degree

OSBURN FLEXIBLE CONDUIT COMPANY,

NEW YORK CHICAGO SAN FRANCISCO

MOULDED MICA SOCKETS

WEATHERPROOF

No. 1143

These sockets are made of Moulded Mica and are absolutely waterproof on top. They are suitable for street decorations, parks, domes, paper mills, furnaces, laundries, tunnels, packing houses and other damp places. They are practically indestructible and will withstand considerable rough usage.

Furnished in several forms, the No. 1143 being threaded for screwing to brackets.

No. 1140

H. W. JOHNS-MANVILLE CO.

Manufacturers Electric Railway Supplies, Asbestos and Magnesia Pipe and Boiler Coverings, Roofing and Packings

100 William Street - - NEW YORK

New York	Philadelphia	San Francisco	Minneapolis	London
Milwaukee	St. Louis	Los Angeles	Little Rock	Paris
Chicago	Pittsburg	Seattle	New Orleans	Brussels
Boston	Cleveland	Kansas City		

Transformer Decision Reversed

On May 3rd the United States Court of Appeals for the Southern District of New York handed down a decision in the case of the Westinghouse Electric & Mfg. Co. vs. the Montgomery Light & Power Company involving Stanley patent No. 469,809, *REVERSING* a decision of the Lower Court favorable to the Westinghouse Company.

This decision of the Court of Appeals ***favorable to the Montgomery Light & Power Company*** is one step in a long line of litigation having for its object a monopoly of the manufacture, sale and use of standard transformers such as used by all central station lighting and power companies.

Considerable publicity has been given the earlier decision by the Lower Court favorable to the plaintiffs, and this announcement of the reversal by the Court of Appeals will therefore dispel any misapprehension of the true merits of this litigation which may have arisen in the minds of central station people.

Users of Wagner apparatus may rest assured that this apparatus does not infringe the valid patents of other companies. It is the policy of the Wagner Company invariably to carefully investigate all the United States letters patent bearing upon its lines of manufacture, and to so design its apparatus that the patents belonging to others, valid in the opinion of our attorneys, are in no sense infringed. The wisdom of this policy is evidenced by the fact that after thirteen years of continuous manufacture of all its standard lines, there has been no patent decision against this Company or its apparatus which has stopped the manufacture of a single line of product, or inconvenienced a single customer in any way.

The Montgomery Light & Power Company is using types "M" and "MH" transformers manufactured by this Company.

Wagner Electric Manufacturing Co.

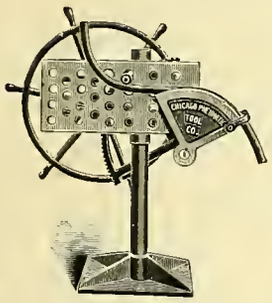
ST. LOUIS, U. S. A.

AITON MACHINE CO.

INSULATING, CABLING, RUBBER AND HYDRAULIC MACHINERY.

OFFICE:
126 LIBERTY ST., NEW YORK
WORKS: HARRISON, N. J.

The Chicago Pipe Bending Machine



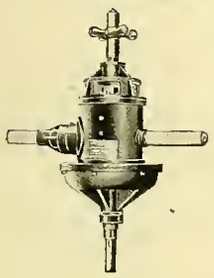
Is invaluable for all kinds of pipe and ornamental iron work, as well as for the bending of electrical conduits. Bends piping of steel, iron, brass, copper, or other material, cold, up to two inches diameter with one man.

One man can bend a piece of two-inch pipe to an **S** bend in three minutes, no other assistance or device being necessary or needed.

It is well adapted for the use of special dies that can be readily attached for bending light angles, flats or tee bars to any desired radius as easily as bending pipe.

Full particulars furnished on application.

The Duntley Air-Cooled Electric Drills

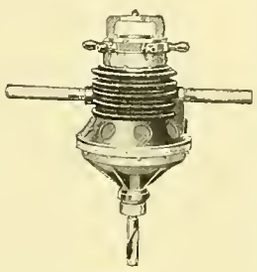


Drill D-IC

Are manufactured in sizes to correspond with our Air Drills. They are invaluable in any machine or repair shop where electric current can be obtained; also office buildings, hotels, steamship, etc., can use them advantageously. Wound for 110 and 220 volts direct current.

Over 3,000 Sold During the Month of May, 1905

Full particulars, etc., on request.



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Write for full particulars
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"NEW IDEA" SOLDERING PASTE SAMPLE FREE
NEW IDEA SOLDERING PASTE CO., 214 Hibbard Ave., Detroit, Mich.

ABOVE ALL OTHER CONSIDERATIONS

Electric Storage Batteries of the "Unit Accumulator" Type are

RELIABLE

FOR STREET RAILWAYS, CENTRAL LIGHTING AND POWER STATIONS, TELEPHONE CENTRAL ENERGY SYSTEMS, ETC.

Descriptive Catalogue and Prices Furnished Upon Application. Ask for Bulletin on "A MODERN TELEPHONE EXCHANGE."

National Battery Company
BUFFALO, N. Y.

Branch Offices: NEW YORK, CHICAGO

STANLEY INSTRUMENT CO., GREAT BARRINGTON, MASS.

ARE NOW MANUFACTURING AND SOLICIT ORDERS FOR

MODEL H-6 ROTATED JEWEL BEARING STANLEY WATTMETERS

For Alternating Current, Single Phase and Polyphase Service constructed to conform strictly to the suggestion contained in the following language quoted from the opinion filed September 9th, 1904, in the
UNITED STATES CIRCUIT COURT OF APPEALS FOR THE FIRST CIRCUIT:
"If the device stopped with "a metallic rotating body" and some method other than a counting machine operated by it was used for determining the number of its revolutions, we might not be able to charge the respondent with infringing. We might then well apply the proposition of the respondent that a mere meter is in a different art from a motor. ***** "Therefore, as it may well be that, if the counting mechanism was of a kind not operated by the "metallic rotating body," we should not be compelled to find infringement, we hesitate in view of the minute amount of energy exerted."
The Train Registration, or Counting Mechanism in Model H-6 Wattmeters is independently operated and positively driven by a spring; the disc or rotating body does not and cannot operate the counting mechanism; train friction removed from rotating body of meter.
Jewel Surface always new—Spring Supported Pivot overcomes vibration.

PERMANENT ACCURACY AT ALL LOADS
PRICES CONSIDERABLY LESS TO ALL PURCHASERS THAN HERETOFORE PREVAILING
SPECIAL VERY LOW PRICES FOR ENTIRE REQUIREMENTS OR QUANTITY
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Gould Storage Battery Co.

Complete Storage Battery Plants

Railway Line and Regulating
Isolated and Train Lighting
Central Lighting and Power
Electric Vehicle and Telephone

GOULD COUNTER E. M. F. BOOSTER SYSTEMS

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Gest. G. M.

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Hill Elec. Co., W. S.
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Tornquist Elec Mfg. Co.
Trumbull Elec. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Drills, Electric.
Chicago Pneumatic Tool Co.

Drying Machinery.
Alton Machine Co.

Dynamos and Motors.
Allis-Chalmers Company.
(Bullock El. Mfg. Co.)
Bissell Co., The F.
Central Electric Co.
Century Electric Co.
Crocker-Wheeler Co.
Ft. Wayne Elec. Wks. Inc.
General Elec. Co.
Gregory Electric Co.
Mechanical Appliance Co.
National Electric Co.
Northern Electrical Mfg. Co.
Parsell & Weed.
Robbins & Myers Co.
Stanley—G. I. Elec. Mfg. Co.
Star Dynamo Co.
Stow Manufacturing Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Economizers, Fuel.
Green Fuel Economizer Co.

Electric Heating Appl.
Electric Appliance Co.
Simplex Elec. Heating Co.
Western Electric Co.

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Crocker-Wheeler Co.
General Electric Co.
Westinghouse El. & Mfg. Co.

Electrical and Mechanical Engineers.
Arnold Co., The.
Badt, F. B.
Baker & Co., W. E.
Bryan, Wm. H.
Byllesby & Co., H. M.
Cornell, T. S.
Evans, Almirall & Co.
General Elec. Securities Co.
Humphrey, Henry H.
Hunt & Co., Robt. W
Jackson, D. C. & W. B.
Kemp, R. W.
Kohler Brothers.
Northern Electrical Mfg. Co.
Ruebel, Schwedtman, Wells.
Sargent & Lundy.
Schott, W. H.
Stanley G. I. Elec. Mfg. Co.
Stanton, LeRoy W.
Underhill, Chas. R.
Willis. G. M.

Electrical Instruments.
(Recording and Testing.)
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Diamond Meter Co.
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Electric Appliance Co.
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General Electric Co.
Machado & Roller.
Pignolet, L. M.
Reliance Instrument Co.
Robert Inst. Co., The
Stanley—G. I. Elec. Mfg. Co.
Stanley Instrument Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
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Crocker-Wheeler Company.
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Allis-Chalmers Company.

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Allis-Chalmers Company.
Marinette Gas Engine Co.

Engines, Oil,
American Diesel Engine Co.

Engines, Steam.
Allis-Chalmers Company.
Brownell Co., The

Fans and Fan Motors.
Central Electric Co.
Century Electric Co.
Crocker-Wheeler Company.
Edison Mfg. Co.
General Electric Co.
Robbins & Myers Co., The
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Fans, Exhaust and Ventilating.
Green Fuel Economizer Co.

Fibre.
Kartavert Mfg. Co.
Vulcanized Fibre Co.

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Plume & Atwood Mfg. Co.

Fixtures, Gas and Elec.
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Doxsee-Barrere Electrical Co.
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Stow Mfg. Co.

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Chicago Fuse Wire & Mfg.Co.
D. & W. Fuse Company.
Electric Appliance Co.
Johns-Manville Co., H. W.
Manhattan Elec. Supply Co.
Peru Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Company.

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Addison Glass Co.

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Fostoria Incan. Lamp Co.
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Phœnix Glass Co.
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Replogle Governor Works.

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Holmes Fibre-Graphite Co.

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Amer. District Steam Co.

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Electric Appliance Co.
Incandescent Electric Light Manipulator Co.

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Allis-Chalmers Company.

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Robertson & Sons, Jas. L.

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Hartford Steam Boiler Inspection & Insurance Co.

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Alton Machine Co.

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American Electrical Works.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
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Kartavert Mfg. Co.
Manhattan Elec. Supply Co.
Mica Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
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Gregory Electric Co.
Manhattan Elec. Supply Co.
Stanley—G. I. Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

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Bryan-Marsh Company.
Buckeye Electric Company.
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Edison Decorative & Miniature Lamp Dept.
Electric Appliance Co.
Fostoria Incand. Lamp Co.
General Electric Co.
Standard Elec'l Mfg. Co.
Sunbeam Incan. Lamp Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamps, Incandescent—Replacers & Cleaners.
Inc. El. Lt. Manipulator Co.

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Baller Machine Co.

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Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Manhattan Elec. Supply Co.
Stanley—G. I. Elec. Mfg. Co.
Tornquist Elect'l. Mfg. Co.
Wesco Supply Co.
Western Electric Co.

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Klein & Sons, Mathias.

Magnet Wires.
(See Wires and Cables.)

Mechanical Draft.
Green Fuel Economizer Co.

Mica.
Chicago Mica Co.
Mica Insulator Co.
Munsell & Co., Eugene.

Mining Apparatus, Elec.
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(Bullock El. Mfg. Co.)
Crocker-Wheeler Company.
General Electric Co.
Jeffrey Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Mining Machinery,
Allis-Chalmers Company.

Motors, (See Dynamos and Motors.)

Nippers and Pliers.
Klein & Sons, Mathias.

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Carhartt & Co., Hamilton.

Patent Attorneys.
Bain, Foree.
Stevens & Co., Milo B.

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Minneapolis Cedar & Lbr. Co.
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Pacific Coast Pole Co.
Perrizo & Sons.
Phelan, D. W.
Pillsbury-Watkins Co.
Pittsburg & L. S. Iron Co.
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S. E. Missouri Cypress Co.
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Torrey Cedar Co.
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White Marble Lime Co.
Worcester Co., C. H.

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Allis-Chalmers Company.
Jeffrey Mfg. Co.

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Tornquist Elec. Mfg. Co.

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Continuous Rail Joint Company of America.

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Gregory Electric Co.
Southwestern Elec Co.

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Cutler-Hammer Mfg. Co.
General Electric Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

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Alton Machine Co.

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Highland Park College
Michigan College of Mines.
Pratt Institute.
Rose Polytechnic Inst.

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Bissell Co., The F.
Chicago House Wrecking Co.
Gregory Electric Co.
Southwestern Elec. Co.
Matthews & Bro., W. N.

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Haller Machine Co.
Western Display Co.

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Sauquoit Silk Mfg. Co.

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Pass & Seymour.
Sauter Co., G. F.
Yost Elec. Mfg. Co.

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Chicago Solder Co.
Crollius & Son, E. R.
New Idea Soldering Paste Co.
Western Electric Co.

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Amer. Elec. & Controller Co.

Speaking Tubes.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Co.

Specialties, Electrical Mfrs. and Designers.
Haller Machine Co.

Speed Indicators.
Weston Electrical Inst. Co.

Storage Batteries.
American Battery Co.
Chicago Pneumatic Tool Co.
Electric Storage Battery Co.
General Storage Battery Co.
Gould Storage Battery Co.
National Battery Co.
Toledo Stor. Bat. & Elec. Co.
Universal Elec. Stor. Bat. Co.

Supplies, General Elec.
Amer. Elect'l Supply Co.
Bennett, I. A.
Bissell Co., The F.
Central Electric Co.
Century Electric Co.
Chicago Edison Co.
Electric Appliance Co.
General Electric Co.
Manhattan Elect'l Supply Co
Wesco Supply Co.
Western Electric Co.

Switches.
See Cut-outs and Switches.)

Telephones, Telephone Material and Switchboards.
American El. Telephone Co
Arnold Electric Mfg. Co.
Automatic Electric Co.
Bissell Co., The F.
Central Electric Co.
Electric Appliance Co.
International Tel. Mfg. Co.
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Manhattan Elec. Supply Co.
Stromberg-Carlson Tel. M.Co.
Wesco Supply Co.
Western Electric Co.

Time Switches.
Bissell Co., The F.
Campbell Bros.

Toggle Bolts.
(See Bolts, Toggle.)

Tools.
Klein & Sons, Mathias.
Western Electric Co.

Tools, Pneumatic.
Chicago Pneumatic Tool Co.

Transformers.
Allis-Chalmers Company.
(Bullock El. Mfg. Co.)
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Crocker-Wheeler Co.
Electric Appliance Co.
Ft. Wayne Elec. Works, Inc.
General Electric Co.
Gregory Electric Co.
Kuhlman Electric Co.
La Fayette Elect'l. Mfg. Co.
Manhattan Elec. Supply Co.
National Electric Co.
Stanley—G. I. Elec. Mfg. Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Trucks, Electric Car.
General Electric Co.
Westinghouse El. & Mfg. Co.

Turbines, Steam.
Allis-Chalmers Co.
General Electric Co.
Westinghouse El. & Mfg. Co

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Leffel & Co., Jas.

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Vulcanized Fibre Co.

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Alton Machine Co.

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Belden Mfg. Co.
Bissell Co., The F.
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Crescent Ins. Wire & Chle. Co
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General Electric Co.
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Indiana Rub. & Ins. Wire Co
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Kellogg Switch. & Sup. Co.
Manhattan Elec. Supply Co.
National India Rubber Co
New York Insulated Wire Co.
Northern Wire & Cable Co.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co
Roebling's Sons Co., J. A.
Safety Ins. Wire & Cable Co.
Simplex Electrical Co.
Spargo Wire Co., Jas. A.
Standard Underground C. Co
Wesco Supply Co.
Western Electric Company.

Woodwork, Telephonic.
Telephone Woodworking Co.

For Alphabetical Index of Advertisements See Page 3.

TO THE TRADE

The United States Circuit Court of Appeals at Boston, after a long litigation involving two decisions in our favor, decided that the Tesla patents 511,559 and 511,560 were valid and that the Stanley meter was an infringement of the same, and on June 20th an injunction under these patents was served on the Stanley Instrument Company, enjoining it from the manufacture, use and sale of its meter. Thereupon the Stanley Instrument Co. sent out a circular letter to the Trade announcing that it was prepared to fill all orders with another form of meter which it claimed was not, under the decision of the Court of Appeals, an infringement of the said patents.

We have examined a sample of this meter and taken the advice of our counsel thereupon, and have been advised that in their opinion it is a clear infringement of the said patents, not departing in any material feature, so far as the patents are concerned, from the enjoined meter.

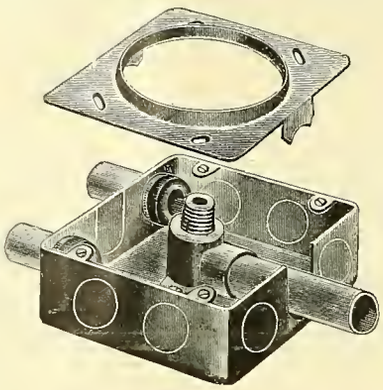
We have no doubt that strenuous efforts will be made to induce central station companies and other users to purchase this latest form of the Stanley meter, and our object in issuing this announcement is to advise you fully of our attitude in the matter and to state that it is our intention, in case we find this meter in use, to bring suit for infringement of our above named patents and enforce our legal remedies against any further breach of our rights thereunder.

Our counsel further advise us that in their opinion the claim of non-infringement is merely a verbal one and has no proper foundation in the opinion of the Circuit Court of Appeals, but that, on the other hand, it is contrary to the whole attitude of the Court in regard to the construction of the patents, and is without foundation in fact; and that a comparison of the meter with the enjoined form shows that the elements so far as the patents in suit are concerned are the same as before, and that practically the only change made is the introduction in connection with the counting train of a revolving bearing and a clock spring which requires periodic winding.

Westinghouse Electric & Mfg. Co.

Bossert Boxes Are Made From Drawn Steel

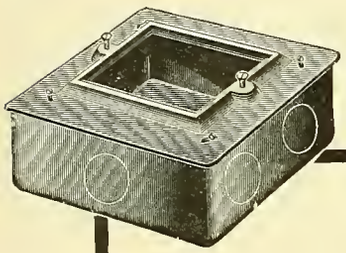
Bossert Outlet Boxes are drawn from one piece of sheet steel under heavy pressure. This makes them practically indestructible. Neither careless men nor the settling of buildings will break them. They are covered, inside and out, with a heavy coating of insulating enamel. Simple in construction yet have wide range of application.

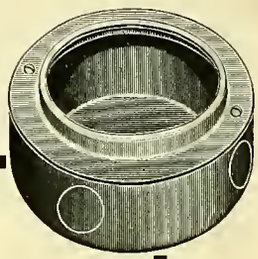


Bossert Boxes Won't Break They Save Money

They have holes closed with hermetically sealed plugs that may be removed with one sharp blow of a hammer. No filing or reaming necessary. The saving in workmen's time represented by this fact together with the saving from no breakage should recommend them to all electrical contractors. They are money ahead by using them.

Standard for Specifications





We Also Make a Superior Grade of

Drawn Steel Bushings **Panel Board Boxes**

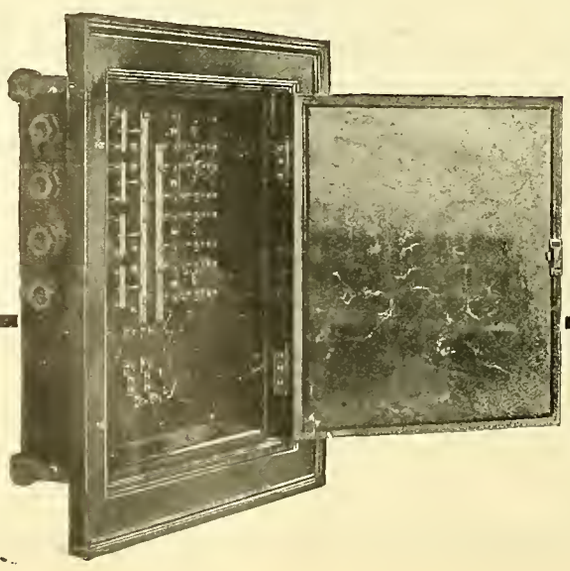
Switch Boards **Panel Boards**

Knife Switches

Bushings are of drawn steel covered with insulating enamel, providing the smoothest surface obtainable. Absolute protection to insulation on wires. Switches have blades made from pure drawn copper. "Bossert or equally approved" is rapidly becoming a stereotyped phrase in all specifications for high grade electrical work. Send for bulletins.

BOSSERT ELECTRIC CONSTRUCTION CO.

Office and Works



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General Electric Company

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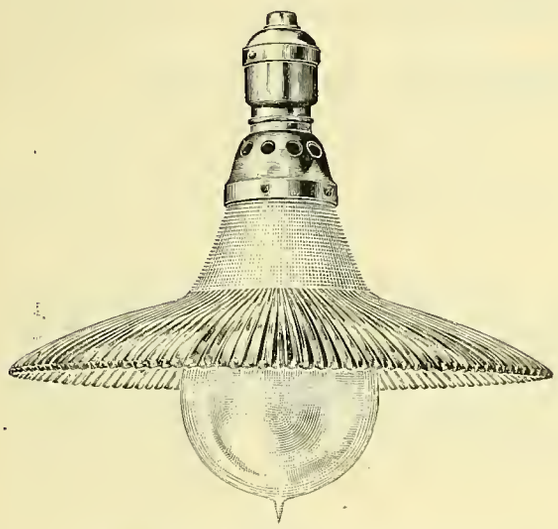
EFFICIENCY 20 PER CENT BETTER THAN ANY OTHER INCANDESCENT LAMP

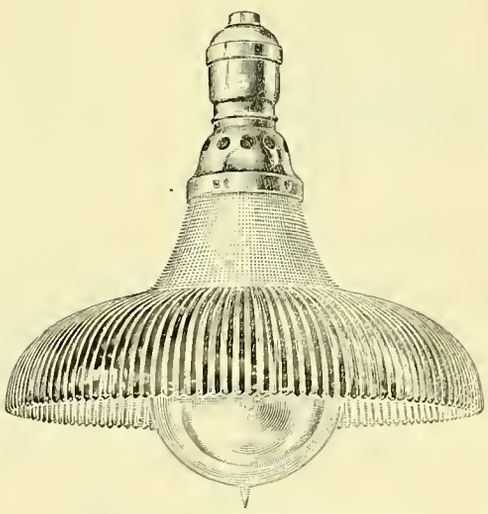
Cover the Field Between the Arc and the Ordinary Incandescent Lamp



New GE Incandescent Unit with
DISTRIBUTING OR "D" FORM OF SHADE

Table of Sizes and Values

Type No. of Lamp	Total Watts	Distributed Candle-Power in Downward Direction
3	125	70
4	187½	105
5	250	140



New GE Incandescent Unit with
CONCENTRATING OR "C" FORM OF SHADE

Table of Sizes and Values

Type No. of Lamp	Total Watts	Concentrated Candle-Power in Downward Direction
3	125	120
4	187½	180
5	250	240

Fitted With Specially Designed Holophane Pagoda Reflectors. Unequalled High Candle-Power Units for General Illumination

GENERAL ELECTRIC COMPANY

Main Lamp Sales Offices HARRISON, N. J.

(641)

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Hoffman Cable Clips
Pierce Specialties
Cook Protective Devices
Eaco Telephones
Cords (the best)
1900 Dry Batteries
Washington Fir Cross-Arms

ELECTRIC APPLIANCE COMPANY
Telephone Manufacturers
CHICAGO AND SAN FRANCISCO

Bijur "High-Duty" Storage Batteries
EASY TO TAKE CARE OF
ALWAYS IN GOOD ORDER
General Storage Battery Co.
42 BROADWAY NEW YORK

MICABOND will save you money in your repair work as well as in your new machines. It is good insulation—made out of the best materials and is sold at reasonable prices.
CHICAGO MICA CO. VALPARAISO, IND.

YOU NEED IT!

Gale's Commutator Compound.
The Only Article That Will Prevent Sparking.
Will keep the Commutator in good condition and prevent cutting. Absolutely will not gum the brushes.
50c. per stick. $5.00 per dozen. Send 50c. for trial stick.
FOR SALE BY ALL SUPPLY HOUSES OR
K. McLENNAN & CO., Sole Manufacturers, Room 411, Inter Ocean Bldg., 130 Dearborn St., CHICAGO.

VOLT - AMMETERS
POCKET SIZE
For testing Batteries and Battery Circuits, Locating Faults, Grounds, etc.
RELIABLE. - ACCURATE.
Send for Circular.
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STORAGE BATTERIES!
(THE "X-CELL")
Complete Battery Plants for Any Purpose
Telephone Power Plants a Specialty
TOLEDO STORAGE BATTERY & ELECTRIC CO., 111 Ottawa St., Toledo, O.

CENTURY ELECTRIC CO.
MANUFACTURERS OF
SINGLE-PHASE SELF-STARTING
MOTORS AND CEILING FANS
ST. LOUIS, MO.

BROCKSMITH DYNAMO CASTINGS

Castings, Punchings, Materials and Blue Prints for constructing the Brocksmith Dynamo, Motor, Dynamotor, Motor-Generator, Single-Phase Rectifier, A. C. Generator, etc.

Send for Catalogue No. 26

PARSELL & WEED
129-131 West 31st Street
NEW YORK CITY

RELIABILITY
is the feature of
THE EDISON LAMP

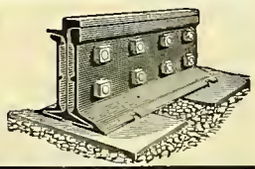
Reliably rated
Reliably made
Reliably supplied
Reliable in brilliancy
Reliable in life.

YOU CAN DEPEND UPON THE EDISON

All Types and Varieties.
Regular Multiple Lamps.
Street Series Lamps.
Miniature Lamps.

GENERAL ELECTRIC COMPANY,
Main Lamp Sales Office,
HARRISON, N. J.

(499)



ADAMS SECONDARY GENERATOR

WESCO

This instrument will do away with your battery expense in operating door bells, elevator bells, electric gas lighters and all annunciator work, as it connects to the secondaries of an alternating current and consumes so little current as not to move a meter, therefore it costs nothing to operate it. Write for descriptive bulletin and prices.

THE WESCO SUPPLY CO. :: St. Louis
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CONTINUOUS RAIL JOINT CO. OF AM.
NEWARK, N. J.
OVER 20,000 MILES IN USE
Highest Award at Paris Exposition, 1900, Buffalo, 1901, and St. Louis, 1904.

WORKS QUICK AND EASY. KEEPS ITS LUSTER. HOLDS OLD TRADE AND MAKES NEW. DOES NOT DETERIORATE. ESTABLISHED 18 YEARS. SOLD BY AGENTS AND DEALERS ALL OVER THE WORLD
3 OUNCE BOX 10 CENTS
SAMPLES SENT FREE
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POLISHES ALL METALS. BRANCHES: NEW YORK, CHICAGO, SAN FRANCISCO. 295 E. WASHINGTON ST. INDIANAPOLIS, IND.
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Of all Qualities, in any Form at Lowest Prices
EUGENE MUNSELL AND CO.
NEW YORK and CHICAGO

INSULATION That Is.
Micanite, Linotape, M. I. C. Compound, Empire Cloth and Paper. For Years the Standard.
MICA INSULATOR CO., Originators
NEW YORK and CHICAGO

USED IN OVER 90% OF THE CENTRAL STATIONS
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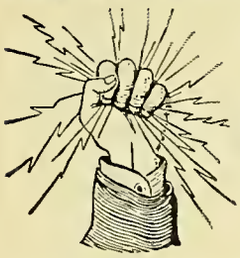
IN THE UNITED STATES

FRANK N. PHILLIPS, Pres. EUGENE R. PHILLIPS, V. P. C. H. WAGENSEIL, Treas. C. R. REMINGTON, Jr., Sec.

AMERICAN ELECTRICAL WORKS,

PROVIDENCE, R. I.



BARE AND INSULATED ELECTRIC WIRE,

ELECTRIC LIGHT LINE WIRE,
INCANDESCENT AND FLEXIBLE CORDS,
Railway Feeder and Trolley Wire,
AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.
CABLES FOR AERIAL AND UNDERGROUND USE.

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MONTREAL BRANCH, Eugene F. Phillips' Electrical Works.
MAIN OFFICES AND FACTORIES, PHILLIPSDALE, R. I.

EXPERT IN ELECTRICITY MECHANICS PATENT CAUSES
SOLICITOR OF **PATENTS**
U. S. & FOREIGN
FORÉE BAIN, 1652-3 Monadnock Blk., CHICAGO

"AMERICAN" STORAGE CELLS
ARE THE BEST. Send for descriptive Circular.
AMERICAN BATTERY CO.,
EST'D 1889. 171 S. Clinton St., Chicago.

OUR PROPOSITION

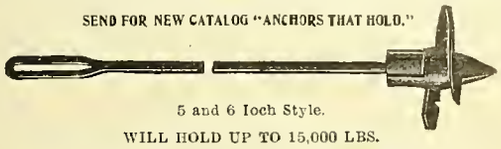
WE WILL SHIP ON 30 DAYS TRIAL
ANY NUMBER OF

STOMBAUGH GUY ANCHORS

OVER TWELVE

IF SATISFACTORY PAY FOR THEM, OTHERWISE, RETURN CHARGES COLLECT
WE PREPAY FREIGHT ON INITIAL ORDERS

SEND FOR NEW CATALOG "ANCHORS THAT HOLD."



5 and 6 Inch Style.
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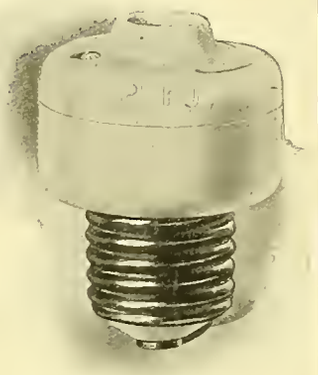

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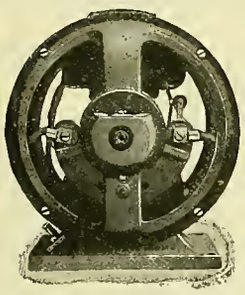

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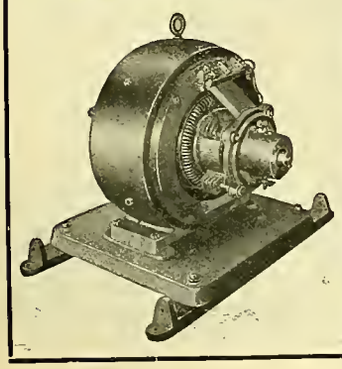

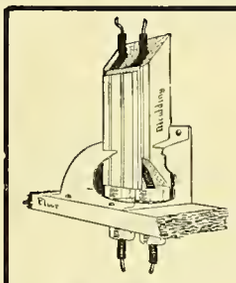

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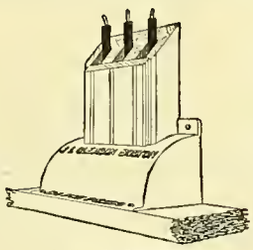

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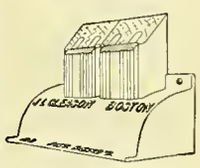

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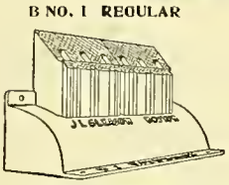

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PREDOMINATES IN 27 States

"IT gives me great pleasure to state, that for 'Gitthereitiveness' your periodical certainly is a winner. As you perhaps are aware, the company I travel for, advertises in all the electrical papers, and it has been a question in my mind whether they reached every central station, as their advertising manager would have our company believe. So, for one year I have kept account of the electrical papers and periodicals subscribed for and received by the manager or superintendent of electric light companies in twenty-seven states, (which has been my territory), and in summing it up, I find that your periodical predominates, three to one. I do not get in many telephone plants, but when I do, I invariably find the 'Western Electrician' staring me in the face."

The letter from which the above is taken, is dated May 8, 1905, and is on file in this office.

WANTED, FOR SALE *and similar* **WANT COLUMN** *advertisements (50 words or less), $1.50 an insertion; additional words 3c each.* **POSITION WANTED** *advertisements (50 words or less), $1.00 an insertion; additional words 2c each.*

POSITION WANTED

Technical graduate, aged 28. Has had installing, operating and selling experience in electrical work. Now with large company as sales engineer. Desires central station or sales managership position. Best references past and present employers. Address BOX 493, care Western Electrician, 510 Marquette Bldg., Chicago.

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In light or power plant as an engineer. Experience, greater part of past twelve years with D. C. and A. C. generators; high and slow speed engines. Thirty-six years of age and strictly temperate. Place preferred where conscientiousness and faithfulness are appreciated. References from former employers. Address BOX 496, care of Western Electrician, 510 Marquette Bldg., Chicago, Ill.

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By a graduate electrical engineer; 4 years' experience in building, operating and testing direct and alternating current machinery; good commercial experience; perfectly familiar with lighting and street railway problems; desire position in central station as chief electrician, engineer or assistant to manager. Address R. N. S., Box 86, Mt. Healthy, Ohio.

WANTED

An experienced Arc Lamp Designer. Give references, state experience and salary desired. Address BOX 494 care of Western Electrician 510 Marquette Building, Chicago.

WANTED

An experienced engineer who can handle high speed engine, and understands electrical work; must be competent, have good record; for a small plant, 1,000 lights direct current. Take full charge of operating the plant successfully. Give reference and salary expected. In a town of 1,900 inhabitants. Address BOX 497, care of Western Electrician, 510 Marquette Bldg., Chicago, Ill.

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Lighting plant. A competent electrician and mechanical engineer of wide experience wishes to lease or will operate plant on shares and will make necessary improvements to insure economical and efficient operation. State in full location, with full particulars. BOX 495, care Western Electrician, 510 Marquette Building, Chicago.

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By a young man 29 years of age with good habits a position as engineer or assistant. Have 7 years' experience with boilers, engines, A. C. and D. C. generators and water-wheels. Have also graduated from I. C. S. in both steam and electricity. Address BOX 499, care of Western Electrician, 510 Marquette Bldg. Chicago.

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Electric supply and contracting business; growing city of 25,000 people. Only a few thousand dollars required to purchase this excellent business. Address box 414, Greensboro, N. C.

FOR SALE

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30,000 ft. No 10	25,000 ft. No. 1-0
46,000 ft. No. 8	14,000 ft. No. 2-0
15,000 ft. No. 6	16,000 ft. No. 3-0
100,000 ft. No. 4	48,000 ft. No. 4-0
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75,000 ft. 300, 350, 400, 500 and 600,000 C. M.

Slow Burning Weatherproof Wire

50,000 lbs. No. 16	40,000 lbs. No. 4
50,000 lbs. No. 14	50,000 lbs. No. 3-0
60,000 lbs. No. 12	100,000 lbs. 300,000 C. M.
50,000 lbs. No. 10	175,000 lbs. 400,000 C. M.
35,000 lbs. No. 8	140,000 lbs. 500,000 C. M.
30,000 lbs. No. 6	40,000 lbs. 600,000 C. M.

Weatherproof Wire, Triple Braid, Solid Conductor

60,000 lbs. No. 14	45,000 lbs. No. 4
50,000 lbs. No. 12	30,000 lbs. No. 3
60,000 lbs. No. 10	25,000 lbs. No. 2
25,000 lbs. No. 8	30,000 lbs. No. 1
110,000 lbs. No. 6	

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1,000,000 split glazed B. & D. Wiring Knobs.
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15,000 Porcelain Cut-outs.
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2,000,000 unglazed Porcelain Tubes.
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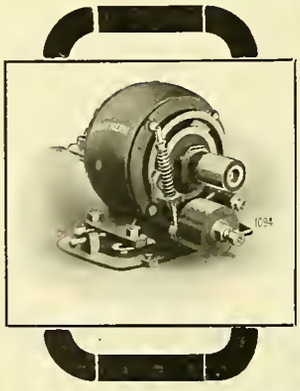

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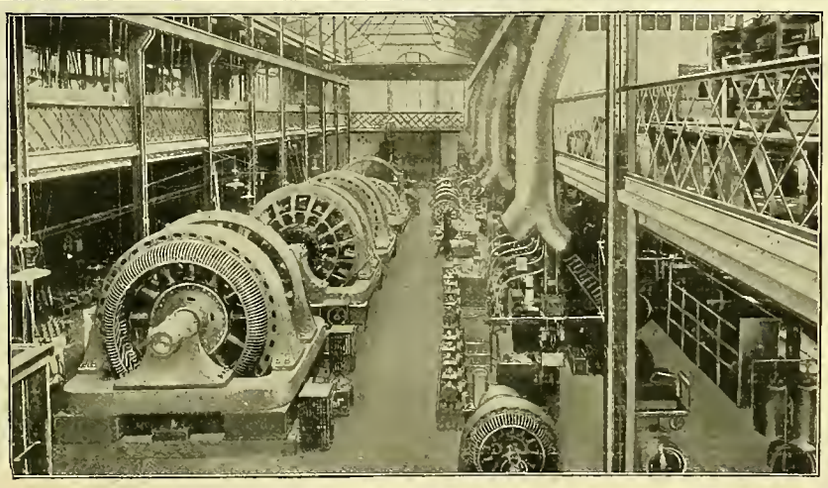

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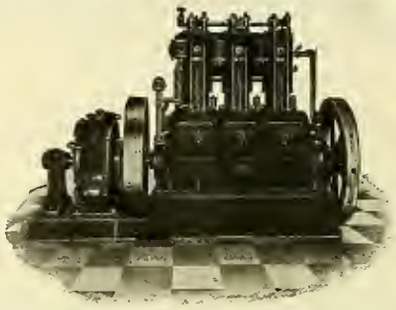

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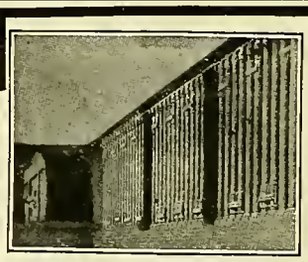

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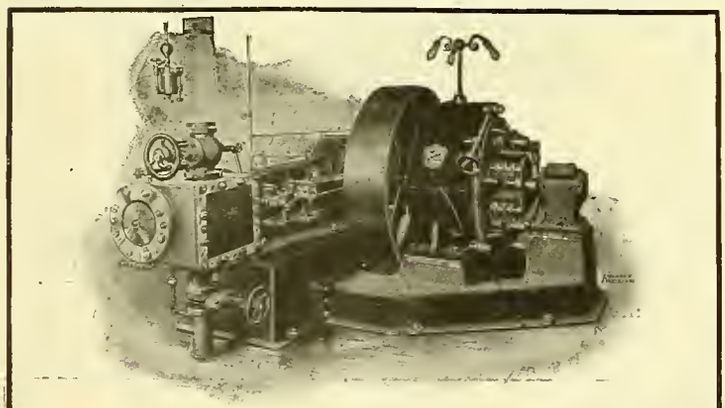

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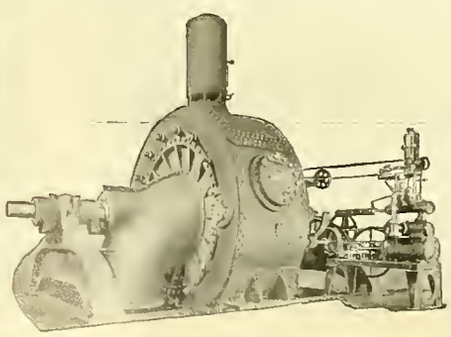

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209.7 ft.	¾	400 r.p.m.	1560	96.50%	83.59%
208.9 ft.	Full	400 r.p.m.	1677	96.70%	80 57%

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NO SCREWS IN SHELL.
SMALL QUANTITY 15½c. Order now.
G. F. SAUTER CO., ELECTRICAL CONTRACTORS
Segel Bldg., Cor. State and Lafayette Sts.,
SCHENECTADY, N. Y.

Just What the World Has Been Waiting For.
NEW "MORRISON"
STORAGE BATTERY

THE CELL

This plate is so strong electrically and mechanically that no amount of electrical abuse or of vibration in traction service can dislodge even the slightest particle of its active material.
Lowest internal resistance of any storage battery in the world.
The weight efficiency is conservatively 14 watts per pound total weight, and electrical efficiency unsurpassed . . . .

UNIVERSAL ELECTRIC STORAGE BATTERY CO.
INCORPORATED
OFFICE: 1355 RAILWAY EXCHANGE BUILDING FACTORY: 36-38 UNION PARK PLACE
CHICAGO, ILLINOIS

THE PLATE

The more money you spend in advertising the more money you have.
The less money you spend in advertising the less money you have.

"FRES-KO"
SOLDERING PASTE
IT "CREEPS" INTO EVERY CREVICE
An absolutely non-corrosive soldering paste — means absolute security—once a joint is soldered.
FRES-KO means PERFECT SECURITY.
FRES-KO CHEMICAL CO. - Fort Wayne, Ind.

The Feature of the Telephone Convention

Among the cities in which our Automatic Telephone System has been adopted are:

Chicago, Ill.	Dayton, Ohio
Grand Rapids, Mich.	St. Marys, Ohio
Colnmbus, Ohio	Woodstock, N. B.
Lincoln, Neb.	Westerly, R. I.
Portland, Maine	Manchester, Iowa
Auburn, N. Y.	Princeton, N. J.
Lewiston, Maine	Albuquerque, N. M.
Fall River, Mass.	Van Wert, Ohio
New Bedford, Mass.	Battle Creek, Mich.
Los Angeles, Cal.	Clayton, Mo.
San Diego, Cal.	Pentwater, Mich.
Hopkinsville, Ky.	Toronto Junction, Can.
Sioux City, Iowa	Wilmington, Del.
Cleburne, Texas	Riverside, Cal.
Columbus, Ga.	Traverse City, Mich.
South Bend, Ind.	Hastings, Neb.
Aberdeen, S. D.	Wausau, Wis.
Miamisburg, Ohio	El Paso, Texas
Auburn, Maine	*Havana, Cuba
Medford, Wis.	*Marianao, Cuba

and Berlin, Germany.

* Sold June 22d, 15,000 line plant for Havana, 600 line plant for Marianao.

was our new Automatic 4-party-line system, with selective ringing and lockout.

Our exhibit of this new development of automatic telephony was the center of a group of interested telephone men during the entire term of the convention.

It not only received their hearty endorsement, but it more than ever convinced them that we are always awake to the needs of the telephone industry and alert to supply them.

This new Automatic 4-party-line-system, with selective ringing and lockout, is ready for the market, in fact we are now filling orders for it. If you are interested, we shall be glad to send you particulars upon request.

Automatic Electric Company

VAN BUREN AND MORGAN STREETS

CHICAGO, U. S. A.

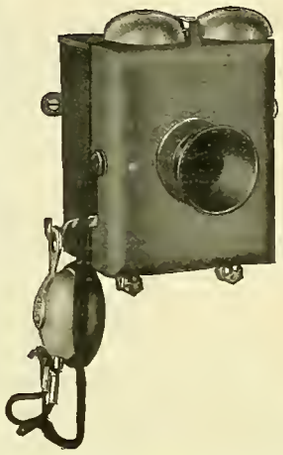
Where Health and Pleasure Wait

IN this latest number of The Four-Track Series the pictures tell the story. There are only a few lines of descriptive matter, and twenty-nine of the most exquisite and interesting half-tones of charming scenes "where health and pleasure wait."

This is one of the most beautiful pieces of advertising ever sent out by a railroad company.

For a copy of "WHERE HEALTH AND PLEASURE WAIT," which is No. 2 of the New York Central's Four-Track Series, send a 2-cent stamp to George H. Daniels, General Passenger Agent, New York Central & Hudson River Railroad, Room No. 326, Grand Central Station, New York.

The ARNOLD TELEPHONE



Is a handsome steel enclosed telephone. In the home from room of mistress to kitchen, library or laundry. Saves hundreds of steps, saves time, is a distinct convenience, not a luxury, but a necessity. Telephone is fitted up complete, ready for installation. Needs no adjustment. Steel clad. Cannot get out of order. Lasts forever. Made as illustrated, designed for separate batteries; also made complete with batteries mounted directly upon telephone back, enclosed in neat box.

Shipped ready for installation.
Full directions with each telephone.

Price, without batteries **$2.50**
Price, with batteries. **3.25**

Arnold Electric Manufacturing Co.
MANUFACTURERS
95 Jackson Boulevard, CHICAGO

Locations for Industries

Erie Railroad

Chicago to New York

The Erie Railroad Company's Industrial Department has all the territory traversed by the railroad districted in relation to resources, adaptability, markets and advantages for manufacturing, and can advise with manufacturers in relation to the most suitable locations. For full information address

LUIS JACKSON
Industrial Commissioner, Erie Railroad Company
21 Cortlandt Street, New York

WE ARE EXPERTS IN

Underground Conduit Construction

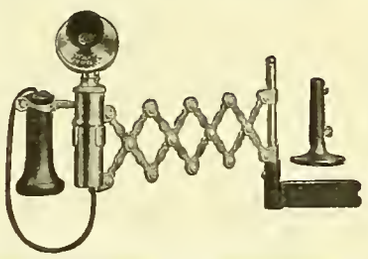
WRITE FOR INFORMATION

C. M. CEST, 277 Broadway, New York
CINCINNATI BOSTON

Continuous and judicious advertising is the magic wand which converts a little business into a big business.

PRESERVE YOUR COPIES
OF THE
WESTERN ELECTRICIAN
BINDERS $1.00 EACH.
ELECTRICIAN PUBLISHING CO.,
Suite 510 Marquette Building, - - - CHICAGO.

Use this on your desk. No more broken desk Telephones. Made any length. :: :: ::



Burn's Adjustable Desk Telephone

AMERICAN ELECTRIC TELEPHONE CO.

We have just moved into our new factory which we erected at 64th and State Streets, Englewood Station, Chicago, Ill.

We manufacture Telephones and Telephone Switchboards of all styles. We have installed many of the largest exchanges. 26 Bulletins describe our apparatus. They are sent postpaid upon request.

Bituminized Fibre Conduit

For Underground Construction

COMBINES the **GOOD FEATURES** of other conduits.
ELIMINATES the **BAD FEATURES** existing in many kinds.
HAS VALUABLE FEATURES not found in any other duct.

The American Conduit Company has a corps of experts in underground construction and is prepared to furnish supervision of work if desired. We would prefer to co-operate with contractors in underground construction, but if desired will submit estimates and bids and take contracts for completed underground systems in any part of the United States or Canada.

AMERICAN CONDUIT COMPANY

Main Offices
1005-6 MANHATTAN BUILDING
CHICAGO.

Other Offices
170 Broadway, New York
336 Macy Street, Los Angeles

McRoy Conduits.

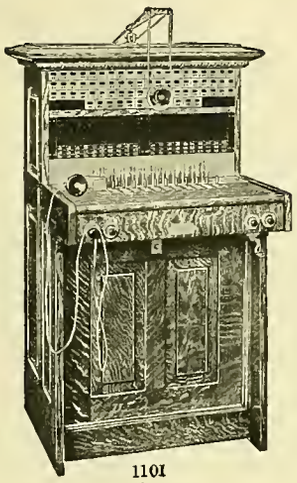
"ROOKERY"—Chicago—

STROMBERG-CARLSON

Generator Call Visual Signal Switchboard.

Has the advantage of being as rapid and costs less to maintain than a lamp signal board. Effective service at small cost.

Signals self restoring on insertion of plug in jack



1101

Key shelf is so low, operator can use an ordinary chair

This type of cabinet has all the advantages and none of the disadvantages of many boards twice its size. Bulletin sent free for the asking. Write to-day.

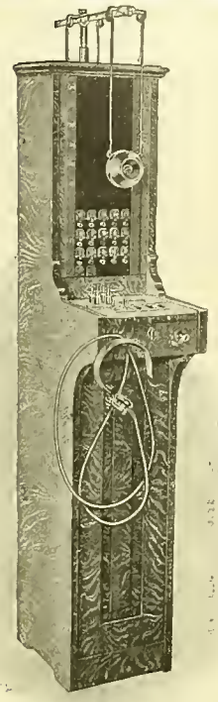
STROMBERG-CARLSON TEL. MFG. CO.

GENERAL OFFICE, ROCHESTER, N. Y. BRANCH OFFICE, CHICAGO, ILL.

Kellogg Express Switchboard Cabinet

The graceful Appearance comes from Simple Lines.

This Attractive Design has been so popular that it has been much copied by other manufacturers



Fifty-Line Capacity Quarter Sawed Oak for the entire Exterior of the Cabinet

Thoroughly seasoned wood

Finished in Light or Golden Oak

Gold Medal Highest Award Buffalo Exposition 1902

Grand Prize Highest Award St. Louis Exposition 1904

The Strongest, Longest Lived, Most Efficient Switchboards made. All telephone experts will tell you that.

Kellogg Switchboard & Supply Co.
Congress & Green Streets
CHICAGO
LOS ANGELES CLEVELAND PHILADELPHIA

OUR SPECIALTY

TELEPHONIC WOODWORK

THE TELEPHONE WOODWORKING COMPANY
TIFFIN, OHIO

Easy Money

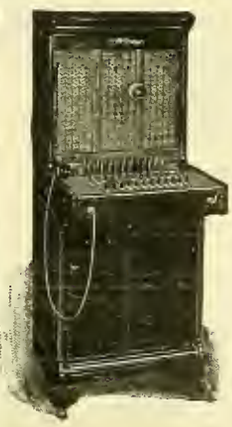
CAN BE MADE BY SECURING SUBSCRIPTIONS TO THE WESTERN ELECTRICIAN WE WILL TELL YOU HOW

WESTERN ELECTRICIAN

510 Marquette Building Chicago

Watson Motors

If you want a small motor for a special purpose Write us Mechanical Appliance Co. Milwaukee Wis.



INTERNATIONAL

Mechanical Self-Restoring Drop Switchboard.

A PERFECT APPARATUS.

Made in any desired capacity.
Sample parts and quotations on request.

INTERNATIONAL TELEPHONE MANUFACTURING CO.
CHICAGO, U. S. A.

Producers and Wholesalers of White Cedar Products

CEDAR POLES

SPECIAL PRICES ON SMALL POLES.

C. H. WORCESTER CO.

SUITE 1206 TRIBUNE BLDG. CHICAGO.

Write for a copy of our TELEGRAPH CODE FOR CEDAR PRODUCTS

Yards
Koss Mich.
L'Anse ..
Munising ..
Ontonagon ..
Wagner Wis.
Peshtigo ..

PILLSBURY-WATKINS COMPANY

LUMBER EXCHANGE. MINNEAPOLIS, MINN.

CEDAR POLES, POSTS, TIES AND SHINGLES.

SOUTHERN OAK TIES.

CEDAR POLES

Minneapolis Cedar & Lumber Co.

Yards in Minnesota and Wisconsin. PRODUCERS MINNEAPOLIS, MINN.

CEDAR POLES

LARGE STOCKS PROMPT SHIPMENTS

THE VALENTINE-CLARK CO.

INCORPORATED - 1892.

234 LA SALLE ST. CHICAGO.

Southern Cedar NO ROTTEN BUTTS. **POLES** Are the Best.

D. W. PHELAN, 277 Broadway, New York

IDAHO "RED" MICHIGAN "WHITE"

CEDAR POLES

We ship more Idaho Poles than all other dealers combined

WESTERN LUMBER and POLE CO., Denver, Colo.

SILVER ANNIVERSARY IN POLE BUSINESS

Just Bought Out — MALTBY CEDAR COMPANY.

Together with our own large stock we are prepared to fill any size Pole Order, at once. Sorting and shipping yards all through Michigan. Michigan White Cedar Poles outlast any wood. We make a specialty of Michigan Cedar. We also produce Ties and Posts in large quantities.

Principal Office: Monroe Mich. W. C. Sterling & Son Co. Principal Yards Bay City and Omer

POLES, TIES, POSTS.

THE PORTER CEDAR CO., SAGINAW, MICH.

PRODUCERS. We want your inquiries always.

POLES.

WHITE CEDAR.

IDAHO CEDAR up to 80 ft.

BERTHOLD & JENNINGS, ST. LOUIS. Chemical Building.

TIES.

OAK, CYPRESS and YELLOW PINE.

"STAR" INCANDESCENT LAMPS

LONG LIFE GUARANTEED CANDLEPOWER, HIGHEST EFFICIENCY.

MADE BY THE MOST SKILLED WORKMEN.

STANDARD ELECTRICAL MFG. COMPANY, : Niles, Ohio.

THE DENVER AND RIO GRANDE R. R.

has more scenic attractions, mountain resorts, mineral springs, hunting and fishing grounds than any other railroad in the world.

It reaches all points of interest in Colorado and Utah.

It is the only line passing through Salt Lake City en route to and from California and North Pacific Coast.

It is the most attractive line to the Portland Exposition.

It has the highest class modern equipment and through car service.

It has a superb dining car service.

Low summer rates for the Epworth League and G. A. R. Conventions.

Write for free illustrated booklets.

S. K. HOOPER, G. P. and T. A. Denver, Colo.

R. C. NICHOL, Com'l Agt. 242 Clark St., Chicago, Ill.

Idaho Cedar Poles

PACIFIC COAST POLE CO. SPOKANE, WASH.

7-Foot Ties, Michigan's Best White Cedar for Electric Railways, Our Specialty.

ALSO TROLLEY POLES

Write us. PERRIZO & SONS, DAGGETT, MICH.

A LIBRARY OF WELL SELECTED ELECTRICAL BOOKS

Is of inestimable value to electricians. Such a library is best formed by occasional and carefully chosen purchases. ELECTRICIAN PUB. CO., 510 Marquette Building, Chicago.

WHITE CEDAR POLES

HALL L. BROOKS

52 WISCONSIN AVENUE

TOMAHAWK, WIS.

POLES

MICHIGAN and IDAHO CEDAR

TRADE MARK

THE F. BISSELL COMPANY. TOLEDO, O.

Cedar Poles

TORREY CEDAR CO., CLINTONVILLE, WIS.

Large Stock Constantly on Hand

MICHIGAN WHITE

CEDAR POLES

LARGE STOCK.

PROMPT SHIPMENTS.

KELLOGG SWITCHBOARD & SUPPLY CO., Chicago.

CEDAR POLES and TIES

YARDS THROUGHOUT THE NORTHWEST
GOOD STOCK — PROMPT SHIPMENTS

DULUTH LOG CO., Duluth, Minn.

We have just sold our entire stock of Cedar Poles to W. C. Sterling & Son Co. of Monroe, but we still have plenty of

"TROLLEY" TIES

on hand yet, and can make ATTRACTIVE PRICES

MALTBY CEDAR COMPANY, 509 Phoenix Block, BAY CITY, MICH.

OBTAIN OUR PRICES

ON ELECTRIC RAILWAY
WHITE CEDAR TIES

THE WHITE MARBLE LIME CO., Manistique, Mich.

Our Specialties

Telephone Poles
Electric Light Poles
Street Railway Poles
Hewn Timbers and Piling, Round or Octagonal

S. E. MISSOURI CYPRESS CO.
Campbell, Mo.

CEDAR POLES

ESTABLISHED 1862
WM. MUELLER COMPANY
1211-12-13 MARQUETTE BLDG. CHICAGO.
EIGHT DISTRIBUTING YARDS

"WESTERN"
POLE HOLE DIGGER

The only satisfactory Pole Hole Digger. Because it will work at the bottom of a deep hole. It will loosen and bring out anything it meets. For sale by all the best supply houses.

Western Steel Gate Co.

Manufacturers of "Western" Railroad Gates.

TWO RIVERS, - WIS.

Poles and Ties — The Fowler Companies

TRADE MARK

Fisher Bldg. Chicago

CEDAR POLES
IN STOCK

We have the following poles on our skids, ready for immediate shipment:

3,000—8" 25'	2,000—8" 30'	2,000—7" 45'	1,200—8" 55'
2,500—7" 30'	4,000—7" 40'	2,000—8" 45'	500—8" 60'
2,000—7" 35'	3,500—8" 40'	2,200—8" 50'	100—8" 65'

and longer.

Buy your poles direct from the producer and receive prompt shipment and satisfaction *always*. Wire for delivered prices at our expense.

THE LINDSLEY BROS. CO.
Spokane, Wash. Portland, Ore. Chicago, Ill.

EVERY COMFORT

Attends the Traveler between

Chicago Indianapolis
Cincinnati & Louisville

Who Travels via the

MONON ROUTE

Consult Your Local Ticket Agent

CEDAR POLES, POSTS, TIES,

H. M. LOUD'S SONS CO., Au Sable, Mich.

Cedar Poles.

Pittsburg and Lake Superior Iron Co. Producers and Wholesalers. Escanaba, Mich.

CENTRAL STATION HEATING

We are the originators and builders of the ONLY underground system of live and exhaust steam heating. Our system is used for the utilization and distribution of exhaust steam from electric-light and power plants, for heating residences, stores, public buildings, etc. 250 plants in successful financial and mechanical operation. We have the only practical Steam Meter. Also manufacturers of Wooden Water Pipe, Steam Pipe Casing, Steam Traps, Condensation Meters, Valves, Economizing Coils, Separators, and a full line of Steamfitters' Supplies.

Write for the STORY of DISTRICT STEAM HEATING

AMERICAN DISTRICT STEAM COMPANY

MAIN OFFICES
LOCKPORT, N.Y.

WESTERN OFFICES: MONADNOCK BLOCK
CHICAGO, ILL.

Westinghouse Prepayment Wattmeter

Satisfies
The Central Station Manager

Because he knows he is getting money to the full value of his current

Satisfies
The Consumer

Because he knows he is getting current to the full value of his money

The Most Satisfactory Prepayment Wattmeter

Successful in Service for Years

Westinghouse Electric & Mfg. Co.
Pittsburg, Pa.

Address Our Nearest District Office:

New York, Atlanta, Baltimore, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Dallas, Denver, Detroit, Los Angeles, Minneapolis, New Orleans, Philadelphia, Pittsburg, St. Louis, Salt Lake City, San Francisco, Syracuse, Seattle.
For Canada: Canadian Westinghouse Co., Ltd., Hamilton, Ontario. Mexico: G. & O. Braniff & Co., City of Mexico.

Do you know we sell Incandescent Lamps? Write for our catalogue.

Crimshaw

Raven White Core

Raven Black Core

ALL OUR WIRES pass inspection and carry the above **TRADE-MARKS** on our tags. We also manufacture **Crimshaw** and **Competition Tapes** and **Splicing Compounds.**

NEW YORK INSULATED WIRE COMPANY,

MAIN OFFICE: 114, 116 & 118 Liberty St., New York.
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SAUQUOIT SILK MFG. COMPANY
INSULATING and BRAIDING SILKS

MILLS:
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CHICAGO OFFICE:
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BOSTON OFFICE:
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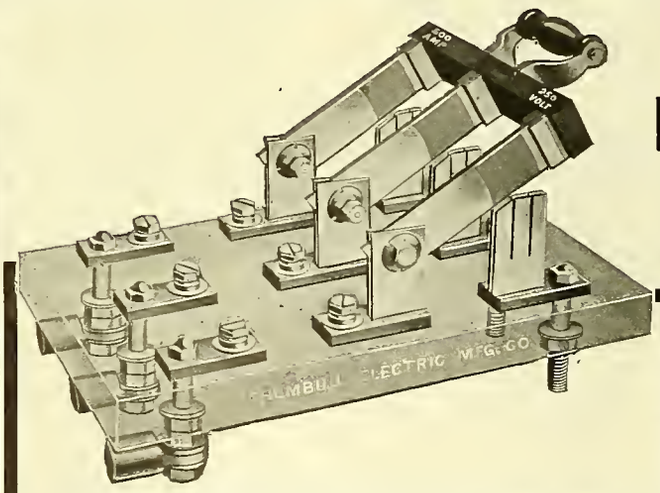

THE NATIONAL SWITCH

Quality costs you nothing; it's the lack of it that you have to pay for—over and over again. When buying switches, if you go to the head of the list and pick our Type A and install them, your expense stops there. But if you stop at any of the hundred and one other makes lower down the line, your greatest expense comes for repairs after the switch has been in use a short time.

Our Type A is the very best switch money can buy and more care is expended in constructing and adjusting it than any other manufacturer considers necessary.

If you are not familiar with the high quality of this switch, when at the National Electrical Contractors' Exhibition, spend a few minutes at Space 56 and get acquainted.

THE TRUMBULL ELECTRIC MFG. CO.
Plainville, Conn. New York, 136 Liberty St.

OUR NEW DESIGN

IN

TYPE A TRANSFORMERS

THE OLD WAY

INSURES

BETTER INSULATION

COOLER OPERATION

HIGHER EFFICIENCY

NEATER WORKMANSHIP

THE NEW WAY

FORT WAYNE ELECTRIC WORKS

FORT WAYNE, IND.

ORDER FROM THE NEAREST BRANCH OFFICE

351

The Inspector

AND

Trouble Man.

By A. E. DOBBS.

Full of information and diagrams for the operator, exchange owner, exchange manager, inspector, trouble man, lineman.

A complete description of telephones and their troubles. How to find and remedy them, together with working plans for exchange construction, complete with diagrams of all up-to-date telephones and switchboards.

This is a practical book, written in **plain language**, and for **anyone** interested in telephony.

Mailed anywhere on receipt of price . . . ONE DOLLAR.

No technicalities. Substantially bound in cloth.

ELECTRICIAN PUBLISHING CO.,

510 MARQUETTE BUILDING, CHICAGO.

RECOGNIZED

BY ALL UNBIASED METER EXPERTS TO BE THE MOST RELIABLE DIRECT CURRENT WATTMETER IN THE WORLD

DUNCAN ELECTRIC MFG. CO.

LAFAYETTE INDIANA, U. S. A.

JOHN A. ROEBLING'S SONS CO.

Insulated Wire of All Kinds

Bare Copper Wire

MAIN OFFICE AND WORKS TRENTON, N. J.

AGENCIES AND BRANCHES

New York Chicago Cleveland San Francisco Philadelphia Atlanta

VULCANIZED FIBRE

Highest grades for electrical insulation and mechanical purposes, in sheets, tubes, rods and special shapes. Catalogues and samples on application.

VULCANIZED FIBRE CO., - Wilmington, Del.

USE

"SAFETY" RUBBER COVERED WIRE AND CABLE

FOR EVERY ELECTRICAL SERVICE.

M. B. AUSTIN & CO.,

CHICAGO REPRESENTATIVE.

THE SAFETY INSULATED WIRE & CABLE CO.,

WORKS: Bayonne, N. J. 114-116 LIBERTY STREET, N. Y.

"The Standard" Fans

THE UNIVERSAL

is the best Fan to carry in stock. By simply loosening a thumb screw it becomes either a Desk or Bracket Fan, and when used in either position its air current may be directed in any direction or at any angle of elevation.

The quality is all that could be desired. We can make immediate delivery and the price is low.

We make ten other models of Ceiling, Desk, Bracket and Oscillating Fans, covering practically every requirement in this line.

Ask for catalogue.

The Robbins & Myers Co.

Main Office and Works: Springfield, Ohio.

OVER

100,000 IN USE

Has proven them

STANDARD W. E. ARC LAMPS

Western Electric Co.

CHICAGO NEW YORK

OTHER LARGE CITIES

TYPE E.

ALTERNATING CURRENT

SCHEEFFER INTEGRATING WATTMETER

Type E for Alternating Current Type F for Direct Current Circuits

DUST AND BUG PROOF IMPROVED CONSTRUCTION

MOVING PARTS ARE EXTREMELY LIGHT INSURING A HIGHLY SENSITIVE AND ACCURATE METER.

WRITE FOR PRICES AND DESCRIPTIVE LITERATURE

DIAMOND METER COMPANY

PEORIA, ILL., - - - - U. S. A.

TYPE F.

DIRECT CURRENT.

Western Electrician

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RUBBER COVERED, WEATHERPROOF, UNDERGROUND AND SUBMARINE.

WESTERN SELLING AGENT, H. R. NIXSON, 1104 Monadnock Block, CHICAGO. The Simplex Electrical Co., 110 State Street, BOSTON, MASS.

TRADE MARK. CRESCENT INSULATED WIRE & CABLE CO. TRENTON, N.J.

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National Code Standard.

CRESCENT INSULATED WIRE AND CABLE CO.

New York Office, 83 BARCLAY STREET. Main Office and Factory, TRENTON, N. J.

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1889—Paris Exposition, Medal for Rubber Insulation.

1893—World's Fair, Medal for Rubber Insulation.

THE STANDARD FOR RUBBER INSULATION.

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THE OKONITE CO., LTD.

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JAMES A. SPARGO, Pres. and Gen'l Mgr.

Manufacturers of

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MANUFACTURERS OF

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TELEPHONE, TELEGRAPH AND FIRE-ALARM CABLES.

All Wires are tested at Factory. JONESBORO, IND.

STANDARD

STANDARD UNDERGROUND CABLE CO.

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BARE AND WEATHERPROOF WIRES AND CABLES.

Rubber Covered Wires and Cables. Underground Cables for all Purposes.

TRANSFORMERS

KUHLMAN ELECTRIC CO., - - ELKHART, IND.

THE PHOENIX GLASS CO. Pittsburg, New York, Chicago

Manufacturers of

Electric Globes and Shades, both Arc and Incandescent

Inner and Outer Globes for all enclosed arc systems

CATALOGUES SENT ON REQUEST

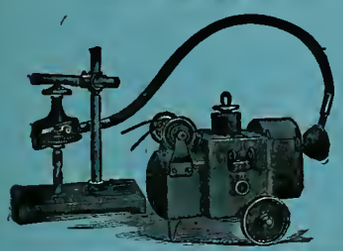
"CIRCULAR LOOM" THE FLEXIBLE CONDUIT

AMERICAN CIRCULAR LOOM CO. TRADE MARK REGISTERED

CONDUITS FOR INTERIOR WIRING.

American Circular Loom Co.

Boston, Mass., New York, Chicago, San Francisco.



ESTABLISHED 1875.

COMBINATION OF

Stow Flexible Shaft

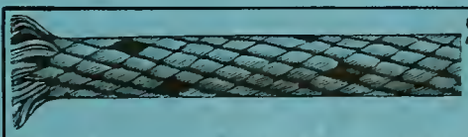
—AND—

MULTI-SPEED MOTOR

Practically dust and water proof. For Portable Drilling, Tapping, Reaming, Emery Grinding, etc. Write for Catalogue and Prices.

STOW MFG. CO., Binghamton, N. Y.

Gen'l European Agents, Selig, Sonnenthal & Co., 85 Queen Victoria Street, London, England



Samson Spot Cord

For ARC LAMP and TROLLEY CORD

Send for Samples and Prices

SAMSON CORDAGE WORKS, - Boston, Mass.

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PROTECT YOUR IDEAS. No patent, no fee.

Consultation free. Established 1864.

Milo B. Stevens & Co., 848 14th St., Washington.

Our No. 1 Insulators in Use

WORK IS MADE EASY

No { TIE WIRE / HALF HITCH / WRAP } Saves Money

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These Instruments are particularly suitable for Isolated Plants and Feeder Circuits in Railway and Power Plants Voltmeters in ranges from 3 to 750 volts. Ammeters in ranges from 1 to 2,500 amp All Weston Instruments are unsurpassed in excellence of workmanship, in accuracy and economy of operation.

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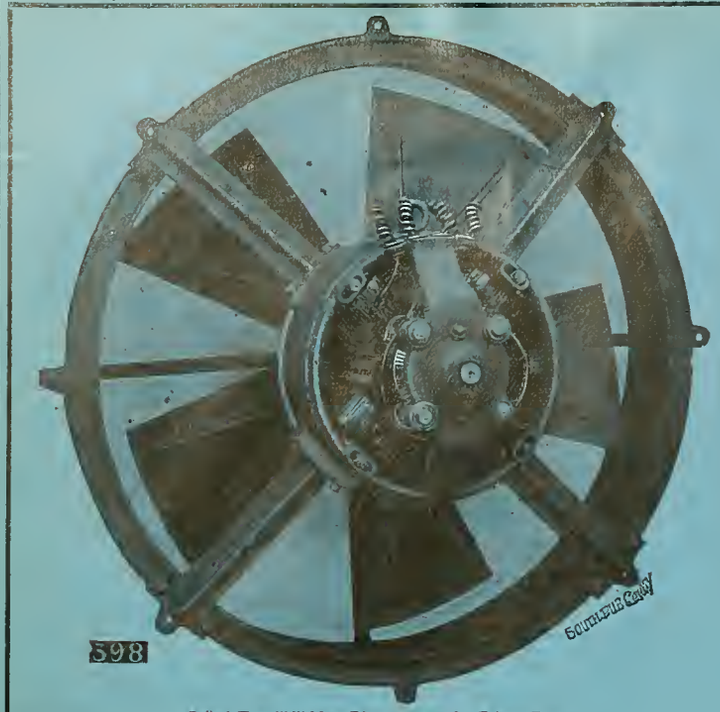

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Bullock Type "N" Motors

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Canadian representatives, Allis-Chalmers-Bullock, Ltd., Montreal

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In most control systems, to obtain slow speeds a second motor is necessary. With the Cutler-Hammer Rotary Press Controller but one motor is required for both the slowest and highest speeds, and it also provides for a large number of intermediate speeds. At any and every speed it gives a steady motion to the press, and prohibits its jumping, no matter how heavy it may be loaded.

This controller is so arranged that there is absolutely no arcing on the segments, the opening of the motor circuit being accomplished by the large solenoid shown in the cut. This solenoid is equipped with a carbon break and blow-out magnets for disrupting the arc. Protective devices are provided to quickly stop the press in case of accident.

Our bulletin No. 65 tells about this type.

The Cutler-Hammer Mfg. Co.

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BECAUSE of the disturbances on the line incident to starting an induction motor the general practice is to allow it to **run continuously** all day, and the apparatus to which it is connected is allowed to run idle when **not** in actual service.

This is one of the many instances in which the Accelerator will **save** wear and tear on the apparatus and will also **save** current while the motor is running idle. In one installation it is **saving three times its cost** in one year in current alone. Besides this it allows the apparatus **eight hours more rest** a day than it had formerly.

The Accelerator can be energized by automatic devices and will connect the apparatus to the motor **only** when necessary, **doing away** with the necessity of running the machine idle, and **reducing the wear** on the apparatus.

It will always start the apparatus gradually and smoothly **without** any shock or jerking.

If you have a proposition of this or a similar sort, we would like to submit a plan of control.

Our catalog explains how the Accelerator is built and how it operates. If you have not received a copy send for one.

Cutler-Hammer Clutch Co.

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ST. LOUIS, 1904

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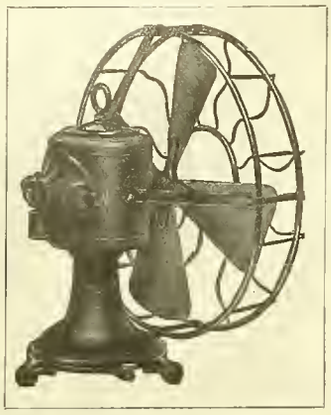

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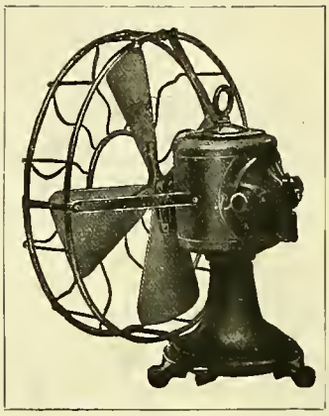

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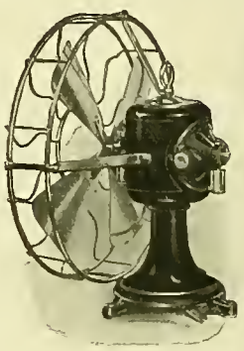

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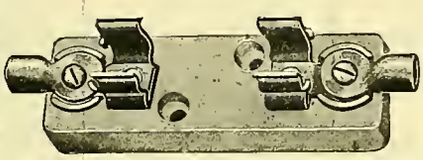

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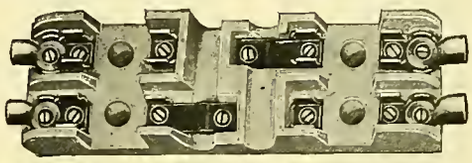

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ARE NOW MANUFACTURING AND SOLICIT ORDERS FOR

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"If the device stopped with "a metallic rotating body" and some method other than a counting machine operated by it was used for determining the number of its revolutions, we might not be able to charge the respondent with infringing. We might then well apply the proposition of the respondent that a mere meter is in a different art from a motor. * * * * * "Therefore, as it may well be that, if the counting mechanism was of a kind not operated by the "metallic rotating body," we should not be compelled to find infringement, we hesitate in view of the minute amount of energy exerted."
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Ft. Wayne Elec. Wks. Inc.
General Electric Co.
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Pignolet, L. M.
Reliance Instrument Co.
Robert Inst. Co., The.
Stanley—G. I. Elec. Mfg. Co.
Stanley Instrument Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co
Weston Electrical Inst. Co.

Electro-Plating Mach'y
Crocker-Wheeler Company.
General Electric Co.

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Jeffrey Mfg. Co.

Engines, Curliss.
Allis-Chalmers Company.

Engines, Gas and Gasoline.
Allis-Chalmers Company.
Marinette Gas Engine Co.

Engines, Oil.
American Diesel Engine Co.

Engines, Steam.
Allis-Chalmers Company.
Brownell Co., The.

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Central Electric Co.
Century Electric Co.
Crocker-Wheeler Company.
Edison Mfg. Co.
General Electric Co.
Robbins & Myers Co., The.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

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Green Fuel Economizer Co.

Fibre.
Kartavert Mfg. Co.
Vulcanized Fibre Co.

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Plume & Atwood Mfg. Co.

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Beardslee Chandeller Mfg. Co.

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Bissell Co., The F.
Doxsee-Barrere Electrical Co.
Haller Machine Co.
Reynolds El. Flasher Mfg. Co.
Schneider & Co., C. O.
Wesco Supply Co.

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Stow Mfg. Co.

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Bissell Co., The F.
Central Electric Co.
Chicago Fuse Wire & Mfg. Co.
D. & W. Fuse Company.
Electric Appliance Co.
Johns-Manville Co., H. W.
Manhattan Elec. Supply Co.
Peru Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Company.

Glasswure, Electric.
Addison Glass Co.

Globes, Reflectors and Shades.
Addison Glass Co.
Fostoria Incan. Lamp Co.
Haller Machine Co.
Phœnix Glass Co.
Wesco Supply Co.
Western Electric Co.

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Replogle Governor Works.

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Dixon Crucible Co., Jos.
Holmes Fibre-Graphite Co.

Guards, Lamp.
Couch Co., Inc., S. H.

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Amer. District Steam Co.

Holders, Inc. Lamps.
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Incandescent Electric Light Manipulator Co.

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Allis-Chalmers Company.

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Hartford Steam Boiler Inspection & Insurance Co.

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Alton Machine Co.

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American Electrical Works.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
Indiana Rub. & Ins. Wire Co.
Johns-Manville Co., H. W.
Kartavert Mfg. Co.
Manhattan Elec. Supply Co.
Mica Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Snyder & Hunt Co.
Standard Underground C. Co.
Vulcanized Fibre Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Iron Castings.
Alton Machine Co.

Lamps, Arc.
Bissell Co., The F.
Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Gregory Electric Co.
Manhattan Elec. Supply Co.
Stanley—G. I. Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

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Bissell Co., The F.
Bryan-Marsh Company.
Buckeye Electric Company.
Central Electric Co.
Chicago Edison Co.
Columbia Incan. Lamp Co.
Edison Decorative & Miniature Lamp Dept.
Electric Appliance Co.
Fostoria Incand. Lamp Co.
General Electric Co.
Sunbeam Incan. Lamp Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

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Inc. El. Lt. Manipulator Co.

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Haller Machine Co.

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Electric Appliance Co.
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General Electric Co.
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Tornquist Elect'l. Mfg. Co.
Wesco Supply Co.
Western Electric Co.

Linemen's Climbers.
Klein & Sons, Mathias.

Magnet Wires.
(See Wires and Cables.)

Mechanical Draft.
Green Fuel Economizer Co.

Mica.
Chicago Mica Co.
Mica Insulator Co.
Munsell & Co., Eugene.

Mining Apparatus, Elec.
Allis-Chalmers Company.
(Bullock El. Mfg. Co.)
Crocker-Wheeler Company.
General Electric Co.
Jeffrey Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Mining Machinery,
Allis-Chalmers Company.

Motors. (See Dynamos and Motors.)

Nippers and Pliers.
Klein & Sons, Mathias.

Overalls.
Carhartt & Co., Hamilton.

Patent Attorneys.
Bain, Foree.
Stevens & Co., Milo B.

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Phosphor Bronze Sm. Co. Ltd.

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Brooks, Hall L.
Duluth Log Co.
Fowler, John H.
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Lindsley Bros. Co.
Loud's Sons Co., H. M.
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Minneapolis Cedar & Lbr. Co.
Mueller Company, William.
Pacific Coast Pole Co.
Perrizo & Sons.
Phelan, D. W.
Pillsbury-Watkins Co.
Pittsburg & L. S. Iron Co.
Porter Cedar Company.
S. E. Missouri Cypress Co.
Sterling & Son, W. C.
Torrey Cedar Co.
Valentine-Clark Co., The.
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Worcester Co., C. H.

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Michigan College of Mines.
Pratt Institute.
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Southwestern Elec. Co.
Matthews & Bro., W. N.

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Amer. Elec. & Controller Co.

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Manhattan Elec. Supply Co.
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Western Electric Co.

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Haller Machine Co.

Speed Indicators.
Weston Electrical Inst. Co.

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Chicago Pneumatic Tool Co.
Electric Storage Battery Co.
General Storage Battery Co.
Gould Storage Battery Co.
National Battery Co.
Toledo Stor. Bat. & Elec. Co.
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Amer. Elect'l Supply Co.
Bennett, I. A.
Bissell Co., The F.
Central Electric Co.
Century Electric Co.
Chicago Edison Co.
Chicago House Wrecking Co.
Electric Appliance Co.
Manhattan Elect'l Supply Co
Wesco Supply Co.
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Switches.
See Cut-outs and Switches.)

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American El. Telephone Co
Arnold Electric Mfg. Co.
Automatic Electric Co.
Bissell Co., The F.
Central Electric Co.
Electric Appliance Co.
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Kellogg Switchb. & Sup. Co.
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Stromberg-Carlson Tel. M.Co
Wesco Supply Co.
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Bissell Co., The F.
Campbell Bros.

Toggle Bolts.
(See Bolts, Toggle.)

Tools.
Klein & Sons, Mathias.

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Chicago Pneumatic Tool Co.

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(Bullock El. Mfg. Co.)
Central Electric Co.
Crocker-Wheeler Co.
Electric Appliance Co.
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Kuhlman Electric Co.
La Fayette Elect'l. Mfg. Co.
National Electric Co.
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Wagner Electric Mfg. Co.
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Allis-Chalmers Co.
General Electric Co.
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Leffel & Co., Jas.

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Kellogg Switch. & Sup. Co.
Manhattan Elec. Supply Co.
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Northern Wire & Cable Co.
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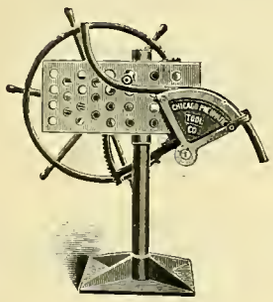
Phillips, Eugene F.
Phillips Insulated Wire Co
Roebling's Sons Co., J. A.
Safety Ins. Wire & Cable Co.
Simplex Electrical Co.
Spargo Wire Co., Jas. A.
Standard Underground C. Co.
Wesco Supply Co.
Western Electric Company.

Woodwork, Telephonic.
Telephone Woodworking Co

For Alphabetical Index of Advertisements See Page 3.

The Chicago Pipe Bending Machine



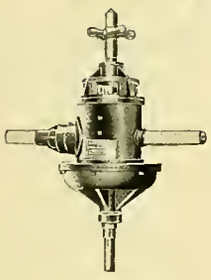
Is invaluable for all kinds of pipe and ornamental iron work, as well as for the bending of electrical conduits. Bends piping of steel, iron, brass, copper, or other material, cold, up to two inches diameter with one man.

One man can bend a piece of two-inch pipe to an **S** bend in three minutes, no other assistance or device being necessary or needed.

It is well adapted for the use of special dies that can be readily attached for bending light angles, flats or tee bars to any desired radius as easily as bending pipe.

Full particulars furnished on application.

The Duntley Air-Cooled Electric Drills

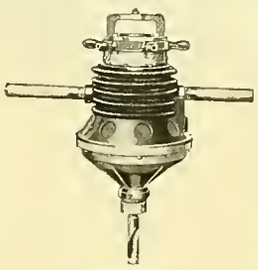


Drill D-1C

Are manufactured in sizes to correspond with our Air Drills. They are invaluable in any machine or repair shop where electric current can be obtained; also office buildings, hotels, steamship, etc., can use them advantageously. Wound for 110 and 220 volts direct current.

Over 3,000 Sold During the Month of May, 1905

Full particulars, etc., on request.



Drill D2

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Seattle San Francisco Denver Detroit Cleveland Toronto Boston Pittsburg Philadelphia Norfolk

NOW READY

THE

P. & S. Decorative Socket No. 417

You don't have to take it apart to wire it up. Simply slip the wires in the slots and turn in the screw.

Your next order solicited.

PASS & SEYMOUR, Inc., Solvay, N. Y.

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Just What the World Has Been Waiting For.

NEW "MORRISON" STORAGE BATTERY

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This plate is so strong electrically and mechanically that no amount of electrical abuse or of vibration in traction service can dislodge even the slightest particle of its active material.

Lowest internal resistance of any storage battery in the world.

The weight efficiency is conservatively 14 watts per pound total weight, and electrical efficiency unsurpassed . . . .

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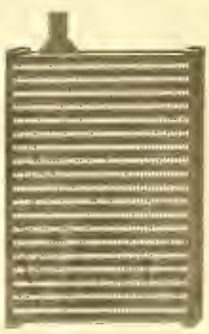
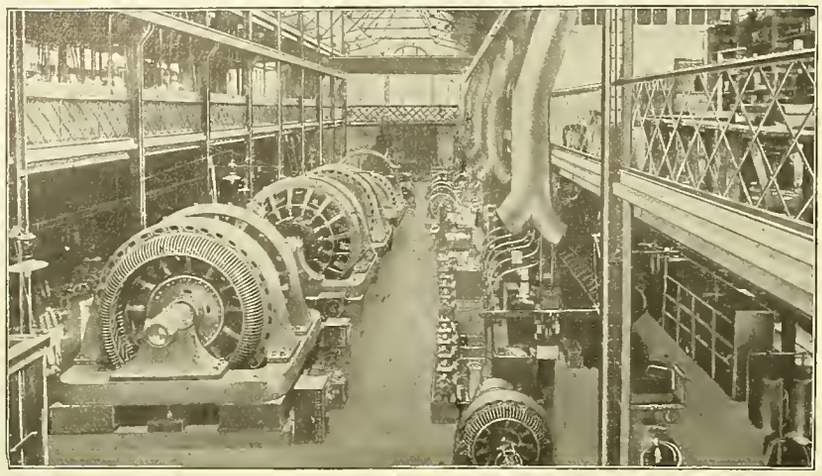
INCORPORATED

OFFICE: 1355 RAILWAY EXCHANGE BUILDING FACTORY: 36-38 UNION PARK PLACE

CHICAGO, ILLINOIS



THE PLATE



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Direct and Alternating Current

Electrical Machinery

Built in all Capacities and Types

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On receipt of

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Every lighting man should have one.

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General Electric Company

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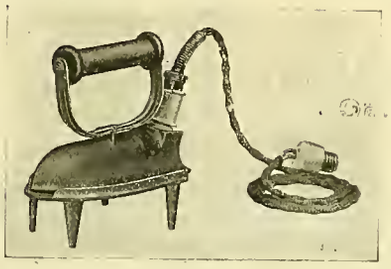

A flat iron with distinctive merit

It is durable and efficient
Simple, safe and convenient

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All trouble is eliminated in the Sangamo D. C. Wattmeter.

We use no brushes or commutators—don't need to.

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Because they are reliable. Cost less than any other make in the end. . . . . .

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HARRISON, N. J.
(507)

VOLT - AMMETERS
POCKET SIZE
For testing Batteries and Battery Circuits, Locating Faults, Grounds, etc.
RELIABLE. - ACCURATE.
Send for Circular.
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SCIENTIFIC DESIGN **CORRECT ENGINEERING** THOROUGH CONSTRUCTION
IN
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Installations Renewals
GENERAL STORAGE BATTERY CO.
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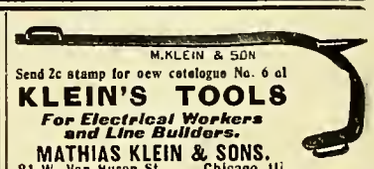

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For Electrical Workers and Line Builders.
MATHIAS KLEIN & SONS.
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You Who are Troubled with Sparking and Cutting of Commutators to Use

The only article that will PREVENT SPARKING. Will keep the commutator in good condition and PREVENT CUTTING.

Absolutely Will Not Gum The Brushes . . .

It will put that high glass on the commutator you have so long sought after.

50 Cts. per Stick. $5.00 per Dozen
For Sale by all Supply Houses, or
FREE, Sample Stick.

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The insulation is the most important part of your machine—be sure you buy only the best. Cheap insulation cannot be good insulation.

IF IT'S MICABOND YOU CAN BE SURE YOU HAVE THE BEST—OUR GUARANTEE IS BEHIND IT

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WORKS QUICK AND EASY. KEEPS ITS LUSTER. HOLDS OLD TRADE AND MAKES NEW. DOES NOT DETERIORATE. ESTABLISHED 16 YEARS. SOLD BY AGENTS AND DEALERS ALL OVER THE WORLD

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ALWAYS READY AND DOES THE WORK. WILL MAKE THE SOLDER FLOW WHERE YOU WANT IT, AND STAY WHERE YOU PUT IT. IN COLLAPSIBLE TUBES AND TIN BOXES.

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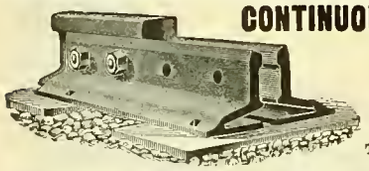

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NEWARK, N. J.
OVER 20,000 MILES IN USE
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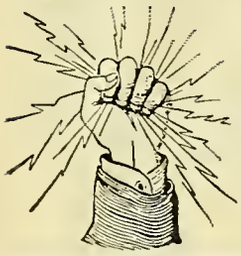
PROVIDENCE, R. I.



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Electric Heating Apparatus
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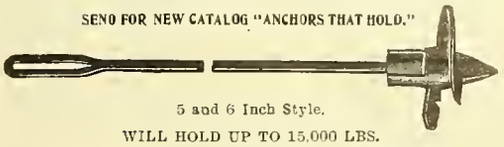
Cambridgeport, Mass.

OUR PROPOSITION
WE WILL SHIP ON 30 DAYS TRIAL
ANY NUMBER OF
STOMBAUGH GUY ANCHORS
OVER TWELVE
IF SATISFACTORY PAY FOR THEM, OTHERWISE, RETURN CHARGES COLLECT
WE PREPAY FREIGHT ON INITIAL ORDERS
SEND FOR NEW CATALOG "ANCHORS THAT HOLD."



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Stops Sparking, Prevents Heating and Cutting
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74-80 Bradford Bldg., Charleston, West Va.

50c Per Stick
$5.00 Per Dozen

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A regular 50 cent stick
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is open to you if you have charge of a
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Write for particulars.

BOSSERT'S BOXES
Drawn steel. One blow of a hammer gives clean round hole. No filing.
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You will confer a favor upon the advertiser by telling him--when you write him--that you saw his ad. in the Western Electrician.

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SMALL QUANTITY 15½c. Order now.
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Whereas, Said application was duly filed with the City Clerk of said City of Marinette, on the 17th day of June, A. D. 1905, and published at the expense of the applicant in the official paper of the City of Marinette, in the manner and form required by Section 940B of the Revised Statutes of the State of Wisconsin for the year 1898; and,

Whereas, Due proof of such publication has been made in the manner in which the publication of ordinances is required to be proved, and such proof duly filed with the City Clerk of said City of Marinette, on the 5th day of July, A. D. 1905, and all in the manner and form as required by Section 940B of the Revised Statutes of the State of Wisconsin for the year 1898; and,

Whereas, In conformity with the provisions of Section 940D of the Revised Statutes of the State of Wisconsin for the year 1898, the Common Council of the City of Marinette has caused to be prepared full specifications containing the rules and regulations for the maintenance and operation of the plant and for the conduct of the business for which such franchise is to be granted, which said specifications were duly and properly approved by said Common Council and the original thereof ordered placed on file in the office of the City Clerk of the City of Marinette, reference to which specifications is hereby made;

NOW, THEREFORE, the Common Council of the City of Marinette requests that proposals be submitted, stating what percentage of the gross receipts from the business carried on under the franchise the bidder will pay annually into the treasury of the City of Marinette in consideration of receiving such franchise. All bids to be written, sealed and made in conformity with the advertisement and the specifications now on file in the office of the City Clerk of the City of Marinette, and addressed to the Common Council of the City of Marinette, Wisconsin, and filed in the office of the City Clerk of the City of Marinette, on or before August 10, 1905, when all bids for such franchise shall be considered closed.

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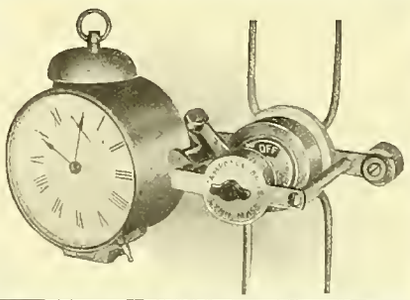

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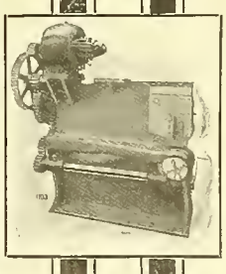

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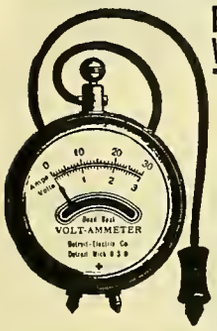

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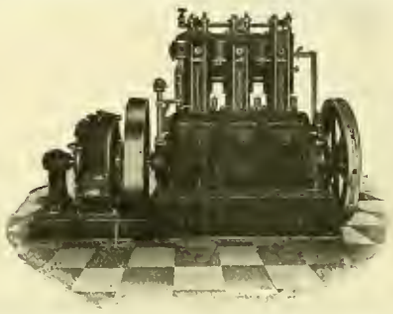

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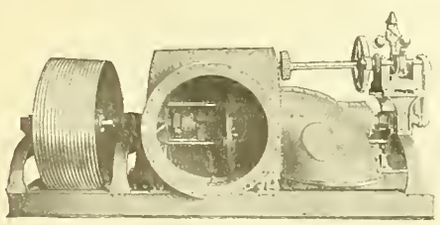

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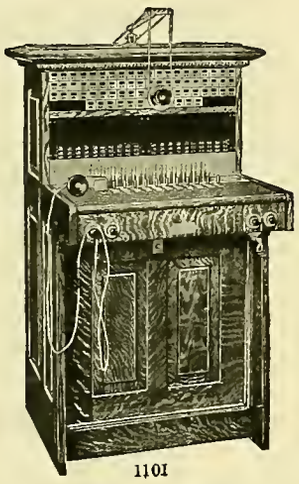

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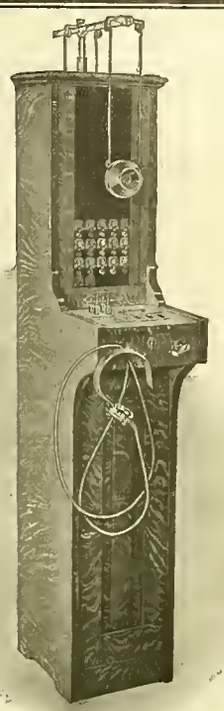

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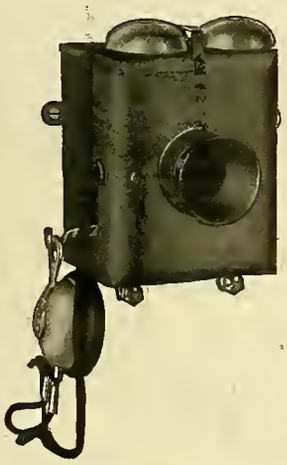

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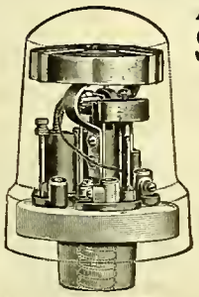

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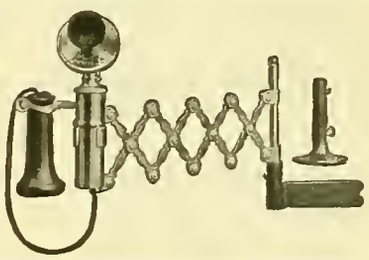

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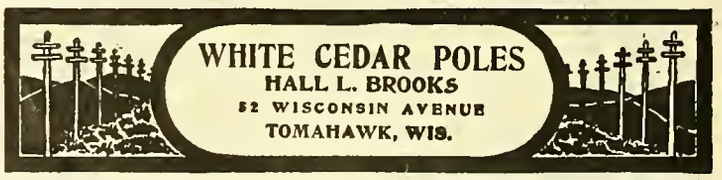

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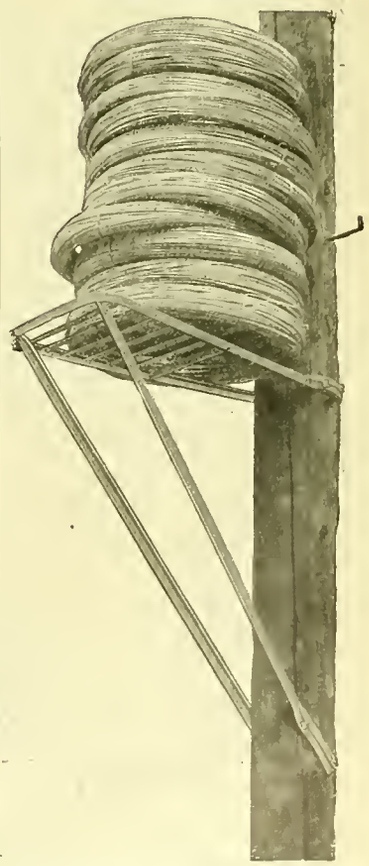

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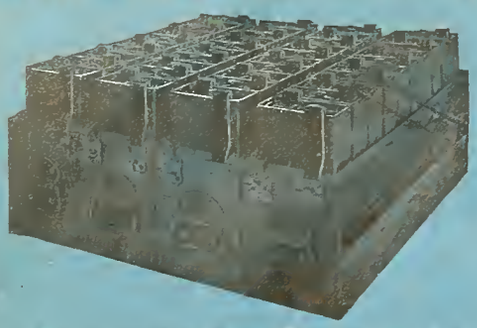

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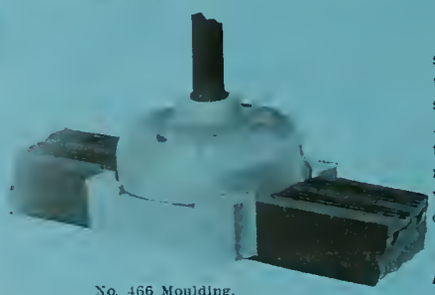

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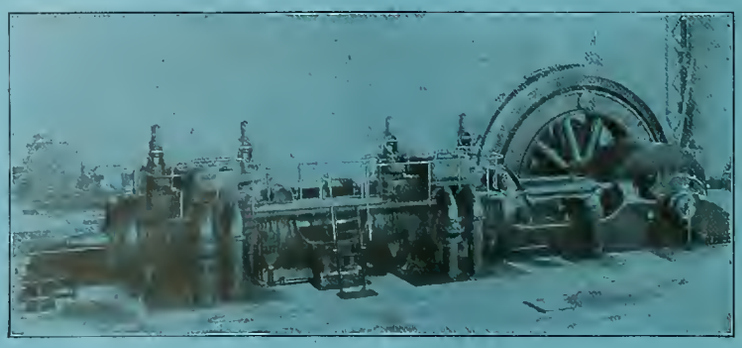

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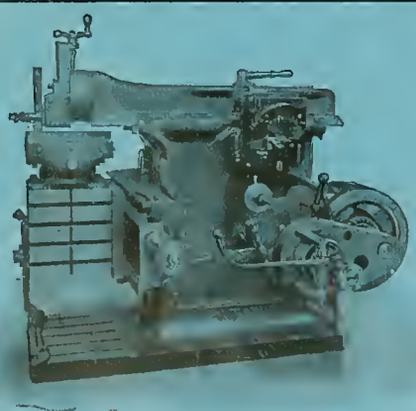

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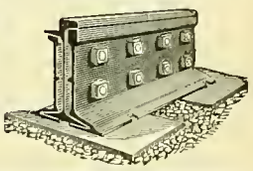

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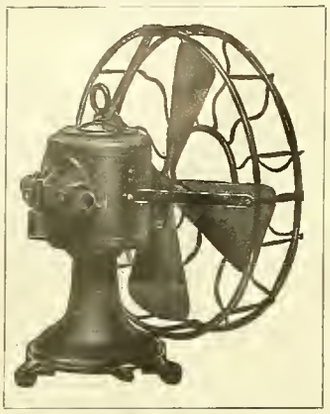

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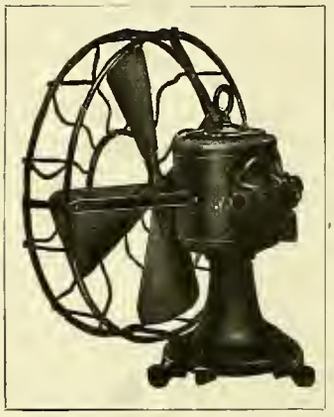

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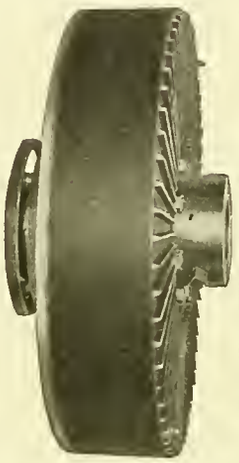

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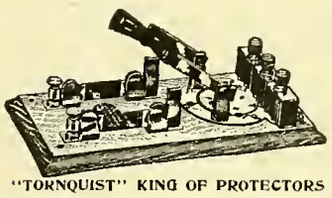

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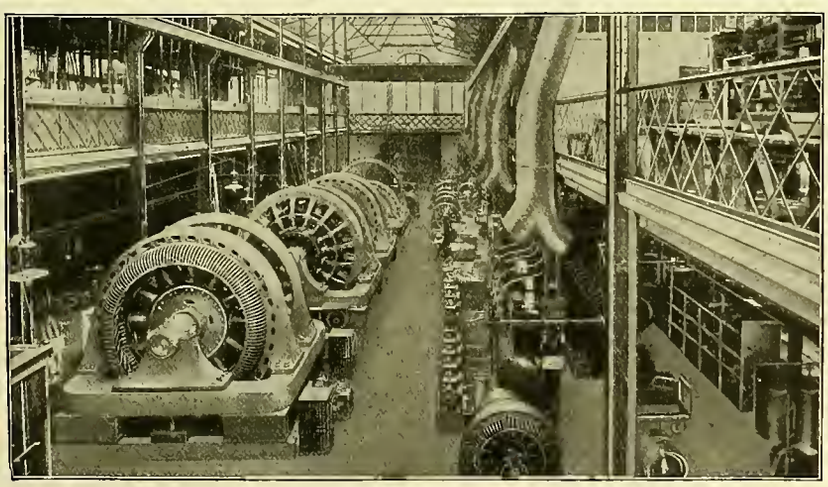

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MILWAUKEE

You will confer a favor upon the advertiser by telling him—when you write him—that you saw his ad. in the Western Electrician.

STANLEY INSTRUMENT CO., GREAT BARRINGTON, MASS.

ARE NOW MANUFACTURING AND SOLICIT ORDERS FOR

MODEL H-6 ROTATED JEWEL BEARING STANLEY WATTMETERS

For Alternating Current, Single Phase and Polyphase Service constructed to conform strictly to the suggestion contained in the following language quoted from the opinion filed September 9th, 1904, in the

UNITED STATES CIRCUIT COURT OF APPEALS FOR THE FIRST CIRCUIT:

"If the device stopped with "a metallic rotating body" and some method other than a counting machine operated by it was used for determining the number of its revolutions, we might not be able to charge the respondent with infringing. We might then well apply the proposition of the respondent that a mere meter is in a different art from a motor. ***** "Therefore, as it may well be that, if the counting mechanism was of a kind not operated by the "metallic rotating body," we should not be compelled to find infringement, we hesitate in view of the minute amount of energy exerted."

The Train Registration, or Counting Mechanism in Model H-6 Wattmeters is independently operated and positively driven by a spring; the disc or rotating body does not and cannot operate the counting mechanism; train friction removed from rotating body of meter.

Jewel Surface always new—Spring Supported Pivot overcomes vibration.

PERMANENT ACCURACY AT ALL LOADS

PRICES CONSIDERABLY LESS TO ALL PURCHASERS THAN HERETOFORE PREVAILING

SPECIAL VERY LOW PRICES FOR ENTIRE REQUIREMENTS OR QUANTITY

ORDERS PROMPTLY FILLED

STANLEY INSTRUMENT CO., GREAT BARRINGTON, MASS.

Gould Storage Battery Co.

Complete Storage Battery Plants

Railway Line and Regulating
Isolated and Train Lighting
Central Lighting and Power
Electric Vehicle and Telephone

GOULD COUNTER E. M. F. BOOSTER SYSTEMS

Sales Offices { NEW YORK, 1 W. 34th Street.
BOSTON, 89 State Street.
CHICAGO, The "Rookery."
SAN FRANCISCO, Century Electric Co.

WORKS: DEPEW, N. Y.

Bulletins.

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Incandes. El. Lt. Manip. Co.

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Inc. El. Lt. Manipulator Co.

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Brownell Co., The

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Wrigley Co., Thos.

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Parsell & Weed

Chains.
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Plume & Atwood Mfg. Co.

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Cutler-Hammer Mfg. Co.
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Western Electric Company.
Westinghouse El. & Mfg. Co.

Cinders.
Plume & Atwood Mfg. Co.

Clutches, Magnetic.
Cutler-Hammer Clutch Co.

Coal and Ashes Handling Machinery.
Jeffrey Mfg. Co.

Coal Mining Machinery.
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Coils and Magnets.
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American Conduit Company
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Engines, Corliss.
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Addison Glass Co.
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Central Electric Co.
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Columbia Incan. Lamp Co.
Edison Decorative & Miniature Lamp Dept.
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Fostoria Incand. Lamp Co.
General Electric Co.
Sunbeam Incan. Lamp Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

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Inc. El. Lt. Manipulator Co.

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Lightning Arresters.
Central Electric Co.
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Manhattan Elec. Supply Co.
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Linemen's Climbers.
Klein & Sons, Mathias.

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Mechanical Draft.
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Chicago Mica Co.
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Munsell & Co., Eugene.

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Phosphor Bronze Sm. Co. Ltd.

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Minneapolis Cedar & Lbr. Co.
Mueller Company, William.
Pacific Coast Pole Co.
Perrizo & Sons.
Phelan, D. W.
Pillsbury-Watkins Co.
Pittsburg & L. S. Iron Co.
Porter Cedar Company.
S. E. Missouri Cypress Co.
Sterling & Son, W. C.
Torrey Cedar Co.
Valentine-Clark Co., The.
Western Lumber & Pole Co.
White Marble Lime Co.
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Pole Hole Diggers.
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Polish (Metal).
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Porcelain Specialties.
Pass & Seymour, Inc.
Peru Electric Mfg. Co.

Portables.
Plume & Atwood Mfg. Co.

Power Transmission Machinery.
Allis-Chalmers Company.
Jeffrey Mfg. Co.

Protectors, Telephone Ex.
Tornquist Elec. Mfg. Co.

Rail Joints.
Continuous Rail Joint Company of America.

Railway Supplies.
Wesco Supply Co.

Re-Winding—Repairs.
Chicago Edison Co.
Gregory Electric Co.
Southwestern Elec. Co.

Rheostats.
Cutler-Hammer Mfg. Co.
General Electric Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Rubber Machinery.
Alton Machine Co.

Schools and Colleges.
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Michigan College of Mines.
Pratt Institute.
Rose Polytechnic Inst.

Second-Hand Mach'y.
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Chicago House Wrecking Co.
Gregory Electric Co.
Southwestern Elec. Co.
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Haller Machine Co.
Western Display Co.

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Sockets & Receptacles.
Pass & Seymour.
Sauter Co., G. F.
Yost Elec. Mfg. Co.

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Chicago Solder Co.
Crolius & Son, E. R.
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Western Electric Co.

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Manhattan Elec. Supply Co.
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Western Electric Co.

Specialties, Electrical Mfrs. and Designers.
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Storage Batteries.
American Battery Co.
Chicago Pneumatic Tool Co.
Electric Storage Battery Co.
General Storage Battery Co.
Gould Storage Battery Co.
National Battery Co.
Toledo Stor. Bat. & Elec. Co.
Universal Elec. Stor. Bat. Co.

Supplies, General Elec.
Amer. Elect'l Supply Co.
Bennett, I. A.
Bissell Co., The F.
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Chicago Edison Co.
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Electric Appliance Co.
Manhattan Elect'l Supply Co
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American El. Telephone Co
Arnold Electric Mfg. Co.
Automatic Electric Co.
Bissell Co., The F.
Central Electric Co.
Electric Appliance Co.
International Tel. Mfg. Co.
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Manhattan Elec. Supply Co.
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Kuhlman Electric Co.
La Fayette Elect'l. Mfg. Co.
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Wagner Electric Mfg. Co.
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Westinghouse El. & Mfg. Co

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Belden Mfg. Co.
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Phillips, Eugene F.
Phillips Insulated Wire Co
Roebling's Sons Co., J. A.
Safety Ins. Wire & Cable Co.
Simplex Electrical Co.
Spargo Wire Co., Jas. A.
Standard Underground C. Co.
Wesco Supply Co.
Western Electric Company.

Woodwork, Telephonic.
Telephone Woodworking Co.

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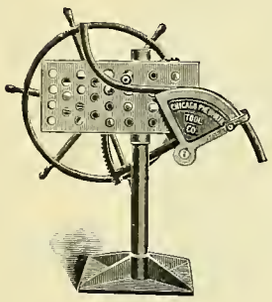
The Chicago Pipe Bending Machine



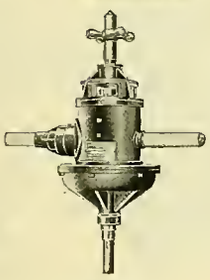
Is invaluable for all kinds of pipe and ornamental iron work, as well as for the bending of electrical conduits. Bends piping of steel, iron, brass, copper, or other material, cold, up to two inches diameter with one man.

One man can bend a piece of two-inch pipe to an S bend in three minutes, no other assistance or device being necessary or needed.

It is well adapted for the use of special dies that can be readily attached for bending light angles, flats or tee bars to any desired radius as easily as bending pipe.

Full particulars furnished on application.

The Duntley Air-Cooled Electric Drills

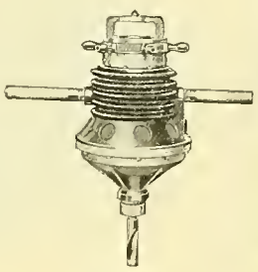


Drill D-1C

Are manufactured in sizes to correspond with our Air Drills. They are invaluable in any machine or repair shop where electric current can be obtained; also office buildings, hotels, steamship, etc., can use them advantageously. Wound for 110 and 220 volts direct current.

Over 3,000 Sold During the Month of May, 1905

Full particulars, etc., on request.



Drill D2

Manufactured By **CHICAGO PNEUMATIC TOOL COMPANY**

Fisher Building, CHICAGO **95 Liberty Street, NEW YORK**

Seattle San Francisco Denver Detroit Cleveland Toronto Boston Pittsburg Philadelphia Norfolk

"Flexduct" is that high standard required in all high-class work. It is very flexible, a high insulation and indestructible

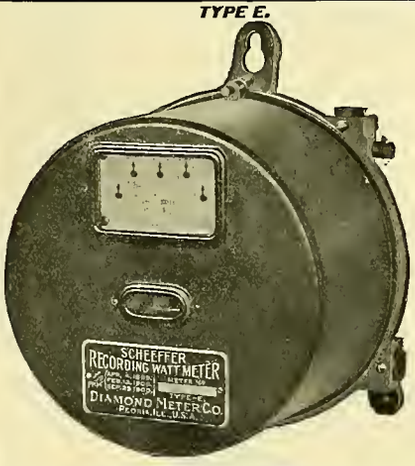
FLEXIBLE CONDUIT

"Flexduct" the National Code Standard. It does not deteriorate, always usable to highest degree

OSBURN FLEXIBLE CONDUIT COMPANY,

NEW YORK CHICAGO SAN FRANCISCO

TYPE E.



ALTERNATING CURRENT

SCHEEFFER INTEGRATING WATTMETER

Type E for Alternating Current Type F for Direct Current Circuits

DUST AND BUG PROOF IMPROVED CONSTRUCTION

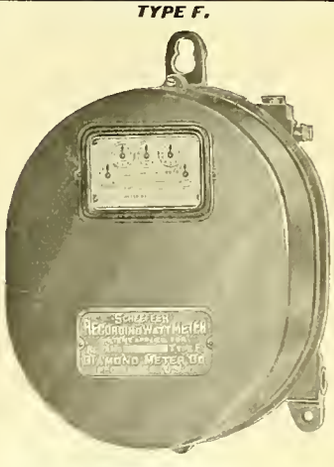
MOVING PARTS ARE EXTREMELY LIGHT INSURING A HIGHLY SENSITIVE AND ACCURATE METER.

WRITE FOR PRICES AND DESCRIPTIVE LITERATURE

DIAMOND METER COMPANY

PEORIA, ILL., - - - - U. S. A.

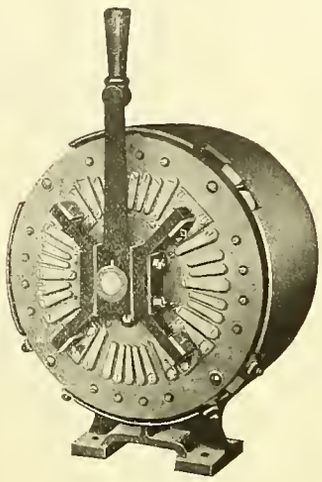
TYPE F.



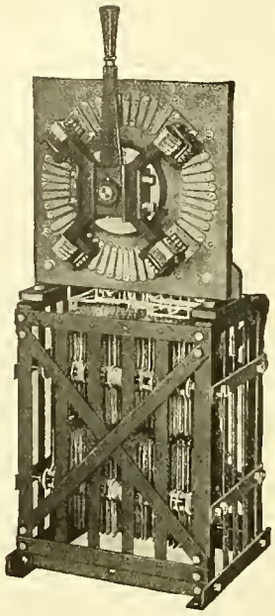
DIRECT CURRENT.

USED IN OVER **90%** OF THE CENTRAL STATIONS **COLUMBIA CARBONS** IN THE UNITED STATES

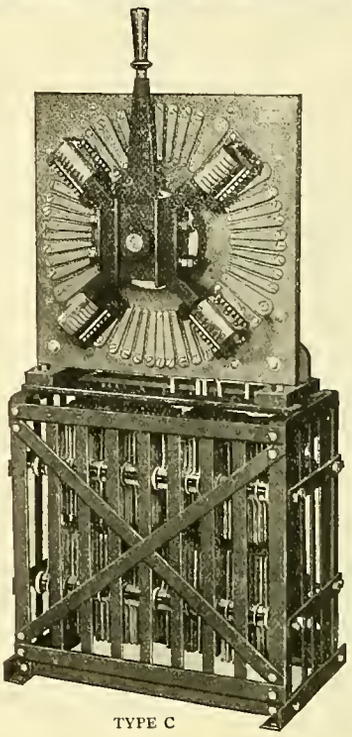
NATIONAL CARBON CO. CLEVELAND, O.



TYPE A



TYPE B



TYPE C

C & H Radial Arm Crane Controller

The above illustrations give a good idea of the ruggedness and compactness of this new controller.

You will notice that the lever carries four arms, at the end of each arm being brushes of drop forged copper so constructed that they will ride over the segments easily, but yet make a good working contact even when the segments become roughened.

You will also notice that the segments are arranged into four sets, connected in series, which divides the full voltage by that number, and practically does away with sparking between segments.

Connection of each segment is made to its respective resistance at the rear of the slate. The resistance is also in four sections and so arranged that a reversing sector is not necessary.

Plainly shown in Types B and C is the blowout coil which surrounds and embraces the controller shaft. The magnetic circuit of this coil is completed by the frame work with the result that it gives a powerful blowout action at each of the four points where the circuit is broken.

To enable the operator to "feel" the "off" position, a centering device is provided, but it is of such construction that it does not interfere with his reversing quickly.

Every part of this controller is renewable and interchangeable. The lever is originally cast in one piece, and all work on it is done with jigs before being separated. The segments are renewable from the front without in any way disturbing the connections. In Types B and C connections are made at the back of the slate, and in Type A the resistance is carried by the case and can be taken out by simply removing four screws.

This controller is adapted for all conditions of service. Type A can be mounted in any position by removing the screws which attach it to the case and rotating it in the case; it can be removed from the case and placed in a recess, or it can be arranged for operation from the floor with ropes. Types B and C may be installed at the rear of the cab and operated from in front by levers.

This controller is the result of a long study of the severe service met with in crane control, and we believe with it we have overcome every objectional feature of former types.

Bulletin No. 59 describes it, and gives prices and dimensions. If you have not received it send for it to-day.

The Cutler-Hammer Mfg. Co.

NEW YORK
BOSTON

Milwaukee, Wis.

CHICAGO
PITTSBURG

Grimshaw

Raven White Core

Raven Black Core

ALL OUR WIRES pass inspection and carry the above TRADE-MARKS on our tags. We also manufacture Grimshaw and Competition Tapes and Splicing Compounds.

NEW YORK INSULATED WIRE COMPANY,

MAIN OFFICE:
114, 116 & 118 Liberty St., New York.

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Electrical Supplies

WRITE FOR PRICES

G. F. SAUTER CO., ELECTRICAL CONTRACTORS

Segel Bldg., Cor. State and Lafayette Sts.

SCHENECTADY, N. Y.

TWO YEAR COURSES IN

Steam and Machine Design, Applied Electricity and Applied Chemistry

PRATT INSTITUTE, - BROOKLYN, N. Y.

Write for catalogue and particulars.

NOVELTY CABLE SLEEVE—Made also in two and three way branches.

SPLICES AND POT HEADS

NOVELTY CABLE POT HEAD

Can be made by any man who can handle a soldering iron, better and cheaper than by any lead joint wiper. And tho' absolutely permanent, they can be opened at any time for inspection or repair and again restored. How much money would this have saved *your* exchange? Details in Catalogue 125-A.

Trade Mark

Made by THE F. BISSELL COMPANY TOLEDO, O.

Our Form L Motor
Sizes ¼ to 3 H. P.

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In and near CHICAGO includes some of the most successful concerns in the world. Send for our illustrated pamphlet

"Users of C-W Motors and Generators"

Large Stock of Machines Carried in Chicago

Crocker-Wheeler Company

Ampere, N. J.

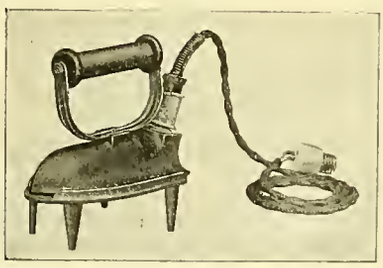
16 Branch Offices

Chicago Office: Old Colony Bldg.

The more money you spend in advertising the more money you have.
The less money you spend in advertising the less money you have.

General Electric Company

New Electric Flat Iron



A flat iron with distinctive merit

It is durable and efficient
Simple, safe and convenient

Send for descriptions

Principal Office: SCHENECTADY, N. Y. Chicago Office: Monadnock Block
Sales Offices In All Large Cities

625

JEWEL TROUBLE

All trouble is eliminated in the Sangamo D. C. Wattmeter.

We use no brushes or commutators—don't need to.

Every Direct Current Central Station should know about the Sangamo Wattmeter—Ask us.

ELECTRIC APPLIANCE COMPANY
CHICAGO and SAN FRANCISCO

BIJUR "HIGH-DUTY"
STORAGE BATTERIES
GENERAL STORAGE BATTERY CO.
42 Broadway, New York

SPARKING *Reduces the working capacity of a motor or dynamo, wears out the commutator, wastes power and may cause a fire. All this may be avoided if you use . . . . . .*

The only article that will PREVENT SPARKING. Will keep the Commutator in good condition and PREVENT CUTTING.

Absolutely Will Not Gum The Brushes.

It will put that high gloss on the Commutator you have so long sought after.

50 Cents per Stick. $5.00 per Dozen.
SEND FOR FREE SAMPLE STICK
For sale by all supply houses, or
K. McLENNAN & CO., Sole Mfrs., Room 411, Inter Ocean Bldg., 130 Dearborn St., Chicago

LET US HAVE YOUR INQUIRIES WHEN IN NEED OF MICA OF ANY DESCRIPTION—WE CAN GIVE YOU WHAT YOU NEED QUICK AND AT THE RICHT PRICES.
CHICAGO MICA CO., VALPARAISO, IND.

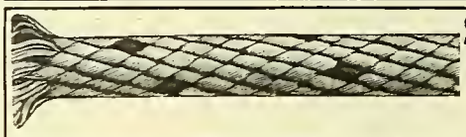
MICA Of all Qualities, in any Form at Lowest Prices
EUGENE MUNSELL AND CO.
NEW YORK and CHICAGO

INSULATION That Is.
Micanite, Linotape, M. I. C. Compound, Empire Cloth and Paper. For Years the Standard.
MICA INSULATOR CO., Originators
NEW YORK and CHICAGO

ADAMS SECONDARY GENERATOR WESCO

This instrument will do away with your battery expense in operating door bells, elevator bells, electric gas lighters and all annunciator work, as it connects to the secondaries of an alternating current and consumes so little current as not to move a meter, therefore it costs nothing to operate it. Write for descriptive bulletin and prices.

THE WESCO SUPPLY CO. :: St. Louis
Branch Warehouse, Ft. Worth, Texas



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For
ARC LAMP and TROLLEY CORD
Send for Samples and Prices
SAMSON CORDAGE WORKS, - Boston, Mass.

Electric Heating Apparatus
SEND FOR 82-PAGE CATALOGUE
"UNIT" ENAMELED RHEOSTATS
SIMPLEX ELECTRIC HEATING CO.
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VOLT - AMMETERS
POCKET SIZE
For testing Batteries and Battery Circuits, Locating Faults, Grounds, etc.
RELIABLE. - ACCURATE.
Send for Circular.
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ALWAYS READY AND DOES THE WORK. WILL MAKE THE SOLDER FLOW WHERE YOU WANT IT, AND STAY WHERE YOU PUT IT. IN COLLAPSIBLE TUBES AND TIN BOXES.
"NEW IDEA" SOLDERING PASTE SAMPLE FREE
NEW IDEA SOLDERING PASTE CO., 214 Hibbard Ave., Detroit, Mich.

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EDISON LAMPS
IN YOUR SOCKETS

And secure the maximum of Good Lighting Service.

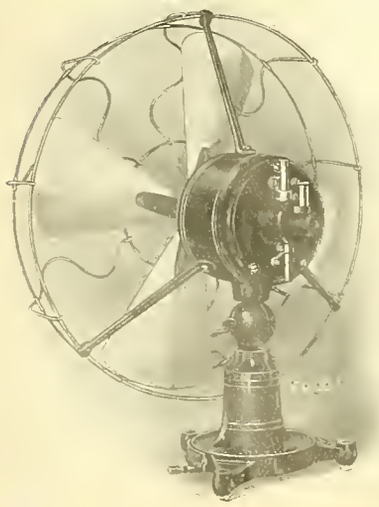
Miniature Lamps. Street Series Lamps.
Regular Multiple Lamps.

GENERAL ELECTRIC COMPANY
MAIN LAMP SALES OFFICE
Harrison, N. J.

LOOK FOR THE LABEL IN THE STEM

(508)

The JAMES A. SPARGO WIRE CO.
JAMES A. SPARGO, Pres. and Gen'l Mgr.
Manufacturers of
BARE AND TINNED COPPER WIRE
FINE SIZES A SPECIALTY Chicago Office, 1501 Monadnock Bldg. ROME, N. Y.



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THE IMPORTANT FACTS

We make ten models of Fans to suit the various needs of the trade.
Each model is the best that can be produced in its line. Each model will last a lifetime.
Our magnificent facilities permit prompt delivery and the lowest price consistent with the high "STANDARD" quality.

THE ROBBINS & MYERS CO.
Main Office and Works: SPRINGFIELD, OHIO

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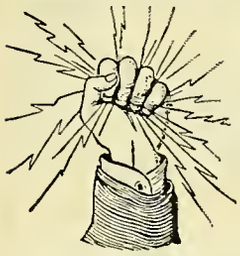
AMERICAN ELECTRICAL WORKS,

PROVIDENCE, R. I.



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ELECTRIC LIGHT LINE WIRE,
INCANDESCENT AND FLEXIBLE CORDS,
Railway Feeder and Trolley Wire,
AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.
CABLES FOR AERIAL AND UNDERGROUND USE.

NEW YORK STORE, W. J. Watson, 26 Cortlandt St.
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MONTREAL BRANCH, Eugene F. Phillips' Electrical Works.
MAIN OFFICES AND FACTORIES, PHILLIPSDALE, R. I.

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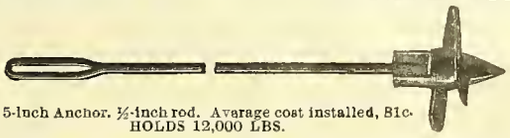
SAVE

SAVE LABOR SAVE TIME SAVE MONEY



5-inch Anchor. ½-inch rod. Average cost installed, 81c.
HOLDS 12,000 LBS.

Try Them at Our Risk and Prove It.

W. N. MATTHEWS & BRO.
Manufacturers
203 N. 2nd St. - - - - St. Louis

EXPERT IN ELECTRICITY MECHANICS PATENT CAUSES
SOLICITOR OF U. S. & FOREIGN PATENTS
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Engineering MECHANICAL, ELECTRICAL, STEAM, CIVIL.

Complete and short courses. Thoroughly equipped engineering shops. **Shop work from the beginning.** Short courses in Steam and Electrical Engineering. Expenses low. Accommodations the best. School all year. Students may enter any time. Correspondence steam and electrical courses. Send for catalogue. Mention course in which interested.
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"AMERICAN" STORAGE CELLS
ARE THE BEST. Send for descriptive Circular.
AMERICAN BATTERY CO.,
ECT'D 1890. 171 S. Clinton St., Chicago.

DON'T BUY ELECTRICAL SUPPLIES

Until you have seen our new Catalogue and new Price List.
Free to the trade.

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NATIONAL CODE STANDARD

WEATHER-PROOF TRADE MARK "O.K." LINE AND HOUSE WIRES

"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Ideal Wire.

Prices and Samples on Application.

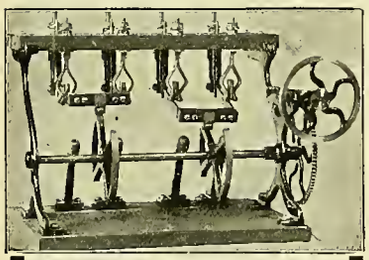
Phillips Insulated Wire Co.
Office and Factory: PAWTUCKET, R. I.

YOST SPECIALTIES.

Sookets, Wall Sockets, Weatherproof Sockets, Rosettes, Receptacles, Cord Adjusters.

Catalogue for the asking.

THE YOST ELECTRIC MFG. CO.
TOLEDO, OHIO.



TO ELECTRICAL CONTRACTORS

Wouldn't you like to represent us in your city and sell the Reco and **Improved Reynolds** Electric Sign **Flashers?**

They are very easy to sell and we'll pay you a fine commission.

You invest absolutely nothing.

Simply make the sale and get your cash commission from us.

The Reco and **Improved Reynolds** are very easy to sell because they not only make a sign ten times as attractive but they save 50% of the current bill. No flashers in the world are so **simple, durable** and **easy to sell** as the **Reco and Improved Reynolds.**

They are **the leaders** everywhere.

Write us for our **liberal** propositions, prices, etc. We know you will be interested.

Reynolds Electric Flasher Manufacturing Co.
221 Fifth Ave., Chicago, U. S. A.

MOULDED MICA SOCKETS

WEATHERPROOF

No. 1143

These sockets are made of Moulded Mica and are absolutely waterproof on top. They are suitable for street decorations, parks, domes, paper mills, furnaces, laundries, tunnels, packing houses and other damp places. They are practically indestructible and will withstand considerable rough usage.

Furnished in several forms, the No. 1143 being threaded for screwing to brackets.

No. 1140

H. W. JOHNS-MANVILLE CO.

Manufacturers Electric Railway Supplies, Asbestos and Magnesia Pipe and Boiler Coverings, Roofing and Packings

100 William Street - - NEW YORK

New York	Philadelphia	San Francisco	Minneapolis	London
Milwaukee	St. Louis	Los Angeles	Little Rock	Paris
Chicago	Pittsburg	Seattle	New Orleans	Brussels
Boston	Cleveland	Kansas City		

PREDOMINATES IN 27 States

"IT gives me great pleasure to state, that for 'Gitthereitiveness' your periodical certainly is a winner. As you perhaps are aware, the company I travel for, advertises in all the electrical papers, and it has been a question in my mind whether they reached every central station, as their advertising manager would have our company believe. So, for one year I have kept account of the electrical papers and periodicals subscribed for and received by the manager or superintendent of electric light companies in twenty-seven states, (which has been my territory), and in summing it up, I find that your periodical predominates, three to one. I do not get in many telephone plants, but when I do, I invariably find the 'Western Electrician' staring me in the face."

The letter from which the above is taken, is dated May 8, 1905, and is on file in this office.

WANTED, FOR SALE *and similar* **WANT COLUMN** *advertisements (50 words or less), $1.50 an insertion; additional words 3c each.* **POSITION WANTED** *advertisements (50 words or less), $1.00 an insertion; additional words 2c each.*

POSITION WANTED

In light or power plant as an engineer. Experience, greater part of past twelve years with D. C. and A. C. generators; high and slow speed engines. Thirty-six years of age and strictly temperate. Place preferred where conscientiousness and faithfulness are appreciated. References from former employers. Address BOX 496, care of Western Electrician, 510 Marquette Bldg., Chicago, Ill.

POSITION WANTED.

A young man twenty-seven years of age desires a position with an electric light, power or manufacturing company, preferably east of Mississippi river. University trained and well experienced in the construction, care and repair of electrical machinery and apparatus and in house-wiring. Former employers as references. Address BOX 502, care Western Electrician, 510 Marquette Building, Chicago.

WANTED

Electrical engineer wanted to take charge of electric light and water plant in small town of about 2,000 inhabitants. Must know how to test meters, do wiring, hold engineer's license, be able to give reference. For further information write L. ALBER, City Clerk, Bellevue, Iowa.

FOR SALE.

Weston Portable Wattmeter, Empire Portable Voltmeter, Empire Portable Ammeter, guaranteed in good condition. DUCKWALL-HARMAN RUBBER & SUPPLY CO., Indianapolis, Ind.

FOR SALE.

GAS ENGINE AND DYNAMO.

A 15-horse gas or gasoline engine now used with 110 V., 128 Amp., 16 K. W. Bain dynamo. All complete; absolutely perfect condition. Used only very short time. Need A. C. generator and transformer. Would consider exchange. Will accept low cash price. Address BOX 501, care Western Electrician, 510 Marquette Building, Chicago.

SECOND-HAND MACHINERY

1 A. 70 T. H. 125 Cycle, 1100 Volt Alternator, 1070 R. P. M.
2 120 K. W. General Electric 125 Cycle, 1100 Volt, Type A. S. 1070 R. P. M. All complete with exciters—self-oiling bearings.
1 150 K. W. General Electric, 2 Phase, 60 Cycle, 2200 Volt, compensated revolving field alternator, 600 R. P. M.
1 270 K. W. T. H. 550 Volt Railway Generator, 600 R. P. M.
1 A. 70 Armature newly rewound.
1 20 K. W. 250 Volt Westinghouse Generator direct coupled to 7x10 Ideal Automatic Engine, new.
1 24x18 Ideal Automatic Engine.
2 66-inch x 20-ft. Return Tubular Boilers built for 130 lbs. working pressure.
2 200 H. P. Marine Type Boilers, equipped with the Morrision furnace, 130 lbs.

The above is all in first-class operating condition and is offered subject to prior sale.

Springfield Light, Heat & Power Company
Springfield, Ill.

Automatic Engines

FOR SALE AT GREAT SACRIFICE

2—200 H. P. 13-in. & 26-in. x 12-in. Armington & Sims tandem compound. Wheels 8-ft. x 22-in. face.

1—150 H. P. 15¼-in. x 15¼-in. Dick & Church center crank. Wheels 6-ft. x 16¼-in. face.

1—125 H. P. 11-in. & 18-in. x 16-in. McEwen tandem compound. Wheel 64-in. diameter x 12½-in. face.

1—15 H. P. 7-in. x 8-in. Payne center crank. Wheels to suit purchaser.

THOMAS P. CONARD
119 So. Fourth St. Philadelphia, Pa.

ELECTRICAL MATERIAL FROM THE ST. LOUIS WORLD'S FAIR

Over one million dollar's worth of electrical supplies is offered for sale at very low prices. This is an opportunity which you dare not overlook. We are making shipment of this material direct from our St. Louis headquarters. We guarantee everything to be strictly in first-class condition.

RUBBER COVERED WIRE

In long lengths, on coils and reels, carefully selected and guaranteed good as new for further service.

140,000 ft. No. 14	130,000 ft. No. 2
65,000 ft. No. 12	60,000 ft. No. 1
30,000 ft. No. 10	25,000 ft. No. 1-0
45,000 ft. No. 8	14,000 ft. No. 2-0
15,000 ft. No. 6	16,000 ft. No. 3-0
100,000 ft. No. 4	48,000 ft. No. 4 0
90,000 ft. No. 3	

75,000 ft. 300, 350, 400, 500 and 600,000 C. M.

Slow Burning Weatherproof Wire

50,000 lbs. No. 16	40,000 lbs. No. 4
50,000 lbs. No. 14	50,000 lbs. No. 3-0
50,000 lbs. No. 12	100,000 lbs. 300,000 C. M.
50,000 lbs. No. 10	175,000 lbs. 400,000 C. M.
35,000 lbs. No. 8	140,000 lbs. 500,000 C. M.
30,000 lbs. No. 6	40,000 lbs. 600,000 C. M.

Weatherproof Wire, Triple Braid, Solid Conductor

60,000 lbs. No. 14	45,000 lbs. No. 4
50,000 lbs. No. 12	10,000 lbs. No. 3
60,000 lbs. No. 10	25,000 lbs. No. 2
25,000 lbs No. 8	30,000 lbs. No. 1
110,000 lbs. No. 6	

Weatherproof Wire, Triple Braid, Stranded Conductor

150,000 lbs No. 2-0	40,000 lbs. No. 1-0

LEAD COVERED CABLE

500,000 feet, all sizes from No. 14 to 500,000 C. M. Quick delivery and low prices.

INCANDESCENT LAMPS

200,000 lamps, used a short time, and in good condition for further service. Have been tested. They are 104 voltage, Edison Base, 8 candlepower. In lots of 1000, each 5 cents.

150,000 brand new Incandescent Lamps in original cases of 200, 250 and 400 Lamps, ranging from 100 to 110 voltage, 8 candlepower, General Electric make. Price each in case lots, 10 cents.

200,000 Colored Incandescent Lamps, brand new, never used, General Electric make, 104 voltage, Edison Base; colors, Amber, Green, Opal and Ruby; put up 200 in a case. Price, each 20 cents; are worth 35 cents each.

20,000 Incandescent Lamps, voltage 100 to 120, Edison, T. H. and Westinghouse Base; 8, 10, 16, 20 and 25 candlepower; put up 250 in a case, second selection. Price each in case lots 10½ cts.

WOOD CONDUIT

100,000 Feet, Size 4½ x 4½

MISCELLANEOUS

300,000 No. 9171 Porcelain, Edison Base Receptacles.
50,000 Weatherproof "Bryant" Sockets.
1,000,000 split glazed B. & D. Wiring Knobs.
300,000 Glazed Porcelain B. & D. Wiring Knobs, sizes 3½, 4½ and 5½.
20,000 No 8 Standard Porcelain Knobs.
200,000 Single Wire glazed Porcelain Cleats.
15,000 Porcelain Cut-outs.
26,000 Plugs.
2,000 000 unglazed Porcelain Tubes.
40,000 Glass Insulators.
20,000 Porcelain Cleats.
All kinds of switches and instruments.

Ask for our Special Catalogue No. 567.

CHICAGO HOUSE WRECKING COMPANY, 35th and Iron Sts., CHICAGO

ADVERTISEMENT FOR BIDS FOR FRANCHISE UNDER SECTIONS 940B TO 940J OF THE REVISED STATUTE OF THE STATE OF WISCONSIN FOR THE YEAR 1898.

Whereas, Application has been made to the Common Council of the City of Marinette, Wisconsin, for a franchise to construct, operate and maintain for a period of twenty-five (25) years in said city of Marinette a messenger and combination fire-alarm, night-watch and patrol system, and to that end to erect and maintain for said period of twenty-five (25) years poles, posts and wires, in and along the streets and alleys of said City of Marinette; and,

Whereas, Said application was duly filed with the City Clerk of said City of Marinette, on the 17th day of June, A. D. 1905, and published at the expense of the applicant in the official paper of the City of Marinette, in the manner and form required by Section 940B of the Revised Statutes of the State of Wisconsin for the year 1898; and,

Whereas, Due proof of such publication has been made in the manner in which the publication of ordinances is required to be proved, and such proof duly filed with the City Clerk of said City of Marinette, on the 5th day of July, A. D. 1905, and all in the manner and form as required by Section 940B of the Revised Statutes of the State of Wisconsin for the year 1898; and,

Whereas, In conformity with the provisions of Section 940D of the Revised Statutes of the State of Wisconsin for the year 1898, the Common Council of the City of Marinette has caused to be prepared full specifications containing the rules and regulations for the maintenance and operation of the plant and for the conduct of the business for which such franchise is to be granted, which said specifications were duly and properly approved by said Common Council and the original thereof ordered placed on file in the office of the City Clerk of the City of Marinette, reference to which specifications is hereby made;

NOW, THEREFORE, the Common Council of the City of Marinette requests that proposals be submitted, stating what percentage of the gross receipts from the business carried on under the franchise the bidder will pay annually into the treasury of the City of Marinette in consideration of receiving such franchise. All bids to be written, sealed and made in conformity with the advertisement and the specifications now on file in the office of the City Clerk of the City of Marinette, and addressed to the Common Council of the City of Marinette, Wisconsin, and filed in the office of the City Clerk of the City of Marinette, on or before August 10, 1905, when all bids for such franchise shall be considered closed.

M. H. MAXWELL,
Dated July 10, 1905. City Clerk.

When a man's electrical business shows a steady and healthy growth; when he sees only the bright side of things and never endeavors to discover a possible dark side; when he says business conditions are improving, you will be pretty safe in assuming that he advertises in the Western Electrician 52 times a year.

We are Headquartera for ELECTRICAL REPAIR WORK We operate the largest repair shops in America and have exceptional facilities for quick work. We repair **all kinds** of electrical apparatus and save our customers **weeks** in time in comparison with sending the work to the manufacturers direct. We have just reduced our prices and ask you to get our quotations on

Armatures Rewound, Commutators Refilled, Transformers Rewound, Etc.

Send for our monthly **"Bargain Sheet,"** showing net prices on our stock of **second-hand** dynamos, motors, meters, transformers and supplies. Every article a bargain.

GREGORY ELECTRIC CO.
54-62 S. Clinton Street - CHICAGO

EVERY COMFORT

Attends the Traveler between

Chicago Indianapolis Cincinnati & Louisville

Who Travels via the

MONON ROUTE

Consult Your Local Ticket Agent

WANTED

Orders for arc lamp designs. Will furnish plans of arc lamps in all essential particulars and for all purposes. Address

A. F. HAMACEK
2014 Kenmore Ave., Chicago, Ill.

ELECTRICAL AND OTHER INDUSTRIES ARE OFFERED LOCATIONS

WITH

Satisfactory Inducements,
Favorable Freight Rates,
Good Labor Conditions,
Healthful Communities,

ON THE LINES OF

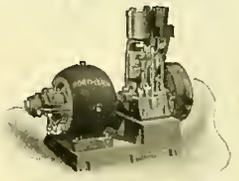
THE ILLINOIS CENTRAL R. R.
AND THE
YAZOO & MISSISSIPPI VALLEY R. R.

For full information and descriptive pamphlet address

J. C. CLAIR,
Industrial Commissioner
1 Park Row, Chicago, Ill

YOU FIND NORTHERN DYNAMOS EVERYWHERE

In all sorts of work, affording economical, convenient satisfactory operation under all sorts of conditions. : : : : : :



Northern Machines Easily Applied

EASILY KEPT IN GOOD OPERATIVE CONDITION

BULLETIN 2546

We show a Northern Spherical Dynamo direct connected to an Ohmen Engine

NORTHERN ELECTRICAL MFG. CO., ENGINEERS MANUFACTURERS
Madison, Wis., U. S. A.
CHICAGO, OFFICE, 425 MONADNOCK BLOCK 546

CHICAGO EDISON COMPANY REPAIR SHOPS

High-Grade Machine Work of All Kinds
Correspondence Solicited.

76 MARKET STREET, CHICAGO. TELEPHONE MAIN 1280

FIRST CLASS EQUIPMENT THROUGHOUT

Dynamos, Armatures, Motors, Arc Lamps, Fans, Instruments.

ELECTRICAL REPAIRING

We Guarantee All Work

DYNAMOS, ARMATURES, MOTORS, ARC LAMPS, INSTRUMENTS, GENERAL REPAIRING. Correspondence Solicited.
NEW AND SECOND-HAND MACHINERY FOR SALE

SOUTHWESTERN ELECTRIC CO., ST. LOUIS.

On receipt of
10 CENTS
we will send you a
Western Electrician Moonlight Schedule
for 1905.
Every lighting man should have one.

Electrician Publishing Company,
510 Marquette Bldg., Chicago.

Tenth Edition. Just Published.

ELECTRICITY SIMPLIFIED

By PROF. T. O'CONOR SLOANE

158 Pages. Fully Illustrated. PRICE, $1.00

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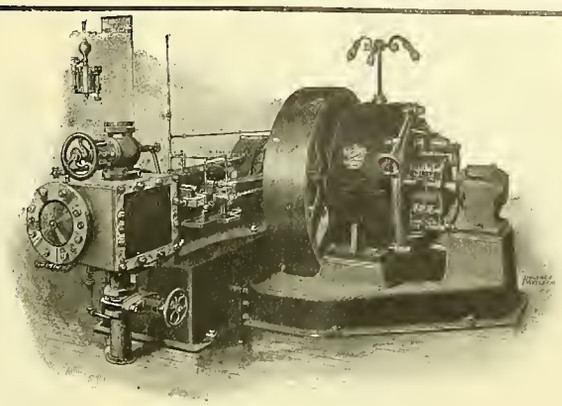

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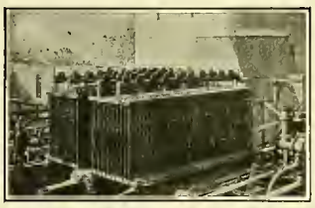

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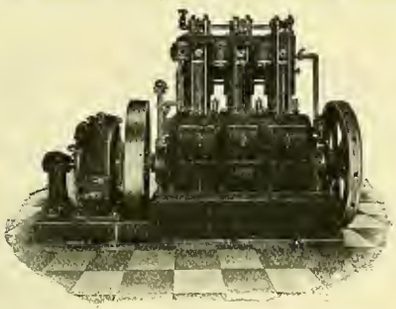

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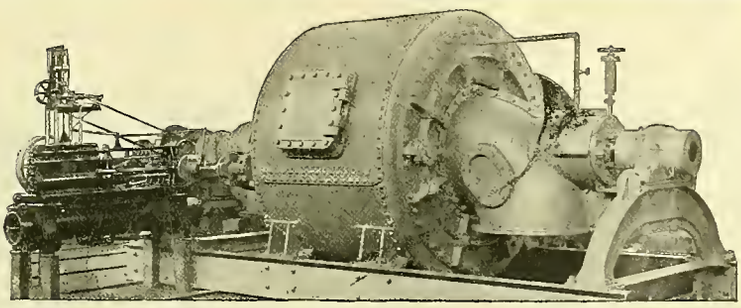

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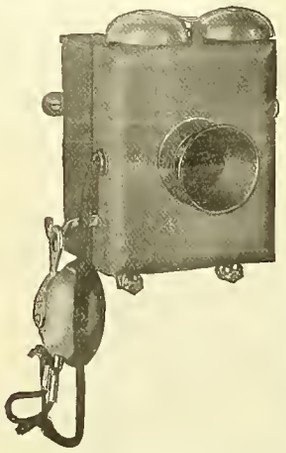

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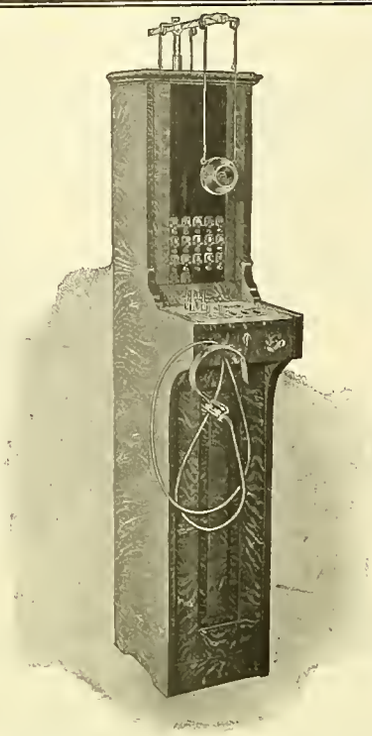

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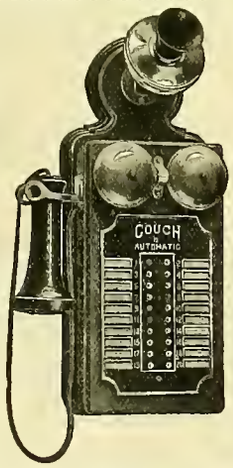

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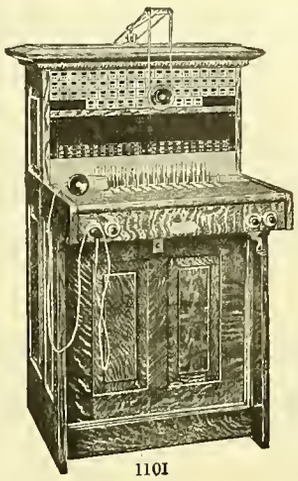

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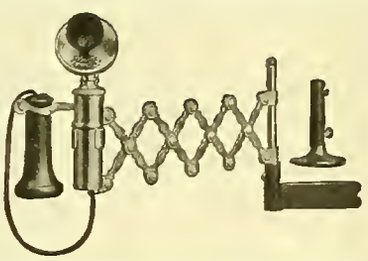

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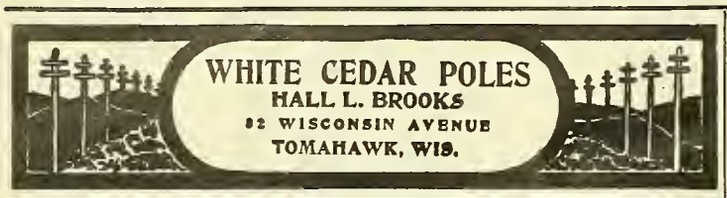

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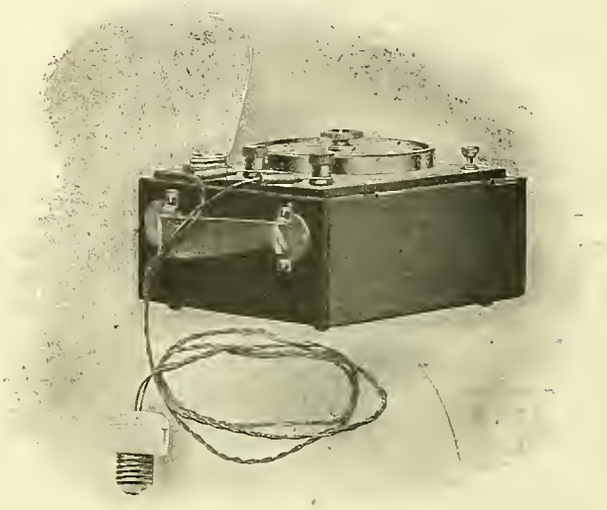

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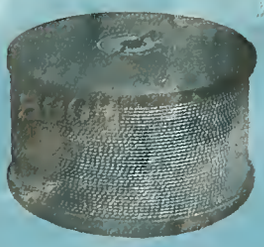

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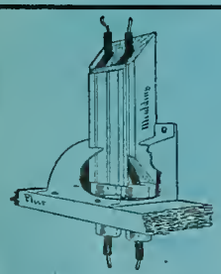

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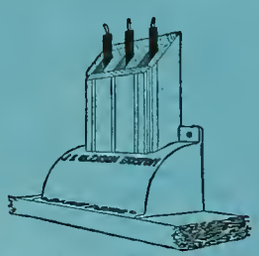

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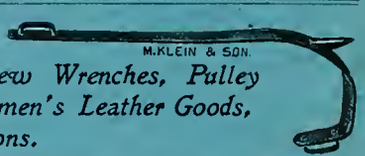

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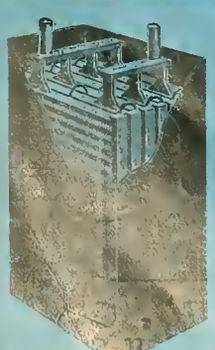

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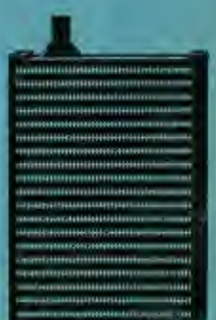

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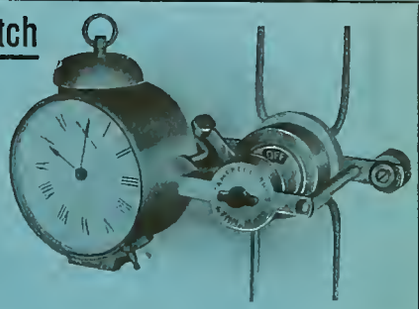

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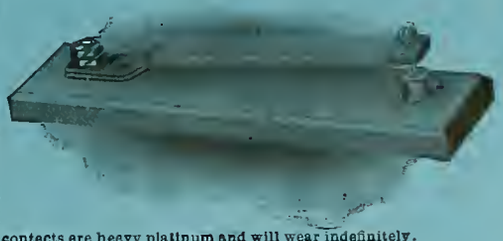

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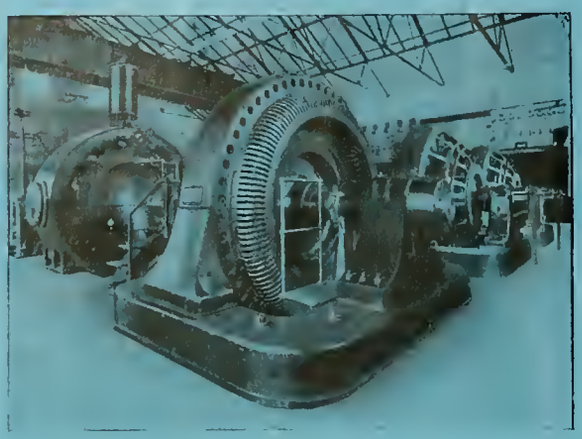

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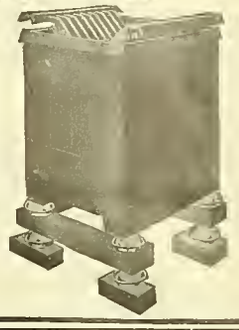
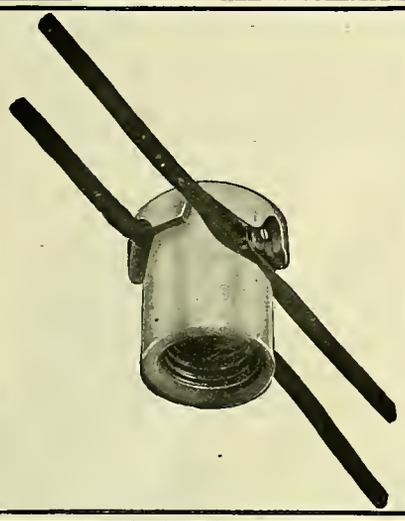




NOW READY

THE

P. & S. Decorative Socket No. 417

You don't have to take it apart to wire it up. Simply slip the wires in the slots and turn in the screw.

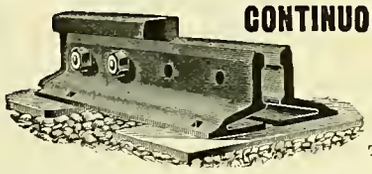
Your next order solicited.

PASS & SEYMOUR, Inc., Solvay, N. Y.

NEW YORK CHICAGO SAN FRANCISCO

TRANSFORMERS

KUHLMAN ELECTRIC CO., - - ELKHART, IND.



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NEWARK, N. J.

OVER 20,000 MILES IN USE

The St. Louis Exposition, 1904, awarded us the only gold medal for rail joint products.

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PLATINUM
Resistance wires to specifications. Protective fuses for small currents.

NEW YORK OFFICE: 120 Liberty Street.

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Ignition fuses for torpedo and mining operations. Special forms for wireless telegraphy.

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PLATINUM
All forms of electrical contacts.

Grand Prize
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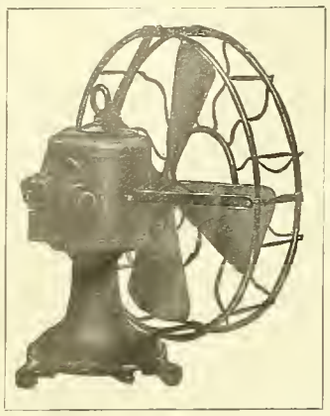


REMEMBER THE NAME AND BUY THE BEST

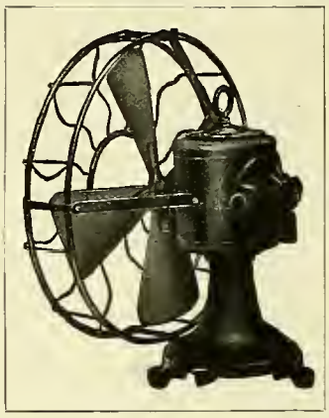
PARAGON FAN MOTORS

STANDARD FOR YEARS

CALL AND SEE THEM OR WRITE FOR PRICES

CHICAGO EDISON COMPANY,

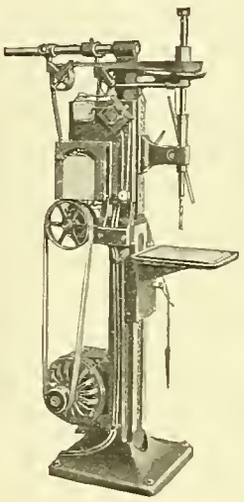
139 ADAMS ST., CHICAGO.



STANLEY-G.I. ELECTRIC MANUFACTURING COMPANY

PITTSFIELD MASSACHUSETTS

TYPE "L" MOTORS



Simple, Compact, Efficient, Substantial, Economical.

Type "L" Motors are particularly well adapted for driving machine tools. Their design is such that constant speed at each position of the rheostat is assured, even though the load varies through wide limits. Send for Motor Bulletin 145.

BRANCH OFFICES:

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CINCINNATI, O., First National Bank Building
PHILADELPHIA, PA., North American Building
SAN FRANCISCO, CAL., 69-75 New Montgomery St.
MEXICO CITY, V. M. Braschi & Co.
CHICAGO, ILL., Monadnock Block
BOSTON, MASS., Oliver Building
NEW YORK, N. Y., 29 Broadway
ST. LOUIS, MO., Century Building
SEATTLE, WASH., Pioneer Building

Not What It Costs But What It Saves

WHEN a friction clutch slips it **grinds** away its faces and exerts about one-half its maximum power. When it **doesn't** slip it starts the load with a **jerk.**

Not much to choose from there.

In starting a load, the Accelerator **gives** but it **doesn't** grind. It **gives** but it exerts its **maximum** power due almost wholly to magnetic induction, **not** to wearing friction. Because it pulls **without** using wearing friction it **doesn't** grind away the faces. Because it exerts **power** while it gives it starts the machine **smoothly.**

Now here's the **proposition** in a nut-shell:

Buy a friction clutch—**renew** faces continually, put up with the continued **expense** and **delays** incident thereto, stand the annoyance of grease thrown around and **take chances** of injuring your machine.

OR—

Buy an Accelerator—**no** renewing of faces, **no** delays, **no** grease, the working parts being **enclosed** in an oil-tight case; **always** get a smooth, easy start for your machine by using push buttons, switches, or automatic devices.

And remember it isn't what we **charge** you for an Accelerator that is **most** important, it's **how many times the Accelerator will save that cost** for you. In one installation it is saving nearly **three times** its cost in one year.

Cutler-Hammer Clutch Co.

MILWAUKEE, WIS.

NEW YORK	BOSTON	CHICAGO	PITTSBURG
136 Liberty St.	176 Federal St.	Monadnock Bldg.	Farmers Bank Bldg.

The "REFLECTRIC"

is furnished FREE to customers by live Central Stations.
Write for booklet.

WESTERN DISPLAY COMPANY, SOLE MANUFACTURERS

ST. PAUL, - - MINN.

AITON MACHINE CO.

INSULATING, CABLING, RUBBER AND HYDRAULIC MACHINERY.

OFFICE:
126 LIBERTY ST., NEW YORK
WORKS: HARRISON, N. J.

D. & W. NEW-CODE FUSES

Are listed fully in the new D. & W. Price-list No. 10,—just issued. This price-list also prints a revised list of old code fuses and is intended as a supplement to the D. & W. Catalogue No. 9. *Write for a copy.*

OKONITE IT NEVER DISAPPOINTS

Central Electric Company,

GENERAL WESTERN AGENTS

207-209-211 East Jackson Boulevard, CHICAGO

OKONITE IT NEVER DISAPPOINTS

"Diamond H" Switches

Trade H Mark

This Trade-Mark guarantees quality.

The Hart Mfg. Co., Hartford, Conn.

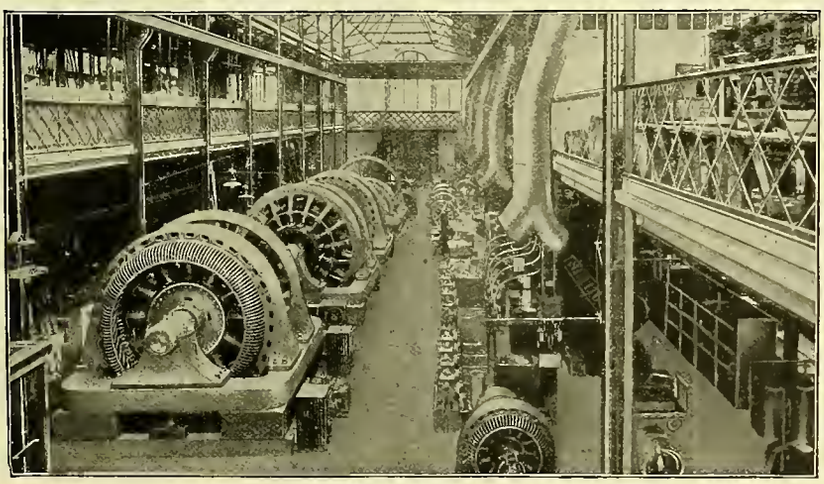
New York Boston Chicago Toronto, Ont.

ELECTRIC PORTABLES

ASK FOR CATALOG

THE PLUME & ATWOOD MFG. CO.

New York Chicago



View in Our Erecting Bay, showing Electrical Machinery (9,000 Kw.) ready for shipment.

Direct and Alternating Current

Electrical Machinery

Built in all Capacities and Types

NATIONAL ELECTRIC COMPANY

MILWAUKEE

You will confer a favor upon the advertiser by telling him—when you write him—that you saw his ad. in the Western Electrician.

STANLEY INSTRUMENT CO., GREAT BARRINGTON, MASS.

ARE NOW MANUFACTURING AND SOLICIT ORDERS FOR

MODEL H-6 ROTATED JEWEL BEARING STANLEY WATTMETERS

For Alternating Current, Single Phase and Polyphase Service constructed to conform strictly to the suggestion contained in the following language quoted from the opinion filed September 9th, 1904, in the

UNITED STATES CIRCUIT COURT OF APPEALS FOR THE FIRST CIRCUIT:

"If the device stopped with "a metallic rotating body" and some method other than a counting machine operated by it was used for determining the number of its revolutions, we might not be able to charge the respondent with infringing. We might then well apply the proposition of the respondent that a mere meter is in a different art from a motor. ***** "Therefore, as it may well be that, if the counting mechanism was of a kind not operated by the "metallic rotating body," we should not be compelled to find infringement, we hesitate in view of the minute amount of energy exerted."

The Train Registration, or Counting Mechanism in Model H-6 Wattmeters is independently operated and positively driven by a spring; the disc or rotating body does not and cannot operate the counting mechanism; train friction removed from rotating body of meter.

Jewel Surface always new—Spring Supported Pivot overcomes vibration.

PERMANENT ACCURACY AT ALL LOADS

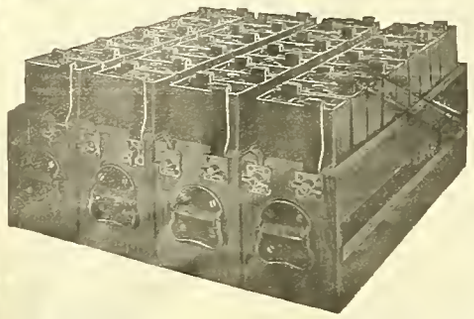
PRICES CONSIDERABLY LESS TO ALL PURCHASERS THAN HERETOFORE PREVAILING

SPECIAL VERY LOW PRICES FOR ENTIRE REQUIREMENTS OR QUANTITY

ORDERS PROMPTLY FILLED

STANLEY INSTRUMENT CO., GREAT BARRINGTON, MASS.

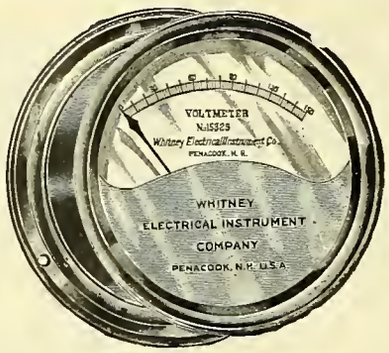
HIGH CLASS WORK



in small lighting plants where a storage battery not to exceed 250 ampere hours (25-16 C. P. lamps for 8 hours) is needed.

Also in telephone, fire alarm and police patrol storage battery work. Let us quote on above class of work.

Northwestern Storage Battery Co.,
285 Madison St., - - - - Chicago, Ill.



Diam. of body, 6 in., of base flange 7½ in.

THE
"I. P." (ISOLATED PLANT) TYPE
DIRECT-CURRENT
INSTRUMENTS

Are winners. Scales are equally divided, indications are dead beat, high range ammeters have separate shunts and the cases are of heavy polished brass.

Prices are right, the list figure for the meter illustrated, for instance, being $16.50.

WRITE FOR DISCOUNTS TO

MACHADO & ROLLER,
203 BROADWAY, NEW YORK CITY, N. Y., Or Your Nearest Supply House.

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Wesco Supply Co.
Western Electric Co.

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Western Electric Co.

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Leather Preserver Mfg. Corp.

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Western Electric Co.

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Electric Appliance Co.
National Carbon Co.
Reisinger, Hugo.
Wesco Supply Co.

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Plume & Atwood Mfg. Co.

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Wesco Supply Co.
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Westinghouse El. & Mfg. Co.

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Plume & Atwood Mfg. Co.

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Cutler-Hammer Clutch Co.

Coal and Ashes Handling Machinery.
Jeffrey Mfg. Co.

Coal Mining Machinery.
Allis-Chalmers Company.

Coils and Magnets.
Western Electric Co.

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Fres-Ko Chemical Co.
McLennan & Co., K.
Slusser Bros.

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Stanley—G. I. Elec. Mfg. Co.

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American Conduit Company
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Electric Appliance Co.
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Osburn Flexible Conduit Co.
Wesco Supply Co.

Conduits, Clay.
McRoy Clay Works.

Contractor, Elec. Subway.
Gest, G. M.

Contractors and Electric Light Plants.
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Wagner Electric Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

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Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Company.

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General Elec. Co.
Gregory Electric Co.
National Electric Co.
Northern Electrical Mfg. Co.
Parsell & Weed.
Robbins & Myers Co.
Stanley—G. I. Elec. Mfg. Co.
Stow Manufacturing Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
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Electric Heating Appl.
Electric Appliance Co.
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Kohler Brothers.
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Sargent & Lundy.
Schott, W. H.
Stanley—G. I. Elec. Mfg. Co.
Stanton, LeRoy W.
Underhill, Chas. R.
Willis, G. M.

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Central Electric Co.
Diamond Meter Co.
Duncan Elec. Mfg. Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
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Machado & Roller.
Pignolet, L. M.
Reliance Instrument Co.
Robert Inst. Co., The.
Stanley—G. I. Elec. Mfg. Co.
Stanley Instrument Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co
Weston Electrical Inst. Co.

Electro-Plating Mach'y
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General Electric Co.

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Allis-Chalmers Company.

Engines, Gas and Gasoline.
Allis-Chalmers Company.
Marinette Gas Engine Co.

Engines, Oil.
American Diesel Engine Co.

Engines, Steam.
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Central Electric Co.
Century Electric Co.
Crocker-Wheeler Company.
Edison Mfg. Co.
General Electric Co.
Robbins & Myers Co., The.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Fans, Exhaust and Ventilating.
Green Fuel Economizer Co.

Fibre.
Kartavert Mfg. Co.
Vulcanized Fibre Co.

Fittings.
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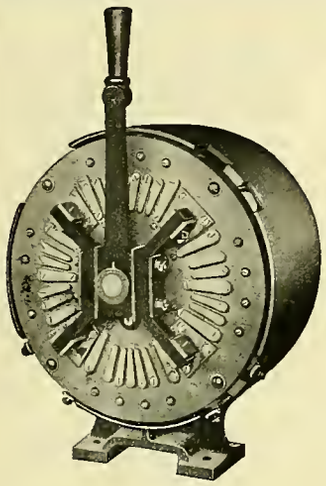

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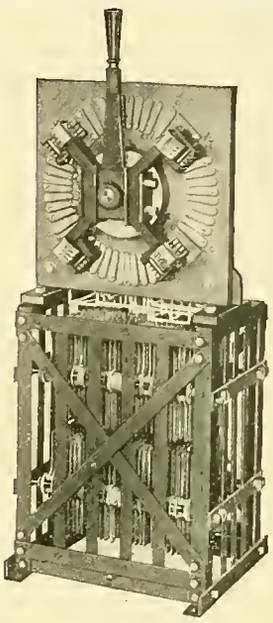

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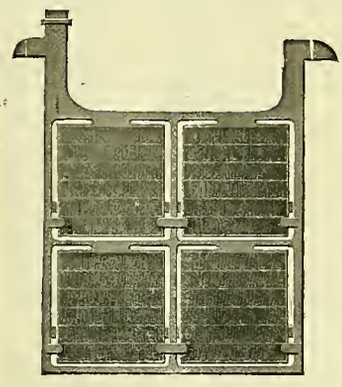

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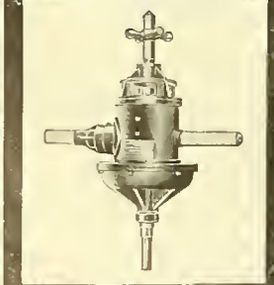

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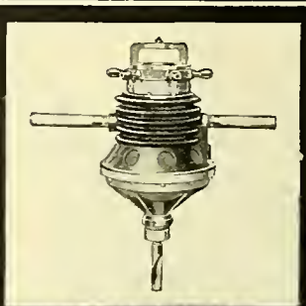

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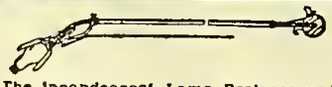

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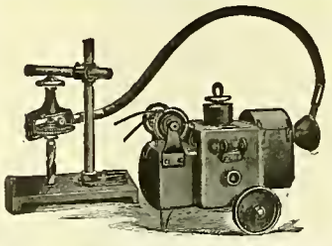

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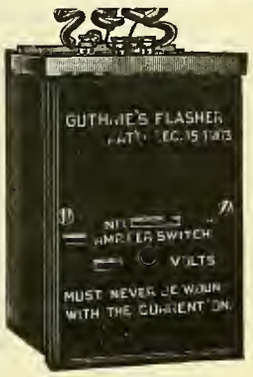

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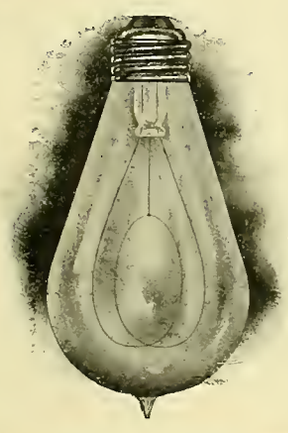

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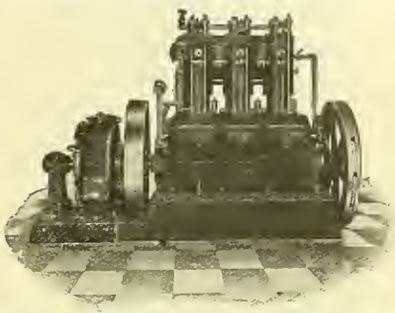

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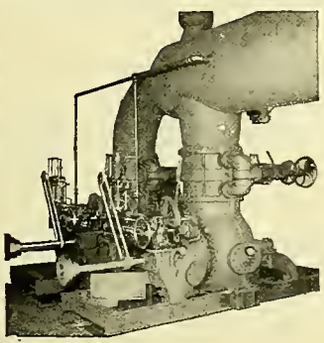

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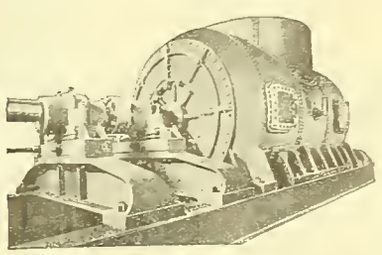

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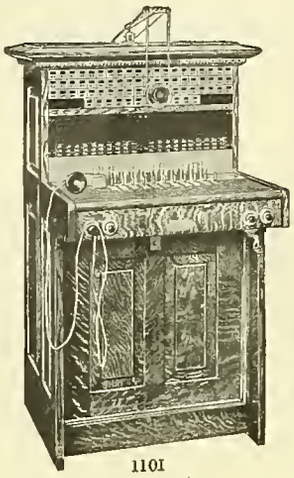

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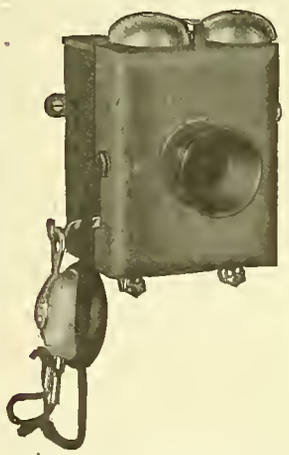

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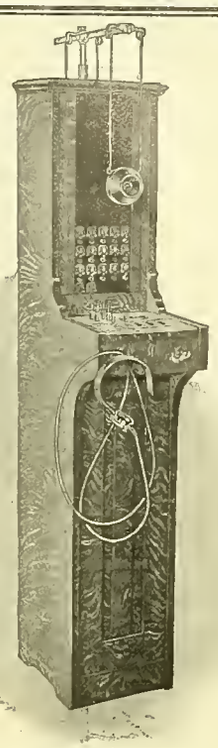

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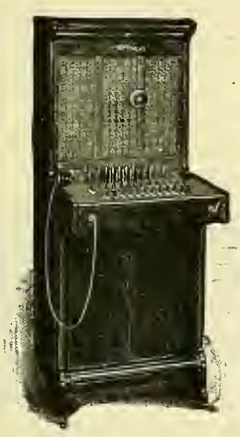

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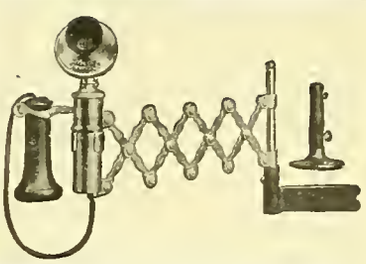

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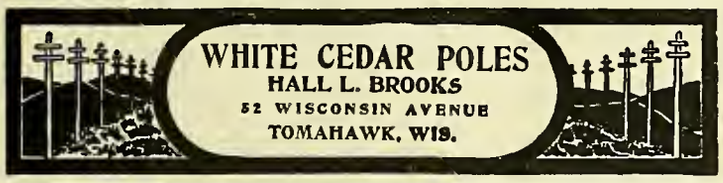

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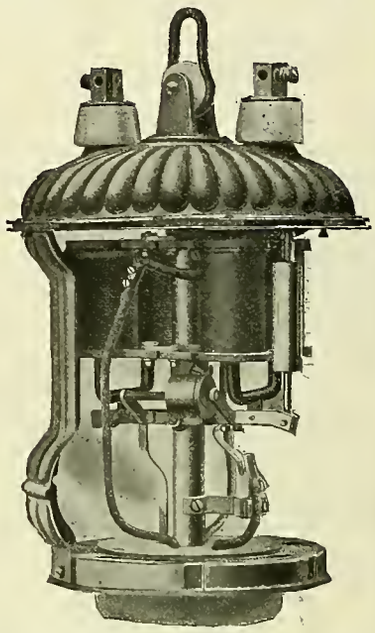

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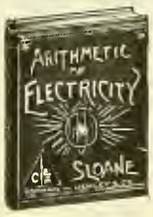

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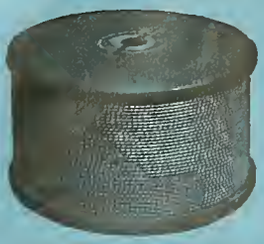

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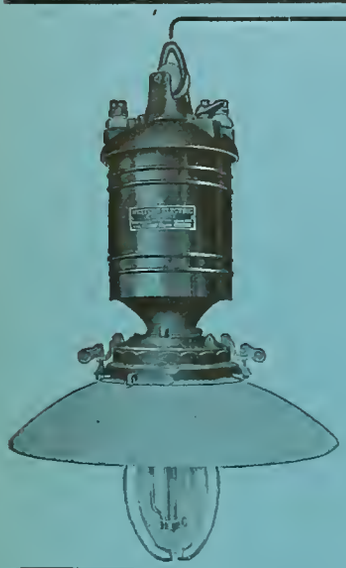

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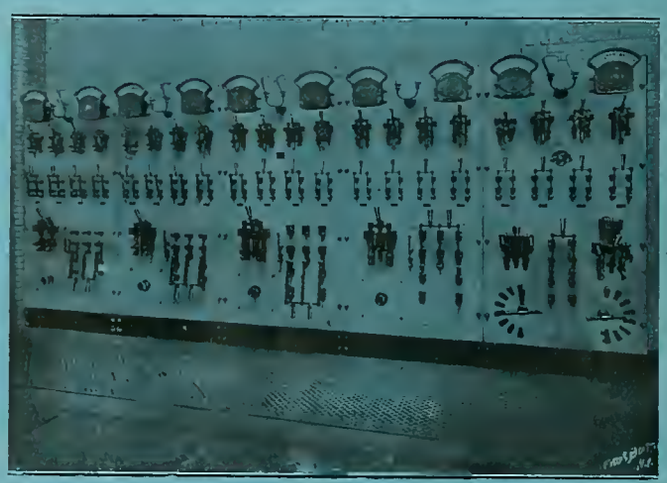

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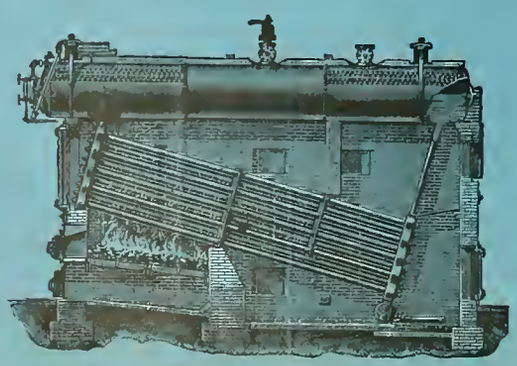

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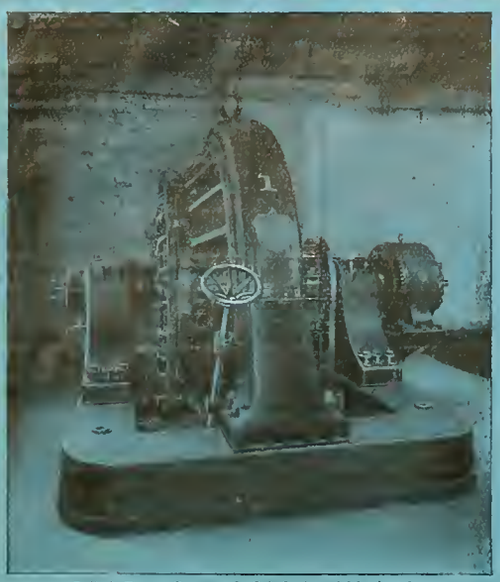

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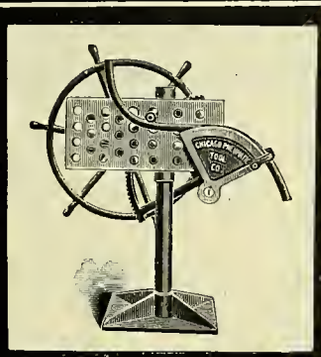

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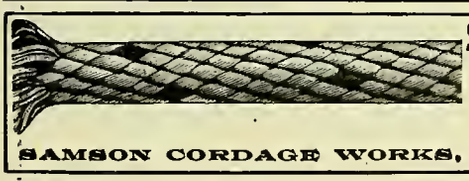

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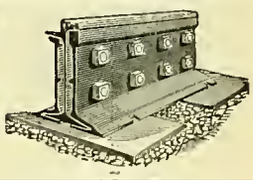

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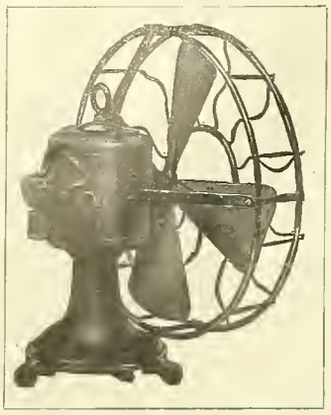

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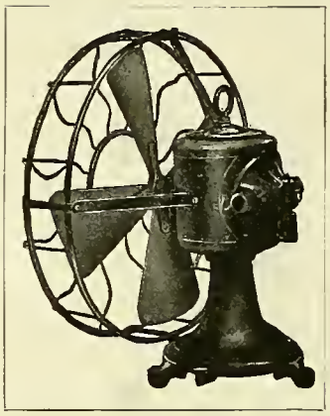

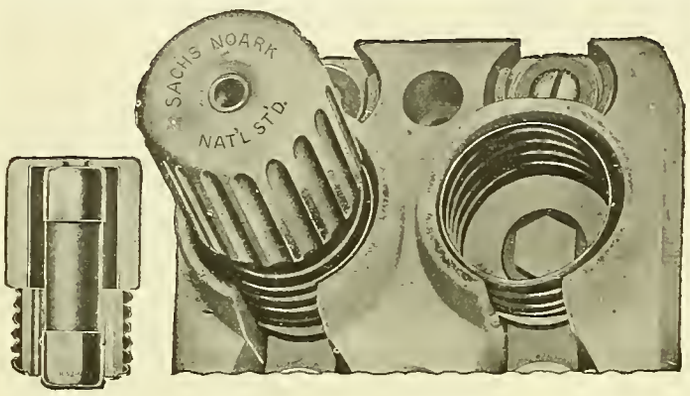

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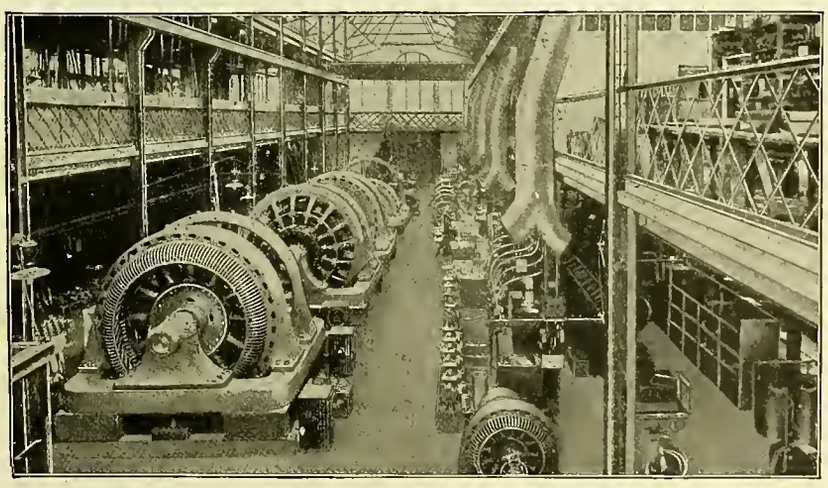

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Addison Glass Co.
Fostoria Incan. Lamp Co.
Haller Machine Co.
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Hydraulic Machinery.
Alton Machine Co.
Allis-Chalmers Company.

Indicators.
Robertson & Sons, Jas. L.

Inspection & Insurance
Hartford Steam Boiler Inspection & Insurance Co.

Insulating Machinery.
Alton Machine Co.

Insulators and Insulating Materials.
American Electrical Works.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
Indiana Rub. & Ins. Wire Co.
Johns-Manville Co., H. W.
Kartavert Mfg. Co.
Manhattan Elec. Supply Co.
Mica Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Vulcanized Fibre Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Iron Castings.
Alton Machine Co.

Lamps, Arc.
Bissell Co., The F.
Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Gregory Electric Co.
Manhattan Elec. Supply Co.
Stanley—G. I. Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamps, Incandescent.
Bissell Co., The F.
Bryan-Marsh Company.
Buckeye Electric Company.
Central Electric Co.
Chicago Edison Co.
Columbia Incan. Lamp Co.
Edison Decorative & Miniature Lamp Dept.
Electric Appliance Co.
Fostoria Incand. Lamp Co.
General Electric Co.
Sunbeam Incan. Lamp Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamps, Incandescent—Replacers & Cleaners.
Inc. El. Lt. Manipulator Co.

Letters, Metal, Sign.
Haller Machine Co.

Lightning Arresters.
Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Manhattan Elec. Supply Co.
Stanley—G. I. Elec. Mfg. Co.
Tornquist Elect'l. Mfg. Co.
Wesco Supply Co.
Western Electric Co.

Linemen's Climbers.
Klein & Sons, Mathias.

Magnet Wires.
(See Wires and Cables.)

Mechanical Draft.
Green Fuel Economizer Co.

Mica.
Chicago Mica Co.
Mica Insulator Co.
Munsell & Co., Eugene.

Mining Apparatus, Elec.
Allis-Chalmers Company. (Bullock El. Mfg. Co.)
Crocker-Wheeler Company.
General Electric Co.
Jeffrey Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Mining Machinery,
Allis-Chalmers Company.

Motors. (See Dynamos and Motors.)

Nippers and Pliers.
Klein & Sons, Mathias.

Overalls.
Carhartt & Co., Hamilton.

Patent Attorneys.
Bain, Foree.
Stevens & Co., Milo B.

Phosphor Bronze.
Phosphor Bronze Sm. Co. Ltd.

Pipe Bending Machines.
Chicago Pneumatic Tool Co.

Platinum, Wire and Sheet.
Baker & Co., Inc.

Poles and Ties.
Berthold & Jennings.
Brooks, Hall L.
Duluth Log Co.
Fowler, John H.
Kellogg Switch. & Sup. Co.
Lindsley Bros. Co.
Loud's Sons Co., H. M.
Maltby Cedar Co.
Minnesota Cedar & Lbr. Co.
Mueller Company, William.
Pacific Coast Pole Co.
Perrizo & Sons.
Pillsbury-Watkins Co.
Pittsburg & L. S. Iron Co.
Porter Cedar Company.
S. E. Missouri Cypress Co.
Sterling & Son, W. C.
Torrey Cedar Co.
Valentine-Clark Co., The.
Western Lumber & Pole Co.
White Marble Lime Co.
Worcester Co., C. H.

Pole Hole Diggers.
Western Steel Gate Co.

Polish (Metal).
Hoffman, Geo. W.

Porcelain Specialties.
Pass & Seymour, Inc.
Peru Electric Mfg. Co.

Portables.
Plume & Atwood Mfg. Co.

Power Transmission Machinery.
Allis-Chalmers Company.
Jeffrey Mfg. Co.

Protectors, Telephone Ex.
Tornquist Elec. Mfg. Co.

Rail Joints.
Continuous Rail Joint Company of America.

Railway Supplies.
Wesco Supply Co.

Re-Winding—Repairs.
Chicago Edison Co.
Gregory Electric Co.
Southwestern Elec. Co.

Rheostats.
Cutler-Hammer Mfg. Co.
General Electric Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Rubber Machinery.
Alton Machine Co.

Schools and Colleges.
Highland Park College.
Michigan College of Mines.
Pratt Institute.

Second-Hand Mach'y.
Bissell Co., The F.
Chicago House Wrecking Co.
Conard, Thos. P.
Gregory Electric Co.
Southwestern Elec. Co.
Matthews & Bro., W. N.

Signs, Electric.
Haller Machine Co.
Western Display Co.

Silks, Insulating and Braiding.
Sauquoit Silk Mfg. Co.

Sockets & Receptacles.
Pass & Seymour.
Sauter Co., G. F.
Yost Elec. Mfg. Co.

Soldering Sticks, Salts and Paste.
Chicago Solder Co.
Crolius & Son, E. R.
New Idea Soldering Paste Co.
Western Electric Co.

Solenoids.
Amer. Elec. & Controller Co.

Speaking Tubes.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Co.

Specialties, Electrical Mfrs. and Designers.
Haller Machine Co.

Speed Indicators.
Weston Electrical Inst. Co.

Storage Batteries.
American Battery Co.
Chicago Pneumatic Tool Co.
Electric Storage Battery Co.
General Storage Battery Co.
Gould Storage Battery Co.
National Battery Co.
Toledo Stor. Bat. & Elec. Co.
Universal Elec. Stor. Bat. Co.

Supplies, General Elec.
Amer. Elect'l Supply Co.
Bennett, I. A.
Bissell Co., The F.
Central Electric Co.
Century Electric Co.
Chicago Edison Co.
Chicago House Wrecking Co
Electric Appliance Co.
Manhattan Elect'l Supply Co
Wesco Supply Co.
Western Electric Co.

Switches.
(See Cut-outs and Switches.)

Telephones, Telephone Material and Switchboards.
American El. Telephone Co
Automatic Electric Co.
Bissell Co., The F.
Central Electric Co.
Electric Appliance Co.
International Tel. Mfg. Co.
Kellogg Switchb. & Sup. Co.
Manhattan Elec. Supply Co.
Stromberg-Carlson Tel. M.Co
Wesco Supply Co.
Western Electric Co.

Time Switches.
Bissell Co., The F.
Campbell Bros.

Toggle Bolts.
(See Bolts, Toggle.)

Tools.
Klein & Sons, Mathias.

Tools, Pneumatic.
Chicago Pneumatic Tool Co.

Transformers.
Allis-Chalmers Company. (Bullock El. Mfg. Co.)
Central Electric Co.
Crocker-Wheeler Co.
Electric Appliance Co.
Ft. Wayne Elec. Works, Inc.
General Electric Co.
Kuhlman Electric Co.
La Fayette Elect'l. Mfg. Co.
National Electric Co.
Stanley—G. I. Elec. Mfg. Co.
Wagner Electric Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Trucks, Electric Car.
General Electric Co.
Westinghouse El. & Mfg. Co.

Turbines, Steam.
Allis-Chalmers Co.
General Electric Co.
Westinghouse El. & Mfg. Co

Turbine Water Wheels
Leffel & Co., Jas.

Vulcanized Fibre.
Vulcanized Fibre Co.

Wire Rope Machinery.
Alton Machine Co.

Wires & Cables—Magnet Wires.
American Electrical Works.
Belden Mfg. Co.
Bissell Co., The F.
Central Electric Co.
Crescent Ins. Wire & Cble. Co.
Electric Appliance Co.
General Electric Co.
Hazard Manufacturing Co.
Indiana Rub. & Ins. Wire Co
India Rubber & Gutta Percha Insulating Co.
Kellogg Switch. & Sup. Co.
Machattan Elec. Supply Co.
National India Rubber Co
New York Insulated Wire Co.
Northern Wire & Cable Co.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co
Roebling's Sons Co., J. A.
Safety Ins. Wire & Cable Co.
Simplex Electrical Co.
Spargo Wire Co., Jas. A.
Standard Underground C. Co.
Wesco Supply Co.
Western Electric Company.

Woodwork, Telephonic.
Telephone Woodworking Co.

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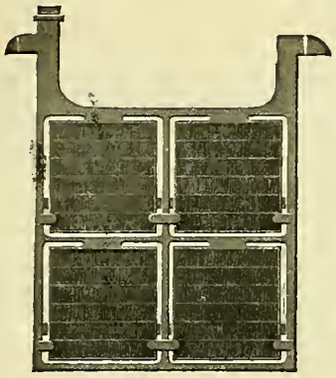

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Electric Storage Batteries of the "Unit Accumulator" Type are

RELIABLE

FOR STREET RAILWAYS, CENTRAL STATIONS, TELEPHONE SYSTEMS, ETC.

Descriptive Catalogue and Prices Furnished Upon Application.

Ask for Bulletin on "A MODERN TELEPHONE EXCHANGE."

National Battery Company

Branch Offices: NEW YORK, CHICAGO BUFFALO, N. Y.

"Diamond H" Switches

Trade H Mark

This Trade-Mark guarantees quality.

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New York Boston Chicago Toronto, Ont.

SELF FLUXING SOLDER

FOR ALL PURPOSES

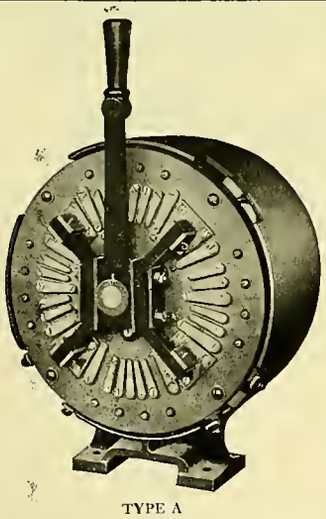
IN 18-INCH STICKS OR ON REELS

Kester Solder Can't Leak Flux.

CHICAGO SOLDER CO.

R. C. MILLER
St. Louis, Mo.
Gen. Western Agt.

46 N. Union Street, CHICAGO



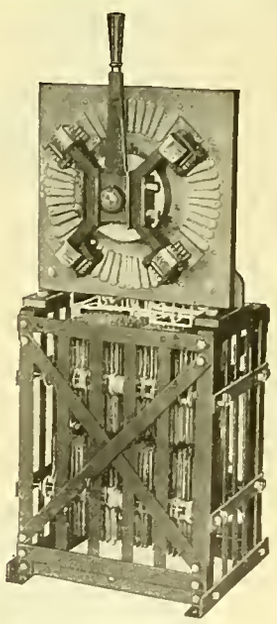
TYPE A

ONE of the strong features of the C-H Radial Arm Crane Controller is the easy access to connections. In Type A, for instance, by removing four screws the front and resistance can be taken from the case. In Types B & C the connections are made at the back of the slate and are accessible at all times without disturbing any part of the controller.

Another of its strong features is the arrangement of the segments in a series of four, which divides up the voltage on each segment and gives a large current carrying capacity without any sparking between segments.

Then there's the blowout, which causes a quick disrupting of the arc on the four contact points upon which the current is broken, adding to the life of these segments and saving constant renewals.

This controller embodies every good point of all other controllers and is without their weak features. If you're interested in crane control let us send you Bulletin No. 59.



TYPE B

The Cutler-Hammer Mfg. Co.

Electrical Controlling Devices - Electrical Engineers

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"FRES-KO" SOLDERING PASTE

IT "CREEPS" INTO EVERY CREVICE

ABSOLUTELY NON-CORROSIVE

This flux paste under the heat of the iron will "run" into every crevice—around a bunch of wires in a socket for instance.

FRES-KO CHEMICAL CO. - Fort Wayne, Ind.

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ELECTRICAL — CIVIL — MECHANICAL
MARQUETTE BUILDING
CHICAGO

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Electrical, Mechanical and Civil Engineer,
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KALAMAZOO, MICH.

HUMPHREY, HENRY H.,
CONSULTING ENGINEER,
Central Lighting Stations.
Electric Power Transmission.
SUITE 1505 CHEMICAL BLDG., ST. LOUIS.

RUEBEL-SCHWEDTMANN-WELLS,
CONSULTING, MECHANICAL AND ELECTRICAL ENGINEERS,
Suite 301 Chemical Building,
ST. LOUIS, U. S. A.

BADT, F. B.
WILLIS, G. M.
Experts. Consulting Engineers.
1504 Monadnock, Chicago

EVANS, ALMIRALL & CO.,
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High Pressure Piping.
1057 Monadnock Blk., Chicago.

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ENGINEERS
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Monongahela Bank Bldg., Pittsburg.
Norfolk House, Cannon St., London.

Long Distance Phone Central 2443.
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BAKER, W. E. & CO.
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Specialty made of financing Electric Light, Telephone, Street Railway, Gas and Water Works Properties. Purchase properties outright. Place entire Bond Issues and Negotiate Loans on same.
1509 Chemical Bldg., St. Louis, Mo.

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Consulting and Contracting Telephone Engineer.
Plans and Specification for complete plants. Old plants overhauled and placed on paying basis. Territory, Kansas, Oklahoma and Indian Territory.
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in this "Directory" enables engineers to keep before all possible customers.

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in this Directory may bring a big customer.

YOU DON'T KNOW
how many customers you fail to get by not having your name in this Directory.

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Consulting Telephone Engineer
Plans, Specifications and Supervision of Installation of Complete Telephone Plants
Special Reports on Telephone Properties and Apparatus
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(Incorporated)
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Lighting, Power, Railways,
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CHICAGO.

UNDERHILL, CHAS. R.
ELECTROMAGNET DESIGNS FOR POWER PURPOSES
Specialty — Designing Electromagnets and Solenoids for a given duty.
55 LIBERTY ST., NEW YORK

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WILLIAM B. JACKSON, M. E.
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AMERICAN SOCIETY OF MECHANICAL ENGINEERS
AMERICAN SOCIETY OF CIVIL ENGINEERS
ENGINEERS. EXPERTS.
MADISON, WIS.

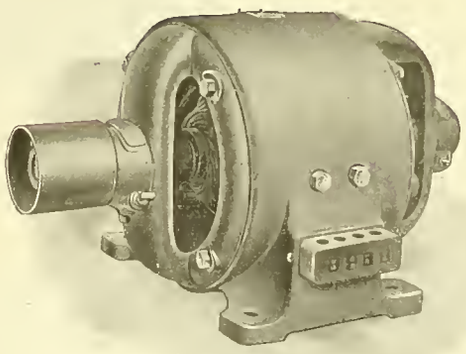
STORAGE BATTERIES!
(THE "X-CELL")
Complete Battery Plants for Any Purpose
Telephone Power Plants a Specialty
TOLEDO STORAGE BATTERY & ELECTRIC CO., 111 Ottawa St., Toledo, O.

When a man's electrical ideas flow freely; when he discusses electrical subjects intelligently and glibly, you will be pretty safe in assuming that he keeps in touch with electrical progress by perusing the Western Electrician 52 times a year.

General Electric Company

The CQ Motor

A new small direct current motor
for small power users



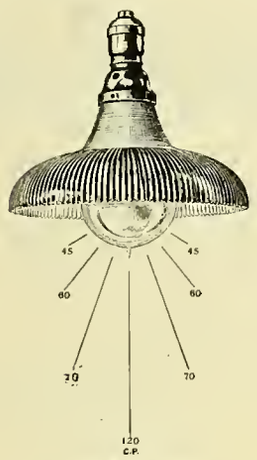
Sizes—¼ to 20 horse-power, cylindrical cast steel frame, rigid adjustable bearing supports. Low center of gravity, absence of all vibration, improved electrical design. The limit of simplicity.

659

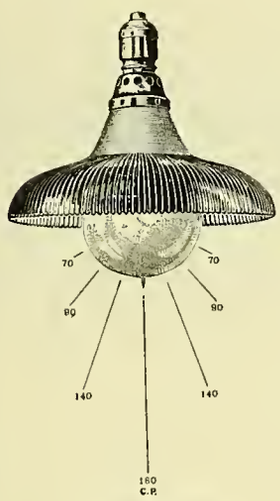
Principal Office: Schenectady, N. Y. Chicago Office, Monadnock Block
Sales Offices in all Large Cities

General Electric Company

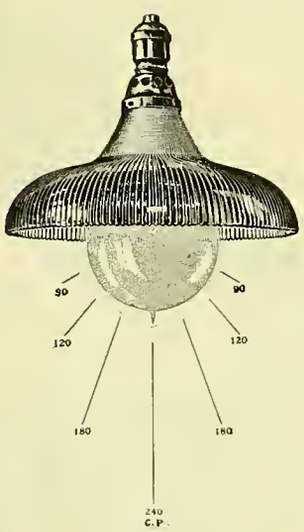
Concentrating Shade



TYPE 3 LAMP



TYPE 4 LAMP



TYPE 5 LAMP

NEW

High Efficiency — High Candle-Power

Incandescent Units

give an increased efficiency of

20%

over the highest efficiency hitherto obtained from incandescent lamps, measured on an equal basis of life.

For installations where the arc lamp is too large and the ordinary incandescent lamp too small, this high efficiency, high candle-power lamp is exactly what is needed.

Whichever is desired, concentrated or distributed light, the proper style of the Holophane Pagoda Reflector, illustrated herewith, will give the best results.

Type No.	Total Watts per Lamp	Distributed Candle-Power in Downward Direction with "D" Form of Reflector	Concentrated Candle-Power in Downward Direction with "C" Form of Reflector
3	125	70	120
4	187½	105	180
5	250	140	240

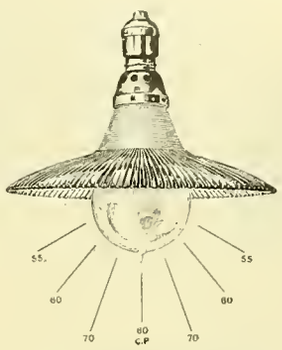
General Electric Company

Main Lamp Sales Offices

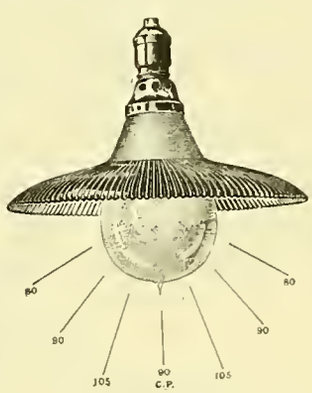
Harrison, N. J.

(657)

Distributing Shade



TYPE 3 LAMP



TYPE 4 LAMP

TYPE 5 LAMP

JEWEL TROUBLE

All trouble is eliminated in the Sangamo D. C. Wattmeter.

We use no brushes or commutators—don't need to.

Every Direct Current Central Station should know about the Sangamo Wattmeter—Ask us.

ELECTRIC APPLIANCE COMPANY
CHICAGO and SAN FRANCISCO

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Get acquainted with the
PEERLESS—MONEY SAVERS
MADE RIGHT
PRICED RIGHT
ARE RIGHT

WESCO

THE WESCO SUPPLY CO., ST. LOUIS, MO.
"EVERYTHING ELECTRICAL"

SCIENTIFIC DESIGN **CORRECT ENGINEERING** THOROUGH CONSTRUCTION
IN
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GENERAL STORAGE BATTERY CO.
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VOLT - AMMETERS
POCKET SIZE
For testing Batteries and Battery Circuits, Locating Faults, Grounds, etc.
RELIABLE. - ACCURATE.
Send for Circular.
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Send 2c stamp for new catalogue No. 6 of
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For Electrical Workers and Line Builders.
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Of all Qualities, in any Form at Lowest Prices
EUGENE MUNSELL AND CO.
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INSULATION That Is.

Micanite, Linotape, M. I. C. Compound, Empire Cloth and Paper. For Years the Standard.

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You Who are Troubled with Sparking and Cutting of Commutators to Use

The only article that will PREVENT SPARKING. Will keep the commutator in good condition and PREVENT CUTTING.
Absolutely Will Not Gum The Brushes . . .
It will put that high gloss on the commutator you have so long sought after.

50 Cts. per Stick. $5.00 per Dozen
For Sale by all Supply Houses, or
FREE, Sample Stick.

K. McLENNAN & CO.,
Sole Manufacturers,
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The insulation is the most important part of your machine—be sure you buy only the best. Cheap insulation cannot be good insulation.
IF IT'S MICABOND YOU CAN BE SURE YOU HAVE THE BEST—OUR GUARANTEE IS BEHIND IT
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"Flexduct" is that high standard required in all high-class work. It is very flexible, a high insulation and indestructible

FLEXIBLE CONDUIT

"Flexduct" the National Code Standard. It does not deteriorate, always usable to highest degree

OSBURN FLEXIBLE CONDUIT COMPANY,
NEW YORK CHICAGO SAN FRANCISCO

THE "KLAHRE" PIPE DIE

Patented May 2, 1899, June 12, 1900—Others pending

With this pipe die one man with great ease can cut a thread on any **two inch steel pipe** now upon the market, using The "Klahre" Pipe Die in an ordinary stock without adjustment. The thread can be run on the pipe as many inches as desired without splitting the pipe, and the die backed off without trouble. This is owing to the fact that it is impossible for the chips to clog the teeth on the die, due to the special clearance that has been provided in this new make of pipe die. The "Klahre" Pipe Die is a unique innovation and through the combination of a full number of teeth and trimming blades, this pipe die can be readily started on the pipe, trimming the taper and cutting the thread at the same time. Experiments were started early in 1897 on this new type of pipe die, and the one illustrated above is now for the first time placed upon the market with the assurance of the manufacturers that it is in every respect what it is guaranteed to be—***a one-man easy starting and cutting die.***

These dies will be sent to responsible firms on 10 days' trial.

PRICE LIST

2 INCH THREAD - -	$5.00 EACH
1½ " " - - - -	5.00 "

Standard sizes of block 4 x 4—⅜ thick. Discounts quoted on application.

THE TURNER BRASS WORKS
23 NORTH FRANKLIN ST. - - CHICAGO

Edison Miniature Lamps

..FOR..

NOVELTY DEVICES

For use in electric flashlights, candlesticks, pocket lanterns, carriage and bicycle lamps, clock lights for bedrooms, ruby lanterns for photography, and for optical, dental and surgical instruments.

All types supplied—accurately rated—carefully selected.

LOOK FOR THE LABEL IN THE SOCKET

Telephone Lamps
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Decorative Lamps

EDISON DECORATIVE AND MINIATURE LAMP DEPARTMENT

General Electric Company, Harrison, N.J.
(512)

ELECTRICAL REPAIRING

We Guarantee All Work

DYNAMOS, ARMATURES, MOTORS, ARC LAMPS, INSTRUMENTS. GENERAL REPAIRING. Correspondence Solicited.
NEW AND SECOND-HAND MACHINERY FOR SALE

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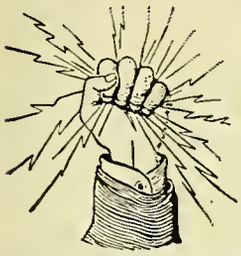
AMERICAN ELECTRICAL WORKS,

PROVIDENCE, R. I.



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ELECTRIC LIGHT LINE WIRE,
INCANDESCENT AND FLEXIBLE CORDS,
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AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.
CABLES FOR AERIAL AND UNDERGROUND USE.

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MAIN OFFICES AND FACTORIES, PHILLIPSDALE, R. I.

TRANSFORMERS

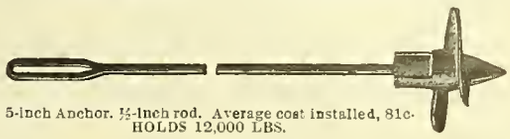
KUHLMAN ELECTRIC CO., - - ELKHART, IND.

Anchors that hold

STOMBAUGH GUY ANCHORS

PROVE

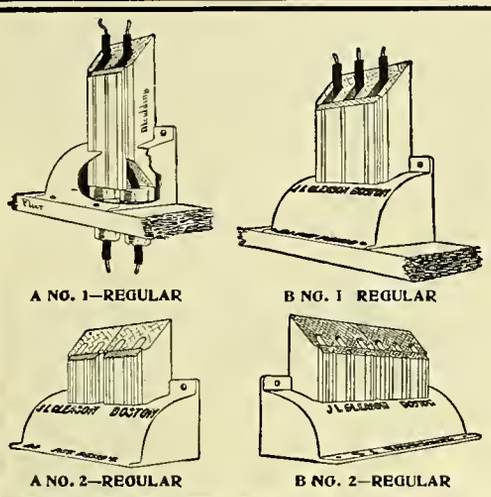
Prove Satisfactory. Prove Inexpensive. Prove Durable.
Prove Better. Prove All Our Claims.



5-inch Anchor. ½-inch rod. Average cost installed, 81c.
HOLDS 12,000 LBS.

Try Them at Our Risk and See

W. N. MATTHEWS & BRO.
Manufacturers
203 N. 2nd St. - - - - St. Louis



Gleason's Moulding Boxes.

Send postal for descriptive pamphlet and price list to

JOHN L. GLEASON
290 South St.
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NATIONAL CODE STANDARD

WEATHER-PROOF TRADE MARK "O.K." LINE AND HOUSE WIRES

"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Ideal Wire.

Prices and Samples on Application.

Phillips Insulated Wire Co.

Office and Factory: PAWTUCKET, R. I.

"AMERICAN" STORAGE CELLS

ARE THE BEST. Send for descriptive Circular.
AMERICAN BATTERY CO.,
EST'D 1899. 171 S. Clinton St., Chicago.

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MECHANICAL, ELECTRICAL, STEAM, CIVIL.

Complete and short courses. Thoroughly equipped engineering shops. **Shop work from the beginning.** Short courses in Steam and Electrical Engineering. Expenses low. Accommodations the best. School all year. Students may enter any time. Correspondence steam and electrical courses. Send for catalogue. Mention course in which interested.
HIGHLAND PARK COLLEGE, DES MOINES, IOWA.

CENTURY ELECTRIC CO.

MANUFACTURERS OF
SINGLE-PHASE SELF-STARTING
MOTORS AND CEILING FANS
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EXPERT IN ELECTRICITY MECHANICS PATENT CAUSES

SOLICITOR OF U. S. & FOREIGN **PATENTS**
FOREE BAIN, 1662-3 Monadnock Blk., CHICAGO

INSULATED WIRES
COTTON AND SILK
NORTHERN WIRE & CABLE CO.

OFFICES: Milwaukee, 740-742 Wells Bldg.
Chicago, 1202 Marquette Bldg.

MAGNET WIRES
South Milwaukee Wis.

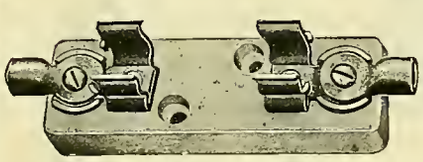
PREDOMINATES IN 27 States

"IT gives me great pleasure to state, that for 'Gitthereitiveness' your periodical certainly is a winner. As you perhaps are aware, the company I travel for, advertises in all the electrical papers, and it has been a question in my mind whether they reached every central station, as their advertising manager would have our company believe. So, for one year I have kept account of the electrical papers and periodicals subscribed for and received by the manager or superintendent of electric light companies in twenty-seven states, (which has been my territory), and in summing it up, I find that your periodical predominates, three to one. I do not get in many telephone plants, but when I do, I invariably find the 'Western Electrician' staring me in the face."

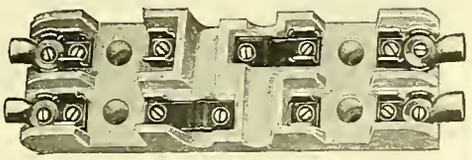
The letter from which the above is taken, is dated May 8, 1905, and is on file in this office.

"UNION" ENCLOSED FUSES

OLD AND NEW CODE STYLES



New Code Blocks



Catalog No. 16 with illustrations is ready and is as plain as a primer. You see what you want at a glance

Our Trade Mark stands for good goods in all Electrical Fuses and Fuse Wire

CHICAGO FUSE WIRE & MFG. CO.

Chicago, Buffalo
New York

WANTED, FOR SALE *and similar* **WANT COLUMN** *advertisements (50 words or less), $1.50 an insertion; additional words 3c each.* **POSITION WANTED** *advertisements (50 words or less), $1.00 an insertion; additional words 2c each.*

POSITION WANTED.

Technical graduate experienced salesman, age 32, would like to secure opening with electrical contractor to sell steam and electric machinery or with an electric light and power company as solicitor for light and power. Services can be secured on basis of reasonable salary and commission. Address BOX 506, Western Electrician, 510 Marquette Building, Chicago, Ill.

POSITION WANTED.

By good all-around electrical construction man, a hustler. Experienced in re-building old systems throughout. Competent to take charge of a plant. Best references. Address Box 510, care of Western Electrician, 510 Marquette Bldg. Chicago.

WANTED.

One second-hand 1,000 K. W. direct coupled compound engine and dynamo. The dynamo can be either 250 volts direct current or 2,300 volts, 60 cycles, 1, 2 or 3 phase alternating current. Please state in detail size of engine, tandem or cross compound, maker of engine, maker of dynamo, length of time they have been in use, location of same and approximate price f. o. b. cars. Address Box 508, care Western Electrician, 510 Marquette Bldg., Chicago. Ill.

WANTED.

A permanent position is open to a first-class experienced Spark and X-Ray Coil Winder. Address Box 511, care of Western Electrician, 510 Marquette Bldg., Chicago.

WANTED.

Strictly first-class electrical repair man to install motors and generators and work in repair shop. State experience, age, salary etc. Address Box 512, care of Western Electrician, 510 Marquette Bldg., Chicago.

WANTED

Orders for arc lamp designs. Will furnish plans of arc lamps in all essential particulars and for all purposes. Address

A. F. HAMACEK
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FOR SALE.

Ideal Electric Light Plant in small city. As I am farmer and don't know how to run it, will sell to practical operator, on easy terms, but must have at least $3000 down, balance to suit you. Absolutely no leasing proposition considered. Address Box 507, care of Western Electrician, 510 Marquette Bldg., Chicago.

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Weston Portable Wattmeter, Empire Portable Voltmeter, Empire Portable Ammeter, guaranteed in good condition. DUCKWALL-HARMAN RUBBER & SUPPLY CO., Indianapolis, Ind.

POLES FOR SALE.

Carload 5 and 6 inch twenty-foot poles: cheap if taken at once. All heavy butts. Strictly N. C. A. specifications. Immediate shipment. Seasoned stock and winter peeled. Write now as this notice may not appear again. I. A. Maltby BOX 256 Bay City Mich.

Have YOU read the

NEW DYNAMO TENDERS' HAND-BOOK

By F. B. BADT?

IF NOT, WHY NOT?

Dynamo tenders cannot get along without it.

Sent prepaid on receipt of price, $1.00.

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510 Marquette Building, - CHICAGO

ELECTRICAL MATERIAL FROM THE ST. LOUIS WORLD'S FAIR

Over one million dollar's worth of electrical supplies is offered for sale at very low prices. This is an opportunity which you dare not overlook. We are making shipment of this material direct from our St. Louis headquarters. We guarantee everything to be strictly in first-class condition.

RUBBER COVERED WIRE

In long lengths, on coils and reels, carefully selected and guaranteed good as new for further service.

140,000 ft. No. 14	130,000 ft. No. 2
65,000 ft. No. 12	60,000 ft. No. 1
30,000 ft. No. 10	25,000 ft. No. 1-0
46,000 ft. No. 8	14,000 ft. No. 2-0
15,000 ft. No. 6	16,000 ft. No. 3-0
100,000 ft. No. 4	48,000 ft. No. 4-0
90,000 ft. No. 3	

75,000 ft. 300, 350, 400, 600 and 600,000 C. M.

Slow Burning Weatherproof Wire

50,000 lbs. No. 16	40,000 lbs. No. 4
60,000 lbs. No. 14	50,000 lbs. No. 3-0
60,000 lbs. No. 12	100,000 lbs. 300,000 C. M.
50,000 lbs. No. 10	175,000 lbs. 400,000 C. M.
35,000 lbs. No. 8	140,000 lbs. 500,000 C. M.
30,000 lbs. No. 6	40,000 lbs. 600,000 C. M.

Weatherproof Wire, Triple Braid, Solid Conductor

60,000 lbs. No. 14	45,000 lbs. No. 4
50,000 lbs. No. 12	30,000 lbs. No. 3
60,000 lbs. No. 10	25,000 lbs. No. 2
25,000 lbs. No. 8	20,000 lbs. No. 1
110,000 lbs. No. 6	

Weatherproof Wire, Triple Braid, Stranded Conductor

150,000 lbs. No. 2-0	40,000 lbs. No. 1-0

LEAD COVERED CABLE

500,000 feet, all sizes from No. 14 to 500,000 C.M. Quick delivery and low prices.

INCANDESCENT LAMPS

200,000 lamps, used a short time, and in good condition for further service. Have been tested. They are 104 voltage, Edison Base, 8 candlepower. In lots of 1000, each 5 cents.

150,000 brand new Incandescent Lamps in original cases of 200, 250 and 400 Lamps, ranging from 100 to 110 voltage, 8 candlepower, General Electric make. Price each in case lots, 10 cents.

200,000 Colored Incandescent Lamps, brand new, never used, General Electric make, 104 voltage, Edison Base; colors, Amber, Green, Opal and Ruby; put up 200 in a case. Price, each 20 cents; are worth 35 cents each.

20,000 Incandescent Lamps, voltage 100 to 120, Edison, T. H. and Westinghouse Base; 8, 10, 16, 20 and 25 candlepower; put up 250 in a case, second selection. Price each in case lots 10½ cts.

WOOD CONDUIT

100,000 Feet, Size 4½ x 4½

MISCELLANEOUS

300,000 No. 9171 Porcelain, Edison Base Receptacles.
50,000 Weatherproof "Bryant" Sockets.
1,000,000 split glazed B. & D. Wiring Knobs.
300,000 Glazed Porcelain B. & D. Wiring Knobs, sizes 3⅛, 4½ and 5½.
20,000 No. 8 Standard Porcelain Knobs.
200,000 Single Wire glazed Porcelain Cleats.
15,000 Porcelain Cut-outs.
26,000 Plugs.
2,000 000 unglazed Porcelain Tubes.
40,000 Glass Insulators.
20,000 Porcelain Cleats.
All kinds of switches and instruments.

Ask for our Special Catalogue No. 567.

CHICAGO HOUSE WRECKING COMPANY, 35th and Iron Sts., CHICAGO

ROCK ISLAND DRY CELLS

ARE THE BEST
JUST TRY THEM
THAT'S ALL WE ASK

ROCK ISLAND BATTERY CO.

GEORGE W. CONOVER
135 Adams Street,
Chicago Representative

ROCK ISLAND, ILL. U. S. A.

562

Motor Drive Illustrations For Central Station Work

CENTRAL Station advertisements can be helped greatly by good illustrations of Motor Driven Machines. We have a vast stock of illustrations of Motor Drives and will gladly help Central Station Managers who plan to increase the demand for their direct current power circuits by illustrating motor drives.

We will furnish electrotypes without charge conditional upon the user giving us full credit in the caption of the illustration.

We have numerous coarse screen half tones for newspaper advertising as well as illustrations to print on enamel stock.

MENTION THE WESTERN ELECTRICIAN WHEN REQUESTING CUTS

NORTHERN ELECTRICAL MFG. CO.
ENGINEERS—MANUFACTURERS
MADISON, WIS., - - - U. S. A.

AMERICAN ELECTRICAL SUPPLY CO

Although our business is growing fast we are still able to take care of more customers. Let us add your name to the satisfied list.

IF ELECTRICAL AND GOOD WE SELL IT

83-85-87 FIFTH AVE CHICAGO

Electrical book buyers buy electrical books from the Electrician Publishing Co., 510 Marquette Bldg., Chicago.

SECOND-HAND MACHINERY

1 A. 70 T. H. 125 Cycle, 1100 Volt Alternator, 1070 R. P. M.
2 120 K. W. General Electric 126 Cycle, 1100 Volt, Type A. S. 1070 R. P. M. All complete with exciters—self-oiling bearings.
1 150 K. W. General Electric, 2 Phase, 60 Cycle, 2200 Volt, compensated revolving field alternator, 600 R. P. M.
1 270 K. W. T. H. 550 Volt Railway Generator 600 R. P. M.
1 A. 70 Armature newly rewound.
1 20 K. W. 250 Volt Westinghouse Generator direct coupled to 7x10 Ideal Automatic Engine, new.
1 24x18 Ideal Automatic Engine.
2 66-inch x 20-ft. Return Tubular Boilers built for 130 lbs. working pressure.
2 200 H. P. Marine Type Boilers, equipped with the Morrision furnace, 130 lbs.

The above is all in first-class operating condition and is offered subject to prior sale.

Springfield Light, Heat & Power Company
Springfield, Ill.

Automatic Engines

FOR SALE AT GREAT SACRIFICE

2—200 H. P. 13-in. & 26-in. x 16-in. Armington & Sims tandem compound. Wheels 8-ft. x 22-in. face.

1—150 H. P. 15¾-in. x 16¾-in. Dick & Church center crank. Wheels 6-ft. x 16¾-in. face.

1—125 H. P. 11-in. & 18-in. x 16-in. McEwan tandem compound. Wheel 64-in. diameter x 12½-in. face.

1—16 H. P. 7-in. x 8-in. Payne center crank. Wheels to suit purchaser.

THOMAS P. CONARD
119 So. Fourth St. Philadelphia, Pa.

FOR SALE.
200 BRAND NEW
General Electric
FAN MOTORS
16 inch, 110 volts.
125 CYCLES
$5.00 each boxed, f.o.b. Chicago
Immediate shipment.

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FIRST CLASS EQUIPMENT THROUGHOUT

High-Grade Machine Work of All Kinds Correspondence Solicited.

Dynamos, Armatures, Motors, Arc Lamps, Fans, Instruments.

CLEAN BOILERS

Dearborn Water Treatment made to suit the case takes off the scale, keeps it off, stops corrosion and foaming. Send gallon of water for analysis. :: :: ::

DEARBORN DRUG & CHEMICAL WORKS,
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New Light On an Old Subject.
AN INTERESTING TREATISE ON GREASE LUBRICATION.
FREE ON REQUEST. SEND FOR IT.
JOSEPH DIXON CRUCIBLE CO., Jersey City, N. J.

REG. TRADE MARKS
"Phosphor Bronze"
DELTA

THE PHOSPHOR BRONZE SMELTING CO. LIMITED,
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ORIGINAL AND SOLE MAKERS IN THE U.S.

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DIESEL ENGINES

Operating on CRUDE or FUEL Oil

Guaranteed Fuel Consumption
on variable load, ranging from ¼ to full load
12½ Gals. per 100 Kw. Hours

SUITABLE FOR ALL STATIONARY POWER

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Steam + Fuel

Saves 10 to 20% in Fuel

We Build and Install Mechanical Draft Plants
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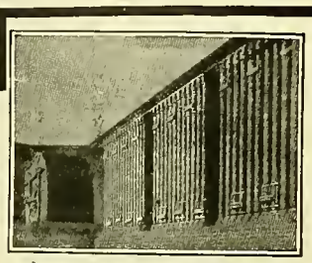

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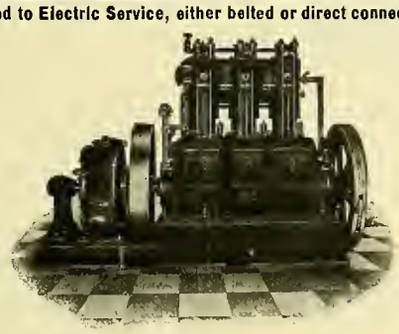
WALRATH GAS ENGINES

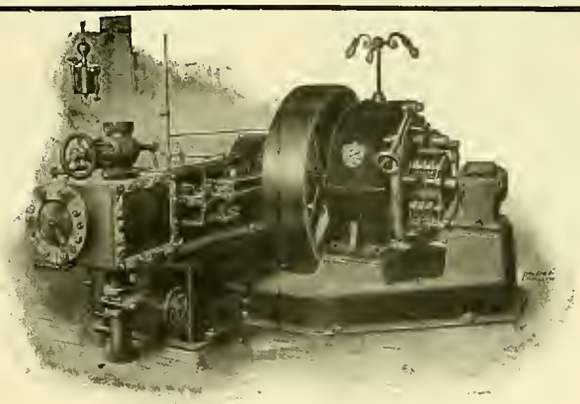
Especially adapted to Electric Service, either belted or direct connected to generators

COMPLETE POWER PLANTS FURNISHED



If you want the most reliable, cheap power known, write for Catalog "W."

MARINETTE GAS ENGINE CO.
CHICAGO HEIGHTS, ILL., U. S. A.



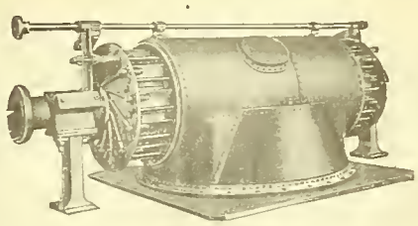
The Brownell Direct-Connected Outfit.

THE BROWNELL CO., Dayton, O.
Manufacturers of Boilers, Engines, Heaters and Sheet Iron Work.

You will confer a favor upon the advertiser by telling him—when you write him—that you saw his ad. in the Western Electrician.

SAMSON TURBINE

The QUICKER the SPEED of a GENERATOR the LOWER its COST. The SAMSOM has a quicker speed for a given power, than any other turbine built. If you expect to DIRECT CONNECT generator to turbine shaft, we can certainly SAVE you considerable EXPENSE in your installation.



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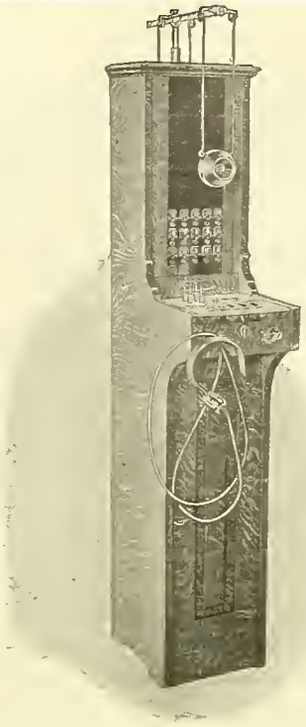
Kellogg Express Switchboard Cabinet

The graceful Appearance comes from Simple Lines.

This Attractive Design has been so popular that it has been much copied by other manufacturers



Fifty-Line Capacity Quarter Sawed Oak for the entire Exterior of the Cabinet

Thoroughly seasoned wood

Finished in Light or Golden Oak

Gold Medal Highest Award Buffalo Exposition 1902

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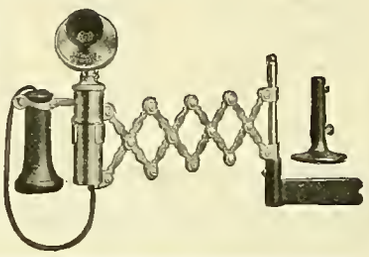
The Strongest, Longest Lived, Most Efficient Switchboards made. All telephone experts will tell you that.

Kellogg Switchboard & Supply Co.
Congress & Green Streets
CHICAGO
LOS ANGELES CLEVELAND PHILADELPHIA

Use this on your desk. No more broken desk Telephones. Made any length. :: :: ::



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AMERICAN ELECTRIC TELEPHONE CO.

We have just moved into our new factory which we erected at 64th and State Streets, Englewood Station, Chicago, Ill.

We manufacture Telephones and Telephone Switchboards of all styles. We have installed many of the largest exchanges. 26 Bulletins describe our apparatus. They are sent postpaid upon request.

INTERNATIONAL

Mechanical Self-Restoring Drop Switchboard.

A PERFECT APPARATUS.

Made in any desired capacity.
Sample parts and quotations on request.

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CHICAGO, U. S. A.

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Drawn steel. One blow of a hammer gives clean round hole. No filing.
SAVE TIME, BOXES AND MONEY
Be up to date. Use them. Write for bulletin giving full particulars.
Bossert Electric Construction Co., UTICA N.Y.

"The Nation's pleasure ground and sanitarium."—*David Bennett Hill.*

THE ADIRONDACK MOUNTAINS.

The lakes and streams in the Adirondack Mountains are full of fish; the woods are inviting, the air is filled with health, and the nights are cool and restful. If you visit this region once, you will go there again. An answer to almost any question in regard to the Adirondacks will be found in No. 20 of the "Four-Track Series," "The Adirondack Mountains and How to Reach Them;" issued by the

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Telephone Principles and Practice

A NEW BOOK IN TELEPHONY

By
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Professor in Telephony in the Armour Institute of Technology

Complete and up-to-date, written by a practical man. All about modern telephone apparatus, their principles and use.

I. Fundamental Ideas
II. Telephone Apparatus
III. Systems of Communication
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IN 32 CHAPTERS, 450 PAGES, 375 ILLUSTRATIONS. PRICE $2.00 POSTPAID

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TELEPHONE TROUBLES Price 25 Cts.
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OUR SPECIALTY
TELEPHONIC WOODWORK
THE TELEPHONE WOODWORKING COMPANY
TIFFIN, OHIO

$4.60 vs. $9.40

Automatic Manual

Our Automatic Telephone System has been adopted in the following cities:

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Grand Rapids, Mich.	Woodstock, N. B.
	St. Marys, Ohio.
Columbus, Ohio.	Westerly, Ohio.
Dayton, Ohio.	Manchester, Iowa.
Lincoln, Neb.	Princeton, N. J.
Portland, Maine.	Albuquerque,
Auburn, N. Y.	N. M.
Lewiston, Maine.	Van Wert, Ohio.
Auburn, Maine.	Battle Creek, Mich.
Fall River, Mass.	Clayton, Mo.
New Bedford, Mass.	Pentwater, Mich.
	Toronto Junction,
Los Angeles, Cal.	Can.
San Diego, Cal.	Wilmington, Del.
Hopkinsville, Ky.	Riverside, Cal.
Sioux City, Iowa.	Traverse City,
Cleburne, Texas.	Mich.
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Aberdeen, S. D.	El Paso, Texas.
Miamisburg, O.	Havana, Cuba.
Medford, Wis.	Marianao, Cuba.
Berlin, Germany.	

Operation and maintenance expense per 'phone per annum of one of the Telephone Companies that replaced their Manual with our AUTOMATIC SYSTEM. (We will send name of company and detailed statement of above upon request.)

This saving of more than 50 per cent in operation and maintenance cost is pretty strong evidence of the economy of AUTOMATICS.

Hand in hand with the decrease in operating expenses goes the increase in quality of service. This latter means more business. All these Automatic advantages combined mean higher values for securities, bigger dividends for the stockholders.

Don't you see that you're wasting money on that out-of-date Manual equipment of yours? If you're a new Company, start with Automatic, and start right.

Automatic Electric Company

VAN BUREN AND MORGAN STREETS

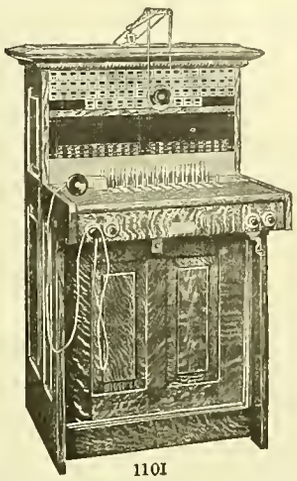
CHICAGO, U. S. A.

STROMBERG-CARLSON

Generator Call Visual Signal Switchboard.

Has the advantage of being as rapid and costs less to maintain than a lamp signal board. Effective service at small cost.

Signals self restoring on insertion of plug in jack



1101

Key shelf is so low, operator can use an ordinary chair

This type of cabinet has all the advantages and none of the disadvantages of many boards twice its size. Bulletin sent free for the asking. Write to-day.

STROMBERG-CARLSON TEL. MFG. CO.

GENERAL OFFICE, ROCHESTER, N. Y. BRANCH OFFICE, CHICAGO, ILL.

ELECTRICITY FOR ENGINEERS.

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Practical Running of Dynamos.

A little booklet on the care and the locating and remedying of troubles in dynamos and motors.

Price, 10 Cents.

Catalogue of mechanical and electrical books free.

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Attends the Traveler between

Chicago Indianapolis Cincinnati & Louisville

Who Travels via the

MONON ROUTE

Consult Your Local Ticket Agent

COODS OF QUALITY

"TORNQUIST" KING OF PROTECTORS

Protect Your Telephone!

THERE IS DANGER

IN A POOR PROTECTOR. :: THE SAFEST DEVICE TO USE IS THE

"TORNQUIST" KING OF PROTECTORS

THOUSANDS SOLD ORDER NOW

We make a full line of high-grade **KNIFE SWITCHES** NONE BETTER

Write for prices and free bulletins

TORNQUIST ELECTRICAL MFG. CO., - Davenport, Iowa

CHICAGO AGENTS, EMPIRE ELECTRIC SUPPLY CO.

YOST SPECIALTIES.

Sookets, Wall Sockets, Weatherproof Sockets, Rosettes, Receptacles, Cord Adjusters.

Catalogue for the asking.

THE YOST ELECTRIC MFG. CO.

TOLEDO, OHIO.

McRoy Conduits.

"ROOKERY"—Chicago

Producers and Wholesalers of White Cedar Products

CEDAR POLES

SPECIAL PRICES ON SMALL POLES.

C. H. WORCESTER CO.

SUITE 1206 TRIBUNE BLD'G. CHICAGO.

Write for a copy of our TELEGRAPH CODE FOR CEDAR PRODUCTS

Yards
Koss Mich.
L'Anse ..
Munising ..
Ontonagon ..
Wagner Wis.
Peshtigo ..

PILLSBURY-WATKINS COMPANY

LUMBER EXCHANGE. MINNEAPOLIS, MINN.

CEDAR POLES, POSTS, TIES AND SHINGLES.

SOUTHERN OAK TIES.

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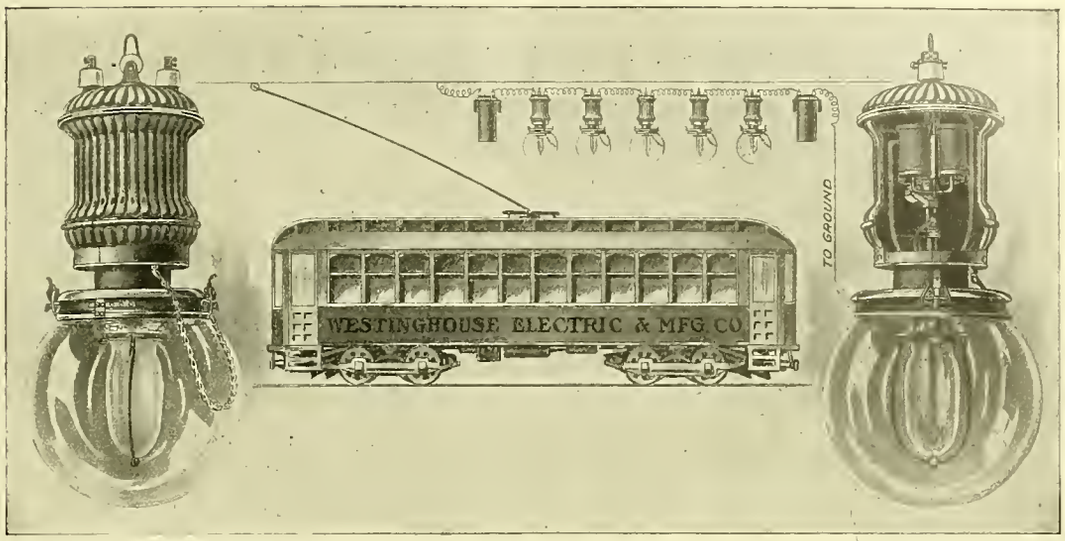

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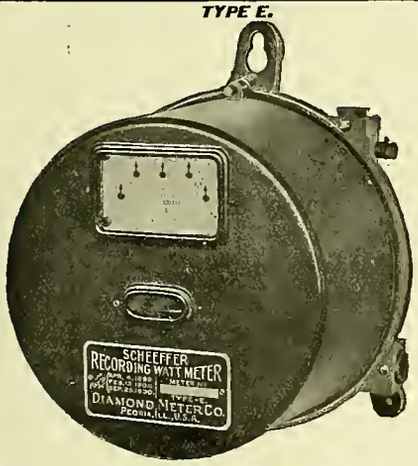

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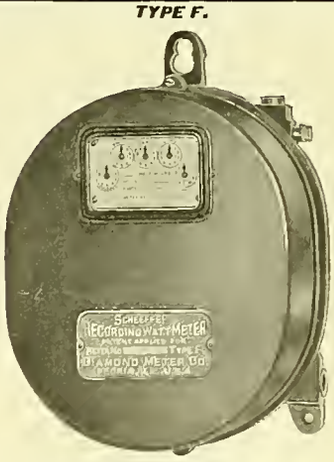

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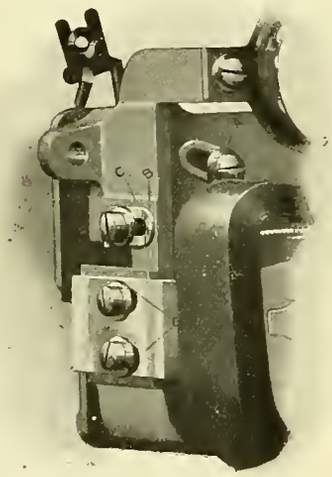

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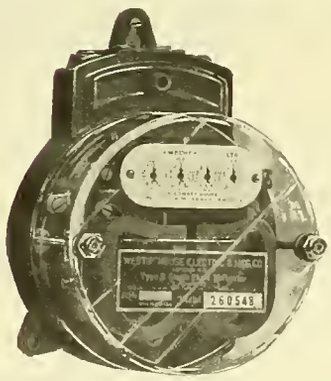

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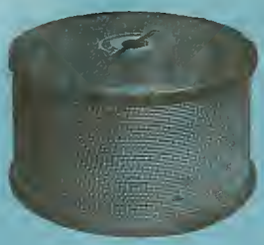

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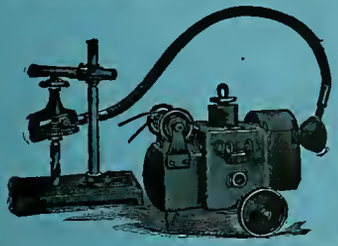

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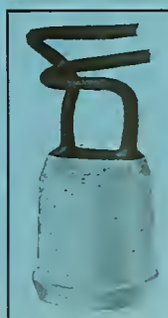

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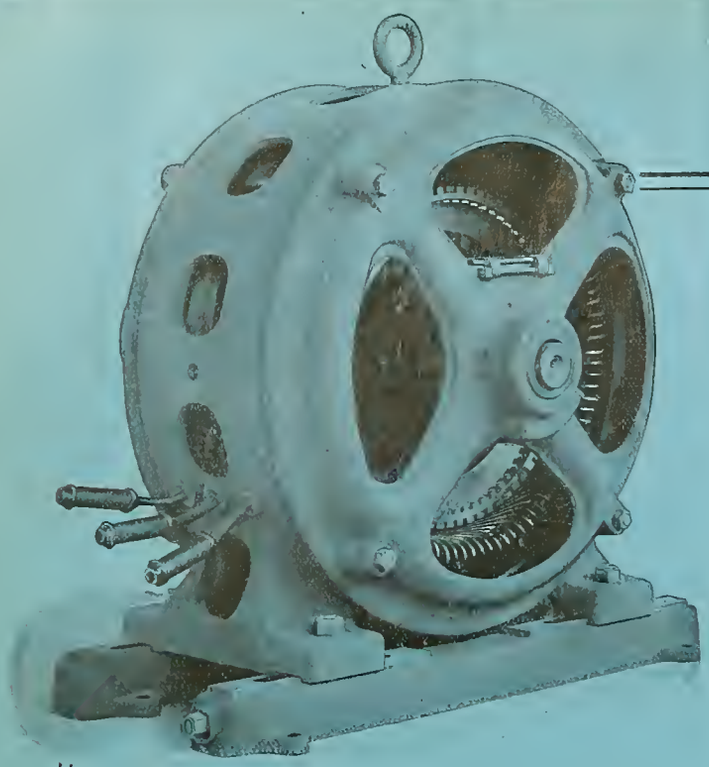

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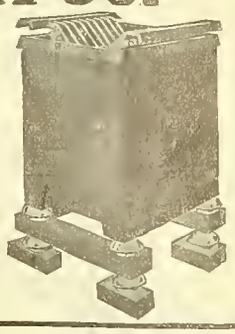

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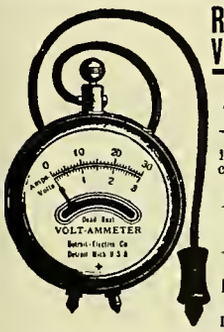

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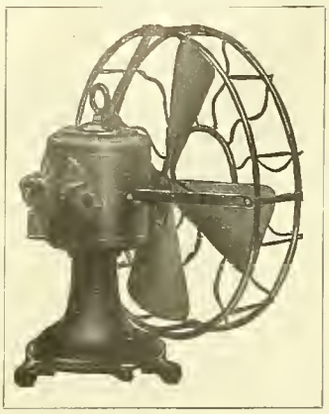

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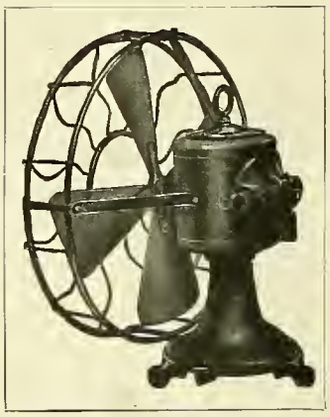

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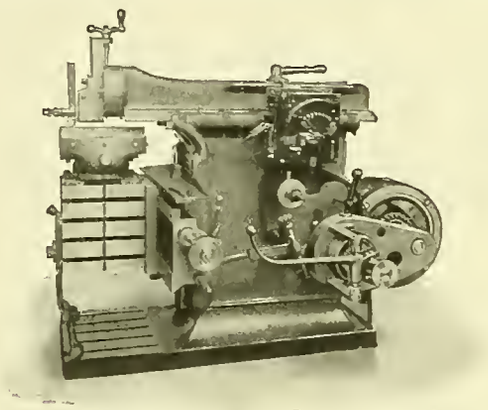

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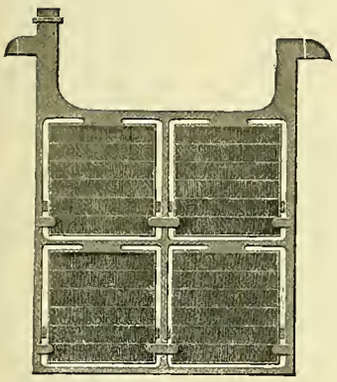

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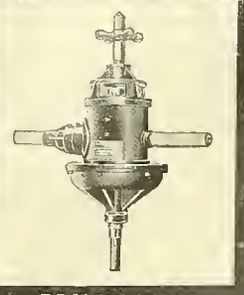

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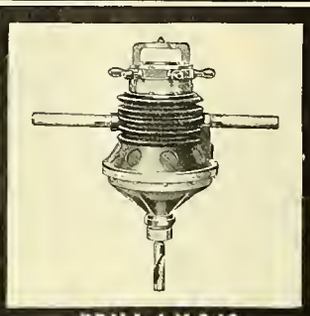

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Westinghouse El. & Mfg. Co

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Western Electric Company.

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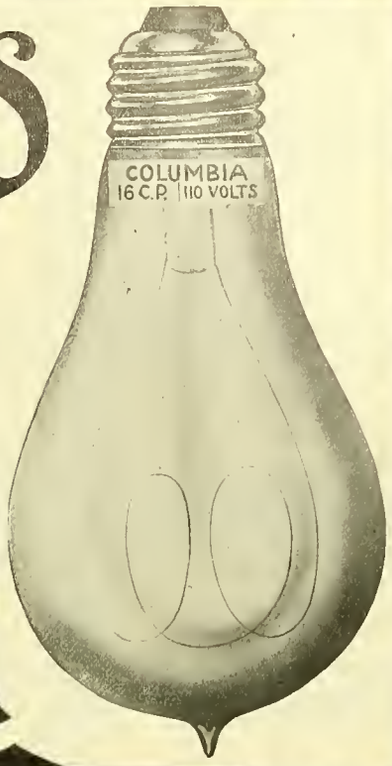
Columbia Lamps



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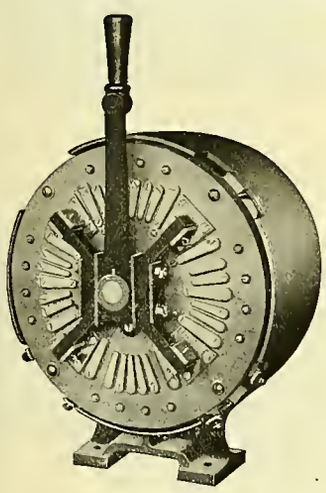

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ONE of the strong features of the C-H Radial Arm Crane Controller is the easy access to connections. In Type A, for instance, by removing four screws the front and resistance can be taken from the case. In Types B & C the connections are made at the back of the slate and are accessible at all times without disturbing any part of the controller.

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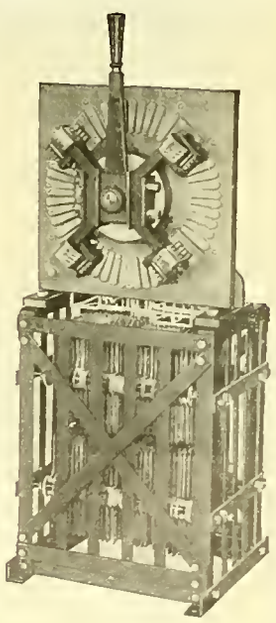
This controller embodies every good point of all other controllers and is without their weak features. If you're interested in crane control let us send you Bulletin No. 59.



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ENGINEERS-CONSTRUCTORS
ELECTRICAL — CIVIL — MECHANICAL
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KALAMAZOO, MICH.

HUMPHREY, HENRY H.,
CONSULTING ENGINEER,
Central Lighting Stations.
Electric Power Transmission.
SUITE 1505 CHEMICAL BLDG., ST. LOUIS.

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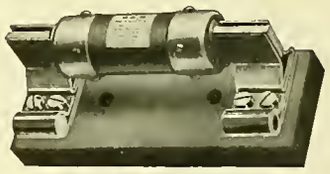
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National Electrical Code Standard.

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ST. PAUL—American Electric Co.
SAN FRANCISCO—California Elec'l Wks.

CENTRAL STATION HEATING

We are the originators and builders of the ONLY underground system of live and exhaust steam heating. Our system is used for the utilization and distribution of exhaust steam from electric-light and power plants, for heating residences, stores, public buildings, etc. 250 plants in successful financial and mechanical operation. We have the only practical Steam Meter. Also manufacturers of Wooden Water Pipe, Steam Pipe Casing, Steam Traps, Condensation Meters, Valves, Economizing Coils, Separators, and a full line of Steamfitters' Supplies.

Write for the STORY of DISTRICT STEAM HEATING

AMERICAN DISTRICT STEAM COMPANY
MAIN OFFICES LOCKPORT, N.Y.
WESTERN OFFICES: MONADNOCK BLDG. CHICAGO, ILL.

GRAND PRIZE

The Highest Possible Award

Has Been Given to

ELECTRA

·TRADE MARK·

HIGHEST GRADE NUERNBERG CARBONS

By the International Jury of Awards, of the Louisiana Purchase Exposition, St. Louis, 1904.

HUGO REISINGER, Sole Importer, 11 BROADWAY, NEW YORK

It Can't Be Beat—The Guthrie Flasher

A SIGN FLASHER WITHOUT A MOTOR

A FEW ADVANTAGES OF THIS FLASHER OVER ALL OTHERS:

First.—The Price is lower.
Second.—It has fewer parts and is therefore the simplest flasher on the market.
Third.—It has no motor to cause trouble and consume current.
Fourth.—It costs nothing to operate this flasher.
Fifth.—It only occupies a space of 5 x 8 inches.
Sixth.—It can be regulated to flash any signs or show window lights in any manner desired.
Any combination of lights, without motor or cylinder.
Simplest and best on the market.
Works on any current.
The disadvantage of a flasher was the motor question.
We have overcome this and are putting out an article that meets a long felt want.

DOXSEE-BARRERE ELECTRIC CO.
1108-1110 Pine St., ST. LOUIS
General Agents for United States and Canada

Agents Wanted

BROCKSMITH DYNAMO CASTINGS

Castings, Punchings, Materials and Blue Prints for constructing the Brocksmith Dynamo, Motor, Dynamotor, Motor-Generator, Single-Phase Rectifier, A. C. Generator, etc.

Send for Catalogue No. 26

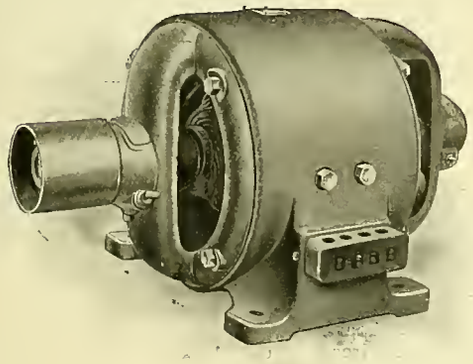
PARSELL & WEED
129-131 West 31st Street
NEW YORK CITY

The FRANKLIN Model Shop

General Electric Company

The CQ Motor

A new small direct current motor for small power users



Sizes—¼ to 20 horse-power, cylindrical cast steel frame, rigid adjustable bearing supports. Low center of gravity, absence of all vibration, improved electrical design. The limit of simplicity.

159

Principal Office: Schenectady, N. Y. Chicago Office, Monadnock Block
Sales Offices in all Large Cities

JEWEL TROUBLE

All trouble is eliminated in the Sangamo D. C. Wattmeter.

We use no brushes or commutators—don't need to.

Every Direct Current Central Station should know about the Sangamo Wattmeter—Ask us.

ELECTRIC APPLIANCE COMPANY
CHICAGO and SAN FRANCISCO

Edison Low Candlepower Lamps

for ECONOMICAL LIGHTING

RELIABLY LONG AND BRILLIANT LIFE

10	C. P.	31 & 36 & 42	Watts
8	"	25 & 28 & 33	"
6	"	24 & 22	"
5	"	21	"
4	"	19	"
3	"	14	"
2	"	13	"
2	"	9	Watts (2 in series)

LOOK FOR THE LABEL IN THE STEM

GENERAL ELECTRIC CO.

All types and varieties
Regular Multiple Lamps
Street Series Lamps
Miniature Lamps

Main Lamp Sales Office
Harrison, N. J.

(493)

LET US HAVE YOUR INQUIRIES WHEN IN NEED OF MICA OF ANY DESCRIPTION—WE CAN GIVE YOU WHAT YOU NEED QUICK AND AT THE RIGHT PRICES.
CHICAGO MICA CO., VALPARAISO, IND.

SPARKING

Reduces the working capacity of a motor or dynamo, wears out the commutator, wastes power and may cause a fire. All this may be avoided if you use . . . . . .

The only article that will PREVENT SPARKING. Will keep the Commutator in good condition and PREVENT CUTTING.

Absolutely Will Not Gum The Brushes.

It will put that high gloss on the Commutator you have so long sought after.

50 Cents per Stick. $5.00 per Dozen.
SEND FOR FREE SAMPLE STICK
For sale by all supply houses, or

K. McLENNAN & CO., Sole Mfrs., Room 411, Inter Ocean Bldg., 130 Dearborn St., Chicago

MICA

Of all Qualities, in any Form at Lowest Prices
EUGENE MUNSELL AND CO.
NEW YORK and CHICAGO

INSULATION That Is.

Micanite, Linotape, M. I. C. Compound, Empire Cloth and Paper. For Years the Standard.

MICA INSULATOR CO., Originators
NEW YORK and CHICAGO

ALWAYS READY AND DOES THE WORK. WILL MAKE THE SOLDER FLOW WHERE YOU WANT IT, AND STAY WHERE YOU PUT IT. IN COLLAPSIBLE TUBES AND TIN BOXES.
"NEW IDEA" SOLDERING PASTE SAMPLE FREE
NEW IDEA SOLDERING PASTE CO., 214 Hibbard Ave., Detroit, Mich.

VOLT - AMMETERS

POCKET SIZE

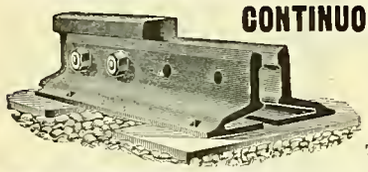
For testing Batteries and Battery Circuits, Locating Faults, Grounds, etc.
RELIABLE. - ACCURATE.
Send for Circular.

L. M. PIGNOLET
78-80 Cortlandt St., NEW YORK, N. Y.

Electric Heating Apparatus

SEND FOR 82-PAGE CATALOGUE

"UNIT" ENAMELED RHEOSTATS
SIMPLEX ELECTRIC HEATING CO.
Cambridgeport, Mass.



CONTINUOUS RAIL JOINT CO. OF AM.
NEWARK, N. J.
OVER 20,000 MILES IN USE

The St. Louis Exposition, 1904, awarded us the only gold medal for rail joint products.

Bijur "High-Duty" Battery
Mechanically Strong
And Chemically Correct
General Storage Battery Company
42 BROADWAY ***NEW YORK***

HORNBERGER TRANSFORMERS

LAFAYETTE ELECTRICAL MFG. CO.
LAFAYETTE, IND.

Water-Wheel Governors

Our new mechanical governors co-operate with the inertia effect on the water and the momentum of the plant.
They have cut the cost of good government in two. Guaranteed in every particular.

REPLOGLE GOVERNOR WORKS
AKRON, OHIO
WRITE FOR DESCRIPTIVE MATTER W.

COPPER AND GERMAN SILVER MAGNET WIRE
TELEPHONE SWITCHBOARD WIRE
BARE COPPER AND GERMAN SILVER WIRE
TINNED COPPER WIRE
ROSIN CORE SOLDER COIL WINDING
MAGNET WINDING MACHINES
AUTOMATIC COUNTERS
FOR COUNTING TURNS OF WIRE WOUND ON MAGNETS

BELDEN MANUFACTURING COMPANY
194 MICHIGAN STREET
CHICAGO

NOW READY

THE

P. & S. Decorative Socket No. 417

You don't have to take it apart to wire it up. Simply slip the wires in the slots and turn in the screw.

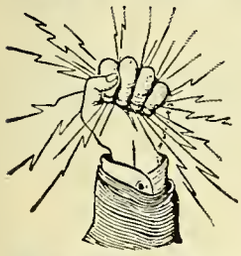
Your next order solicited.

PASS & SEYMOUR, Inc., Solvay, N. Y.
NEW YORK *CHICAGO* *SAN FRANCISCO*

FRANK N. PHILLIPS, Pres. EUGENE R. PHILLIPS, V. P. C. H. WAGENSEIL, Treas. C. R. REMINGTON, Jr., Sec.

AMERICAN ELECTRICAL WORKS,

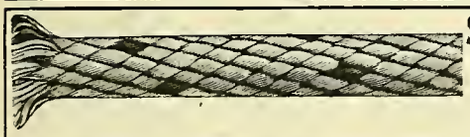
PROVIDENCE, R. I.



BARE AND INSULATED ELECTRIC WIRE,

ELECTRIC LIGHT LINE WIRE,
INCANDESCENT AND FLEXIBLE CORDS,
Railway Feeder and Trolley Wire,
AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.
CABLES FOR AERIAL AND UNDERGROUND USE.

NEW YORK STORE, W. J. Watson, 26 Cortlandt St.
CHICAGO OFFICE, F. E. Donohoe, 135 Adams St.
MONTREAL BRANCH, Eugene F. Phillips' Electrical Works.
MAIN OFFICES AND FACTORIES, PHILLIPSDALE, R. I.



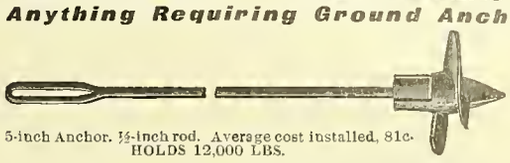
Samson Spot Cord
For
ARC LAMP and
TROLLEY CORD
Send for Samples and Prices

SAMSON CORDAGE WORKS, - Boston, Mass.

Anchors that hold

STOMBAUGH GUY ANCHORS
HOLD

HOLD POLES HOLD FENCES
HOLD STACKS HOLD TOWERS
Hold Anything Requiring Ground Anchorage



5-inch Anchor. ½-inch rod. Average cost installed, 81c.
HOLDS 12,000 LBS.

Try Them at Our Risk and Prove it
W. N. MATTHEWS & BRO.
Manufacturers
203 N. 2nd St. - - - - St. Louis

ADDISON GLASS CO.

Addison, N. Y.

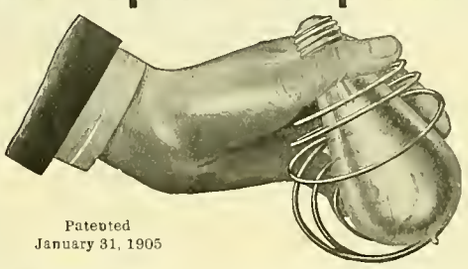
MANUFACTURERS OF

Open and Enclosed
ARC GLOBES

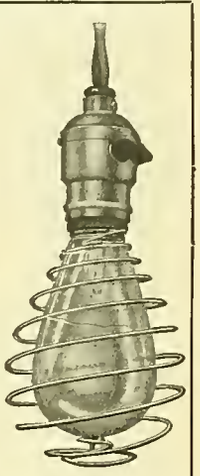
Opal Incandescent Shades and Reflectors

ORDERS RESPECTFULLY SOLICITED
New York Office, 39-41 Cortlandt Street

The "Spiral" Lamp Guard



Patented
January 31, 1905



DIRECTIONS—Insert lamp (*small end first*) between the *largest* helices in the manner shown above, and place the tip of lamp in the eye of the guard. "IT'S SPRINGY ALL OVER"

The simplest and best guard on the market. Each guard compressed and put up in a 4x4 in. Manila envelope. 6 gross in a barrel. Easy to handle. Convenient for stock. :: Write for free sample and prices.

S. H. COUCH CO., Inc., 156 Pearl St., Boston, Mass.
TEL. 4626 MAIN

EXPERT IN ELECTRICITY MECHANICS PATENT CAUSES
SOLICITOR OF **U. S. & FOREIGN PATENTS**
FORÉE BAIN, 1652-3 Monadnock Blk., CHICAGO

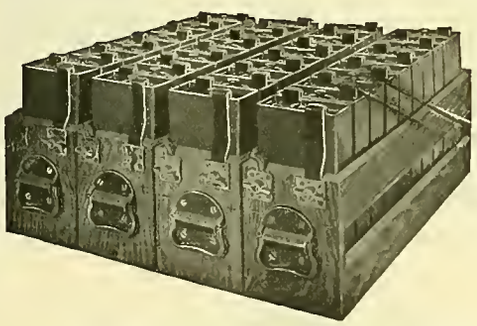
WE BUY OLD BELTS
OR SCRAPS, ANY SIZE OR CONDITION.
WE CLEAN, REPAIR AND RENEW OLD BELTS.
LEATHER PRESERVER MFG. CORP.
27 W. MONROE ST., CHICAGO

SAUQUOIT SILK MFG. COMPANY

INSULATING and BRAIDING SILKS

MILLS:
BETHLEHEM, PA.
PHILADELPHIA, PA.
SCRANTON, PA.
NEW YORK REPRESENTATIVES:
WILLIAM RYLE & COMPANY
54 Howard St.
PHILADELPHIA OFFICE:
4015 Clarissa St.
CHICAGO OFFICE:
210 Monroe St.
BOSTON OFFICE:
78 Chauncy St.

GIVES BEST RESULTS



Specially adapted for small lighting plants not to exceed 25-16 C. P. lamps for 8 hours. Let us quote you on telephone, fire alarm and police patrol battery work.

Cannot be equaled for
Great Capacity, Lightness and Efficiency

Write for Catalogue

Northwestern Storage Battery Co.,
285 Madison St., - - - Chicago, Ill.

NATIONAL CODE STANDARD

WEATHER-PROOF TRADE MARK "O.K." LINE AND HOUSE WIRES

"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Ideal Wire.

Prices and Samples on Application.

Phillips Insulated Wire Co.

Office and Factory: PAWTUCKET, R. I.

PREDOMINATES
IN
27 States

"IT gives me great pleasure to state, that for 'Gitthereitiveness' your periodical certainly is a winner. As you perhaps are aware, the company I travel for, advertises in all the electrical papers, and it has been a question in my mind whether they reached every central station, as their advertising manager would have our company believe. So, for one year I have kept account of the electrical papers and periodicals subscribed for and received by the manager or superintendent of electric light companies in twenty-seven states, (which has been my territory), and in summing it up, I find that your periodical predominates, three to one. I do not get in many telephone plants, but when I do, I invariably find the 'Western Electrician' staring me in the face."

The letter from which the above is taken, is dated May 8, 1905, and is on file in this office.

WANTED, FOR SALE *and similar* **WANT COLUMN** *advertisements (50 words or less), $1.50 an insertion; additional words 3c each.* **POSITION WANTED** *advertisements (50 words or less), $1.00 an insertion; additional words 2c each.*

POSITION WANTED

As superintendent of central station in city of about 10,000 or 20,000 inhabitants. Have had 16 years' experience, 32 years of age, married and temperate. Can furnish best of references. Address Box 514, care Western Electrician, 510 Marquette Bldg., Chicago.

POSITION WANTED

In power plant in manufacturing establishment. 16 years' experience, married, 32 years of age and temperate. Can furnish best of references. Address Box 513, care Western Electrician, 510 Marquette Bldg., Chicago.

POSITION WANTED.

As general manager or electrician in medium-sized plant on or near lake shore. Thoroughly familiar with every detail of plant work. Am at present general manager of a plant operating 24 hours daily, and with good salary, but on account of wife's health desire change of climate. Can come on two week's notice. Address Box 516, care Western Electrician, 510 Marquette Building, Chicago, Ill.

POSITION WANTED.

Owners of Electric Plants who are not receiving the dividends they should and who wish to correspond with a man able to make betterments and extend business, can address the writer. A small city from eight to fifteen thousand inhabitants preferred. Will not go to the South, or West of the Rocky Mountains. Address, Box 616, care Western Electrician, 510 Marquette Building, Chicago, Ill.

WANTED.

One second-hand 1,000 K. W. direct coupled compound engine and dynamo. The dynamo can be either 250 volts direct current or 2,300 volts, 60 cycles, 1, 2 or 3 phase alternating current. Please state in detail size of engine, tandem or cross compound, maker of engine, maker of dynamo, length of time they have been in use, location of same and approximate price f. o. b. cars. Address Box 508, care Western Electrician, 510 Marquette Bldg., Chicago, Ill.

WANTED.

Several linemen who have had some experience in electric light work. Permanent position. Apply by letter to Post Office Box 618, Highland Park, Ill.

WANTED.

A permanent position is open to a first-class experienced Spark and X-Ray Coil Winder. Address Box 511, care of Western Electrician, 510 Marquette Bldg., Chicago.

WANTED.

Strictly first-class electrical repair man to install motors and generators and work in repair shop. State experience, age, salary etc. Address Box 512, care of Western Electrician, 510 Marquette Bldg., Chicago.

FOR SALE.

One single phase alternator, 1100 volts, Fort Wayne, 50 K. W. ampermeter, rheostat and exciter for same, in good condition. Will guarantee in every respect. Reason for selling, increase of business necessitates our having a larger machine. Mauston Electric Service Co., Mauston, Wis.

POLES FOR SALE.

Carload 5 and 6 inch twenty-foot poles: cheap if taken at once. All heavy butts. Strictly N. C. A. specifications. Immediate shipment. Seasoned stock and winter peeled. Write now as this notice may not appear again. I. A. Maltby BOX 256 Bay City Mich.

WHY NOT

Get our easy terms on

ROBERTSON-THOMPSON INDICATOR

WILLIS PLANIMETER

VICTOR REDUCING WHEEL

Jas. L. Robertson & Sons,
198 Fulton St., - New York

PLACE YOUR

"Want" and "For Sale" advertisements in the

WESTERN ELECTRICIAN,

Immediate Returns.

WANTED

Orders for arc lamp designs. Will furnish plans of arc lamps in all essential particulars and for all purposes. Address

A. F. HAMACEK
2014 Kenmore Ave., Chicago, Ill.

FOR SALE.

200 BRAND NEW

General Electric

FAN MOTORS

16 inch. 110 volts.

125 CYCLES

$5.00 each boxed, f.o.b. Chicago

immediate shipment.

Gregory Electric Co.
54-62 S. Clinton St., Chicago.

SECOND-HAND MACHINERY

1 A. 70 T. H. 125 Cycle, 1100 Volt Alternator, 1070 R. P. M.
2 120 K. W. General Electric 125 Cycle, 1100 Volt, Type A. S. 1070 R. P. M. All complete with exciters—self-oiling bearings.
1 150 K. W. General Electric, 2 Phase, 60 Cycle, 2200 Volt, compensated revolving field alternator, 600 R. P. M.
1 270 K. W. T. R. 550 Volt Railway Generator, 600 R. P. M.
1 A. 70 Armature newly rewound.
1 20 K. W. 250 Volt Westinghouse Generator direct coupled to 7x10 Ideal Automatic Engine, new.
1 24x18 Ideal Automatic Engine.
2 66-inch x 20-ft Return Tubular Boilers built for 130 lbs. working pressure.
2 200 B. P. Marine Type Boilers, equipped with the Morrison furnace, 130 lbs.

The above is all in first-class operating condition and is offered subject to prior sale.

Springfield Light, Heat & Power Company
Springfield, Ill.

ELECTRICAL BOOKS.

All Kinds.

ELECTRICIAN PUBLISHING COMPANY,
Suite 510 Marquette Bldg., CHICAGO

WORKS QUICK AND EASY. KEEPS ITS LUSTER. HOLDS OLD TRADE AND MAKES NEW. DOES NOT DETERIORATE. ESTABLISHED 16 YEARS. SOLD BY AGENTS AND DEALERS ALL OVER THE WORLD

U.S. METAL POLISH 3 OUNCE BOX 10 CENTS SAMPLES SENT FREE GEO. W. HOFFMAN

POLISHES ALL METALS. BRANCHES: NEW YORK, CHICAGO, SAN FRANCISCO. 295 E. WASHINGTON ST. INDIANAPOLIS, IND.
HIGHEST AWARD, CHICAGO WORLD'S FAIR, 1893. LOUISIANA PURCHASE EXPOSITION 1904.

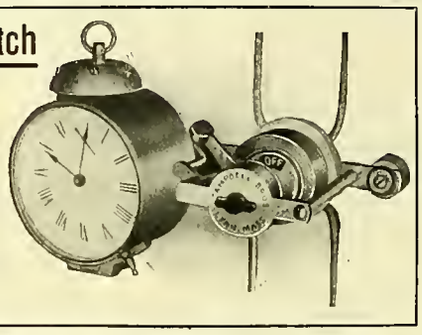
Campbell Time Switch

THE BEST

For operating

Window Lights, Contract Service, Time Exposures

And many other uses too numerous for mention here. Send now for sample and our low prices.



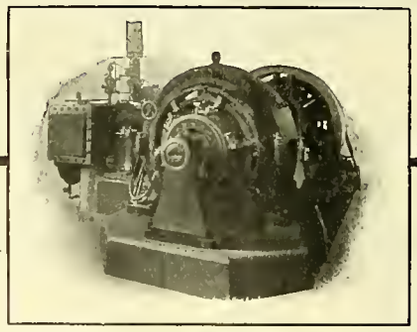
CAMPBELL BROS.
Mfrs. Electrical Apparatus
LYNN, MASS. U. S. A.

AMERICAN ELECTRICAL SUPPLY CO

Although our business is growing fast we are still able to take care of more customers. Let us add your name to the satisfied list.

IF ELECTRICAL AND GOOD WE SELL IT

83-85-87 FIFTH AVE CHICAGO



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As Good as The Best—"And Then Some."

Ball Compound Engine

Northern Dynamos

Northern Direct Current Apparatus possesses all the characteristics of economical, convenient operation common to excellent electric dynamos and motors and

Many exclusive meritorious features that make it worth your while to get acquainted by reading Bulletin No. 2546

NORTHERN ELECTRICAL MFG. CO.,
Engineers Manufacturers.
425 Monadnock Block, Chicago, Ill. Madison, Wis., U. S. A.

PROPOSALS.

SANITARY DISTRICT OF CHICAGO.

TO CONTRACTORS.

Sealed Proposals addressed to the Board of Trustees of the Sanitary District of Chicago and indorsed:

"PROPOSALS for furnishing electrical apparatus and materials and for the installation of the same in the Power House of the Sanitary District of Chicago, near Lockport, Illinois, and transmission line along the Right of Way of the said District to the City of Chicago," will be received by the Clerk of the said Sanitary District at Room 1110 Security Building, Chicago, Ill., until 12 m. (standard time) on Wednesday, the 11th day of October, A. D. 1905, and will be publicly opened by the said Board of Trustees at a meeting of the Board held on that day.

The work for which said tenders are invited is as follows:

Division A—Main Switchboard and Instruments.
Division B—Transfer Boards Oil Circuit-breaker Switches and Knife Switches.
Division C—Remote-controlled Rheostats for Generators.
Division D—Bus Bars and Bus bar and Circuit Compartments.
Division E—Conduits, Service Wiring, Transformer and Generator Connections.
Division F—Transformers and Lightning Arresters.
Division G—Transmission Line Towers or Poles.
Division H—Erecting Towers or Poles.
Division I—Copper and Aluminium Conductors.
Division J—Erection of Cable.
Division K—High Tension Insulators.
Division L—Electric Traveling Crane.

For the purpose of receiving proposals in part and as a whole the specifications are made in Divisions designated in letters A, B, C, etc. Proposals must be made separately on each Division, and as a whole on the total number of Divisions covered by the proposal.

Each bid must be accompanied by a certified check or cash to the amount of five (5%) per cent of the aggregate proposals submitted.

All certified checks must be drawn on some responsible bank doing business in the City of Chicago and shall be made payable to the Clerk of the Sanitary District of Chicago. Said amounts deposited with bids will be held by the Sanitary District until all the respective bids for said work have been canvassed and the contracts awarded and signed. The return of said checks or cash to the bidders to whom the award of said work shall be made shall be conditioned upon their appearing within ten (10) days after receiving notice of such award with bondsmen and executing a contract with the Sanitary District for the work so awarded to them or each of them and giving a bond or bonds satisfactory to the Board of Trustees for the performance of the work contracted for in amounts equal to fifty (50%) per cent of the contract price noted in the proposal.

All proposals must be on blank forms furnished with the specifications, inclosed in blank envelopes and indorsed "Proposal for Divisions A, B, C," or such Division as may be covered by proposal. All specifications must be returned with the proposals.

No bid will be considered unless the party making it shall furnish evidence satisfactory to the Board of Trustees of his experience and ability in this class of work and his financial ability to prosecute said contract in case the same shall be awarded to him. Plans and specifications are on file in the office of the Chief Engineer, Room 1010 Security Building, Chicago.

Contractors are required to state in their bid their individual names and places of residence in full.

The Board of Trustees reserves the right to reject any and all bids.

SANITARY DISTRICT OF CHICAGO,
By Zina R. Carter,
President of Its Board of Trustees.

Attest: S. D. Griffin, Clerk.
Chicago, August 9, 1905.

Only 10 Cents Each

Practical Books ON Electricity.

How to make a dynamo.
How to make a telephone.
How to make an electric motor.
How to make a storage battery.
How to make a Wimhurst electric machine.
How to make a magneto machine.
How to make a medical induction coil.
How to make a pocket accumulator.
How to make a plunge battery.
How to make a voltmeter.
How to make a galvanometer.
How to make a hand dynamo.
How to make a talking machine.
How to make a ⅛ H. P. dynamo or motor.
How to make a toy motor.
How to make an electric bell.
How to make a telegraph instrument.

These books are illustrated and will be sent prepaid on receipt of price.

Electrician Publ'g Co.,
510 Marquette Building,
CHICAGO.

CHICAGO EDISON COMPANY REPAIR SHOPS

76 MARKET STREET, CHICAGO. TELEPHONE MAIN 1280

FIRST CLASS EQUIPMENT THROUGHOUT

High-Grade Machine Work of All Kinds Correspondence Solicited.

Dynamos, Armatures, Motors, Arc Lamps, Fans, Instruments.

ELECTRICAL REPAIRING

We Guarantee All Work

DYNAMOS, ARMATURES, MOTORS, ARC LAMPS, INSTRUMENTS, GENERAL REPAIRING. Correspondence Solicited.
NEW AND SECOND-HAND MACHINERY FOR SALE

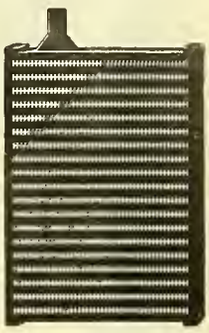
SOUTHWESTERN ELECTRIC CO., ST. LOUIS.

Just What the World Has Been Waiting For.

NEW "MORRISON" STORAGE BATTERY

THE CELL

This plate is so strong electrically and mechanically that no amount of electrical abuse or of vibration in traction service can dislodge even the slightest particle of its active material.
Lowest internal resistance of any storage battery in the world.
The weight efficiency is conservatively 14 watts per pound total weight, and electrical efficiency unsurpassed . . . .



THE PLATE

UNIVERSAL ELECTRIC STORAGE BATTERY CO.

INCORPORATED

OFFICE: 1355 RAILWAY EXCHANGE BUILDING FACTORY: 36-38 UNION PARK PLACE
CHICAGO, ILLINOIS

Crimshaw

Raven White Core

Raven Black Core

ALL OUR WIRES pass inspection and carry the above TRADE-MARKS on our tags. We also manufacture Crimshaw and Competition Tapes and Splicing Compounds.

NEW YORK INSULATED WIRE COMPANY,

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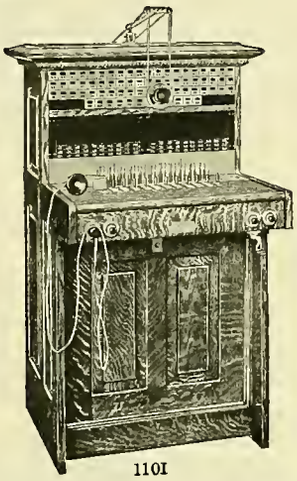

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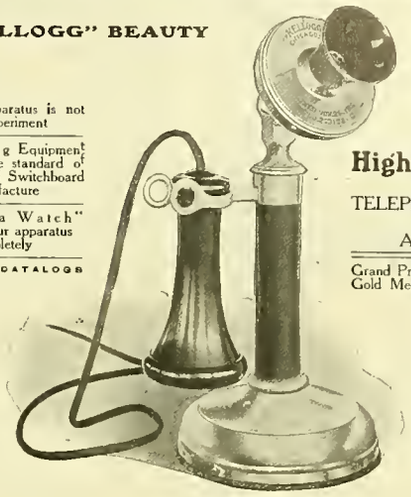

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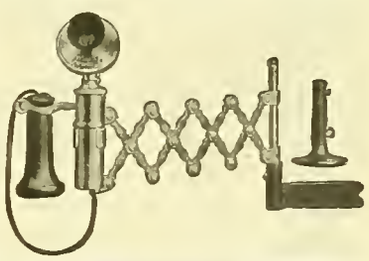

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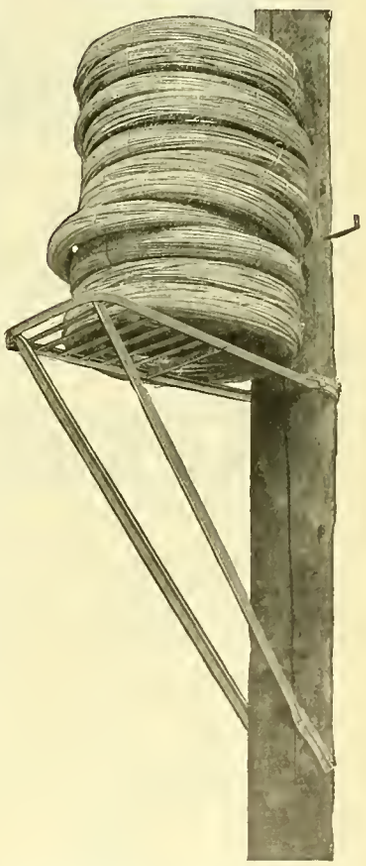

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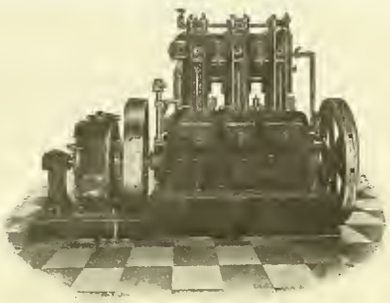

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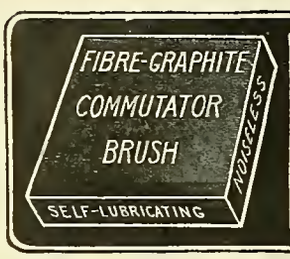

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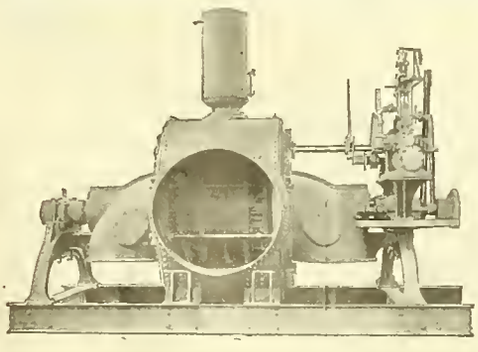

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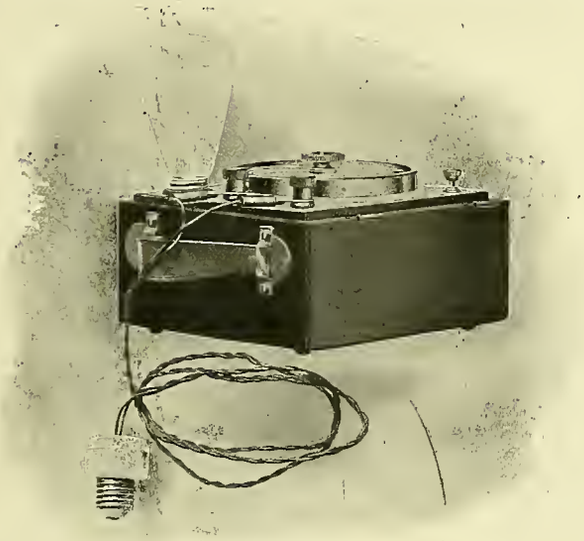

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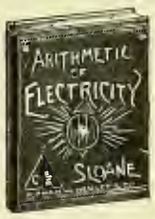

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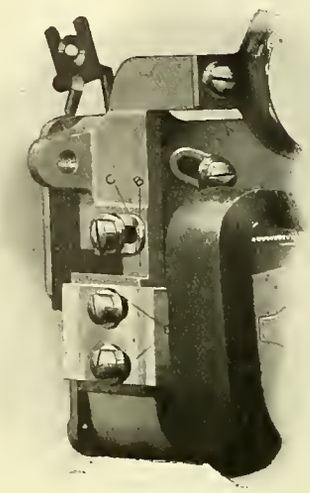

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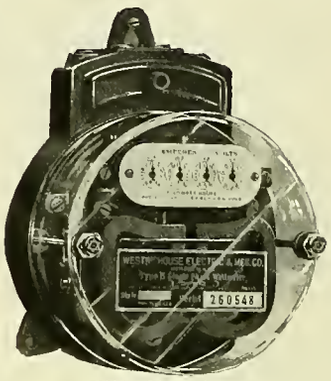

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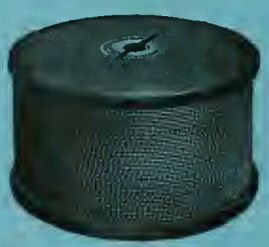

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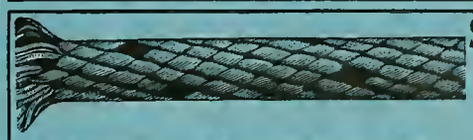
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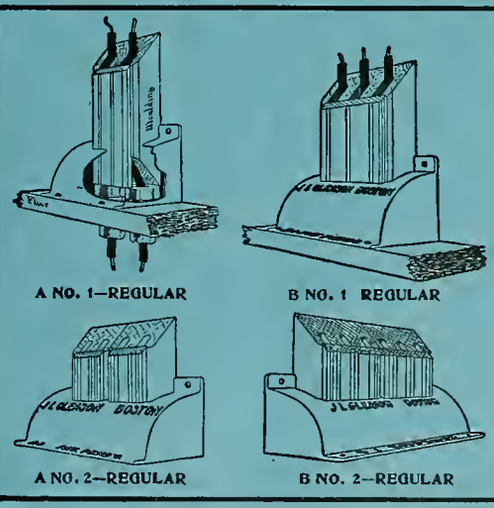
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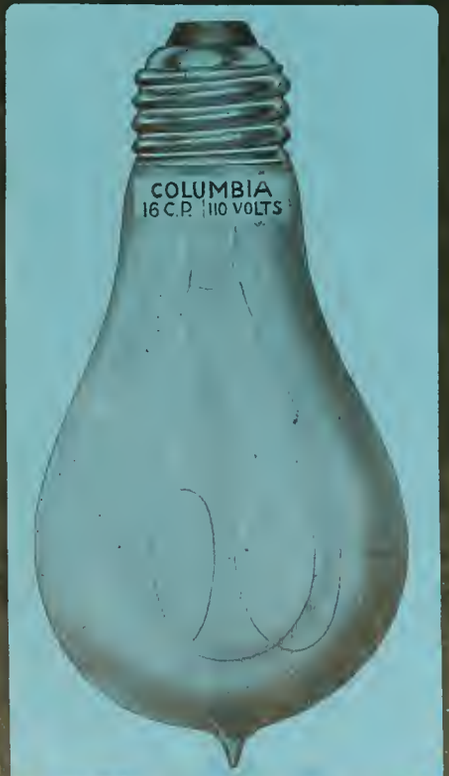

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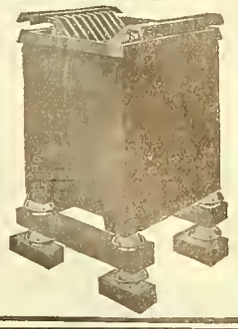

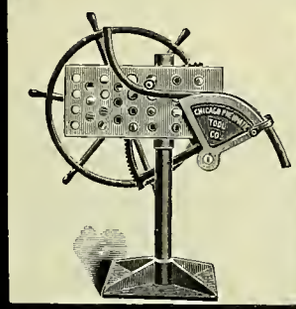

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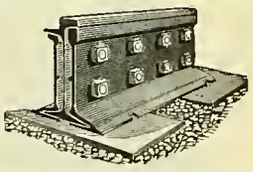

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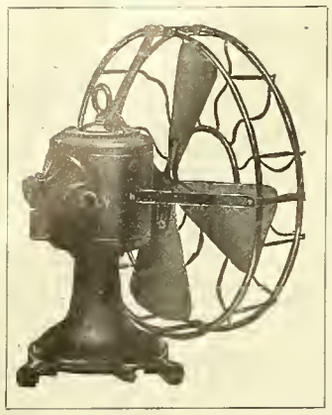

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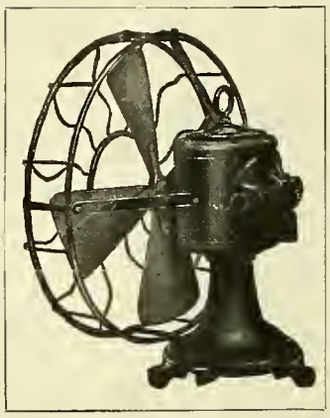

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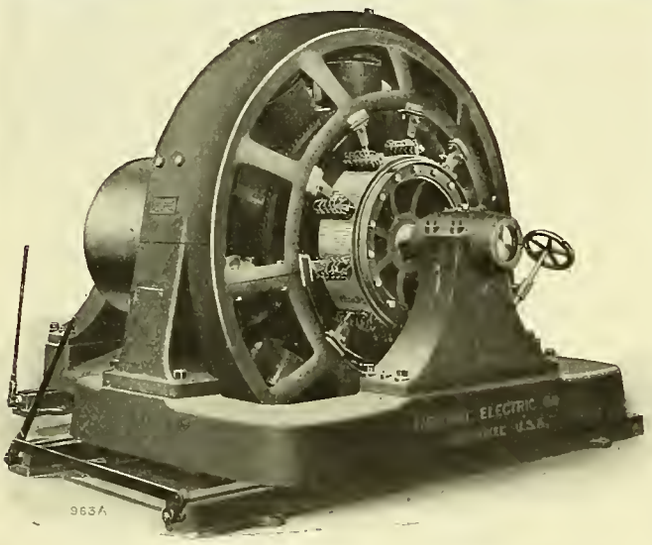

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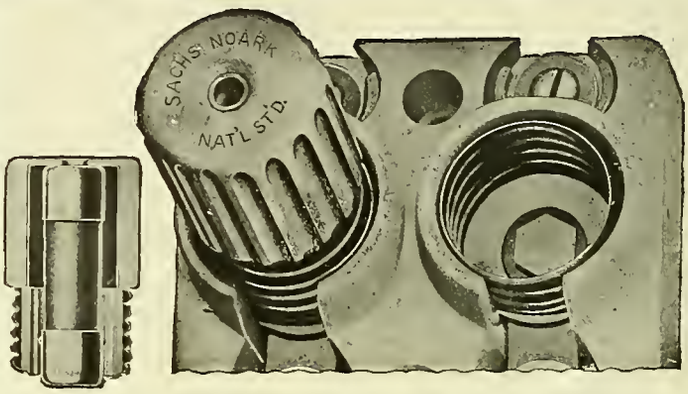

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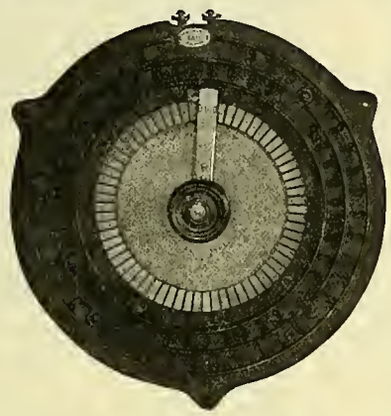

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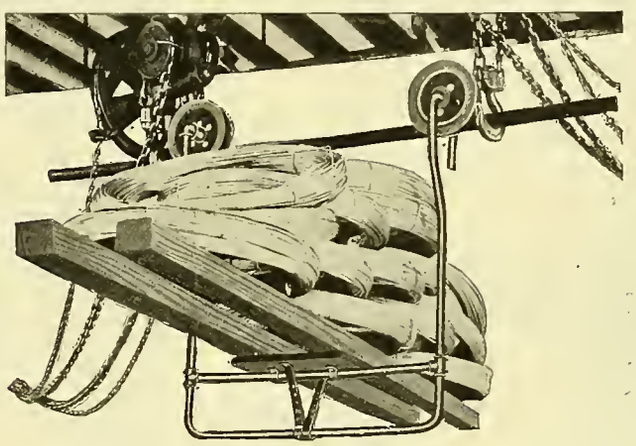

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how many customers you fail to get by not having your name in this Directory.

ENGINEERS
Represented in this "Directory" are enabled to come in touch with many prospective customers who cannot be reached through any other source.

BYLLESBY, H. M. & Co.
(Incorporated)
ENGINEERS
Design, Construct and Operate Railway, Light Power, Hydraulic and Gas Plants.
Examinations and Reports.
New York Life Building - CHICAGO, ILL

HAMACEK, A. F.
Designer of Electrical and Mechanical Apparatus.
Arc Lamps a Specialty
2014 Kenmore Ave., Chicago, Ill.

KOHLER BROS.,
Contracting Electrical Engineers,
Lighting, Power, Railways,
1804-1806-1808-1810-1812 Fisher Building,
CHICAGO.

STANTON, LE ROY W.
Consulting Telephone Engineer
Plans, Specifications and Supervision of Installation of Complete Telephone Plants
Special Reports on Telephone Properties and Apparatus
411 Electrical Bldg., Cleveland, Ohio

DUGALD C. JACKSON, C. E.
WILLIAM B. JACKSON, M. E.
MEMBERS
AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS
AMERICAN SOCIETY OF MECHANICAL ENGINEERS
AMERICAN SOCIETY OF CIVIL ENGINEERS
ENGINEERS. EXPERTS.
MADISON, WIS.

ELECTROMAGNETS AND SOLENOIDS
Induction Coils Spark Coils Ruhmkorff Windings
EVERYTHING IN THE COIL LINE
SPECIALTY: Calculation, Design and Construction of Electro-Magnets and Solenoids to perform a given duty
CHARLES R. UNDERHILL, 55 Liberty St., New York

Michigan College of Mines
F. W. McNAIR, President
A state institution making use of an active mining district. For Yearbook and Record of Graduates apply to
President or Secretary.

2 IN ONE
WAGNER TRANS-FORMERS
SERVE TWO PURPOSES
THEY CAN BE USED FOR EITHER
LIGHTING OR POWER

service, and give the same high efficiency as the best of transformers designed for either service alone.
They show practically the same regulation on unbalanced three-wire loads as on two-wire loads.
These transformers are interchangeable on motor and lighting loads. They have the same voltage ratio for motor work as for lighting. Bulletin No. 66 tells more. Write for a copy. Also Motor-Generator Sets, Bulletin No. 69; Indicating Meters, Bulletin No. 67; and A. C. Motors, Bulletin No. 68.

WAGNER ELECTRIC MANUFACTURING CO.
ST. LOUIS MISSOURI U. S. A.

Where a friction clutch will operate satisfactorily you do not need an Accelerator.

Where a friction clutch starts a load too abruptly, where it causes continual delay and expense for adjustment and repairs and when it cannot be balanced for as high speeds as you require, an Accelerator is what you do need.

Book One tells about the Accelerator, the only clutch ever designed that will automatically accelerate a load from rest to full speed, that will operate for years without appreciable wear, and that can be balanced for the highest speeds.

Send us your address and we'll gladly mail you a copy.

Cutler-Hammer Clutch Co.
MILWAUKEE, WIS.

NEW YORK 136 Liberty St. | BOSTON 176 Federal St. | CHICAGO Monadnock Bldg. | PITTSBURG Farmers Bank Bldg.

ENGINEERS AND ELECTRICIANS

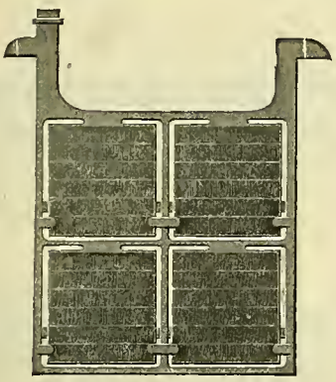
Stops Sparking, Prevents Heating and Cutting

A Money-Making Proposition

is open to you if you have charge of a motor or generator. We will send you FREE a regular 50c stick just to prove how good it really is, and will explain our profit-sharing plan on trial orders.

Send 3 cents in stamps to cover postage.

SLUSSER BROTHERS, Mfgrs. Electrical and Mechanical Specialties, Bradford Bldg., CHARLESTON, W. VA.



ABOVE ALL OTHER CONSIDERATIONS

Electric Storage Batteries of the "Unit Accumulator" Type are

RELIABLE

FOR STREET RAILWAYS, CENTRAL STATIONS, TELEPHONE SYSTEMS, ETC.

Descriptive Catalogue and Prices Furnished Upon Application.

Ask for Bulletin on "A MODERN TELEPHONE EXCHANGE."

National Battery Company

Branch Offices: NEW YORK, CHICAGO BUFFALO, N. Y.

"Flexduct" is that high standard required in all high-class work. It is very flexible, a high insulation and indestructible

FLEXIBLE CONDUIT

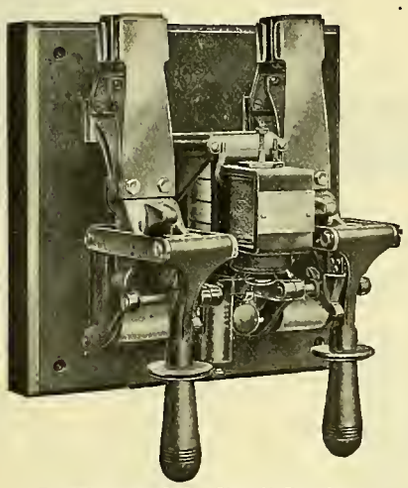
"Flexduct" the National Code Standard. It does not deteriorate, always usable to highest degree

OSBURN FLEXIBLE CONDUIT COMPANY,

NEW YORK CHICAGO SAN FRANCISCO

General Electric Company

Automatic Circuit Breakers



Double-pole C. P. Circuit Breaker with low voltage release

Carbon Break 1 to 1000 amperes 250 to 650 volts

They meet every requirement.

Furnished with low voltage, overload or underload release attachments and with shunt trip, auxiliary or bell alarm switches.

Construction is simple, compact and durable.

Price is low.

Detailed information supplied promptly on request.

Principal Office: Schenectady, N. Y. Chicago Office, Monadnock Bldg. Sales Offices in all Large Cities

676

JEWEL TROUBLE

All trouble is eliminated in the Sangamo D. C. Wattmeter.

We use no brushes or commutators—don't need to.

Every Direct Current Central Station should know about the Sangamo Wattmeter—Ask us.

ELECTRIC APPLIANCE COMPANY
CHICAGO and SAN FRANCISCO

VOLT - AMMETERS
POCKET SIZE
For testing Batteries and Battery Circuits, Locating Faults, Grounds, etc.
RELIABLE. - ACCURATE.
Send for Circular.
L. M. PIGNOLET
78-80 Cortlandt St., New York, N. Y.

M. KLEIN & SON
Send 2c stamp for new catalogue No. 6 of
KLEIN'S TOOLS
For Electrical Workers and Line Builders.
MATHIAS KLEIN & SONS.
81 W. Van Buren St. Chicago, Ill.

LAMPS

Get acquainted with the
PEERLESS—MONEY SAVERS
MADE RIGHT
PRICED RIGHT
ARE RIGHT
WESCO
THE WESCO SUPPLY CO., ST. LOUIS, MO.
"EVERYTHING ELECTRICAL"

RELIABLE RENEWALS
DURABLE
INSTALLATIONS **EFFICIENT**
GENERAL STORAGE BATTERY CO.
42 Broadway NEW YORK

WORKS QUICK AND EASY. KEEPS ITS LUSTER. HOLDS OLD TRADE AND MAKES NEW. DOES NOT DETERIORATE. ESTABLISHED 16 YEARS. SOLD BY AGENTS AND DEALERS ALL OVER THE WORLD
3 OUNCE BOX 10 CENTS
SAMPLES SENT FREE
U.S. METAL POLISH GEO. W. HOFFMAN
POLISHES ALL METALS. BRANCHES: NEW YORK, CHICAGO, SAN FRANCISCO. 295 E. WASHINGTON ST. INDIANAPOLIS, IND.
HIGHEST AWARDS: CHICAGO WORLD'S FAIR, 1893. LOUISIANA PURCHASE EXPOSITION 1904.

MICA
Of all Qualities, In any Form at Lowest Prices
EUGENE MUNSELL AND CO.
NEW YORK and CHICAGO

INSULATION That Is.

Micanite, Linotape, M. I. C. Compound, Empire Cloth and Paper. For Years the Standard.

MICA INSULATOR CO., Originators
NEW YORK and CHICAGO

"AS GOOD AS
THE EDISON"

is the claim made for all other lamps. When you can get the "Edison" why take
"Just as Good?"
LARGE STOCKS—PROMPT SHIPMENTS.

LOOK FOR THE LABEL IN THE STEM

All types and varieties. Regular multiple lamps.
Street series lamps. Miniature lamps.

GENERAL ELECTRIC COMPANY
Main Lamp Sales Office, - - Harrison, N. J.
(488)

YOU NEED IT!

Cale's Commutator Compound.
The Only Article That Will Prevent Sparking.
Will keep the Commutator in good condition and prevent cutting. Absolutely will not gum the brushes.
50c. per stick. $5.00 per dozen. Send 50c. for trial stick.
FOR SALE BY ALL SUPPLY HOUSES OR
K. McLENNAN & CO., Sole Manufacturers, Room 411, Inter Ocean Bldg., 130 Dearborn St., **CHICAGO.**

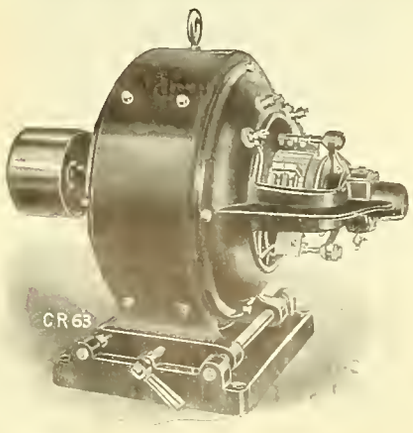
AMERICAN ELECTRICAL SUPPLY CO

Although our business is growing fast we are still able to take care of more customers. Let us add your name to the satisfied list.

IF ELECTRICAL AND GOOD WE SELL IT

83-85-87 FIFTH AVE CHICAGO

MICABOND
will save you money in your repair work as well as in your new machines. It is good insulation—made out of the best materials and is sold at reasonable prices.
CHICAGO MICA CO. VALPARAISO, IND.



"The Standard" Motors
20 FRAMES

from 15 HP down—Motors suitable for over 90% of all classes of work for which Motors can be used, and each frame from the smallest to the largest designed with extreme care and built in a factory lacking nothing of complete facilities for making the best possible Motors.

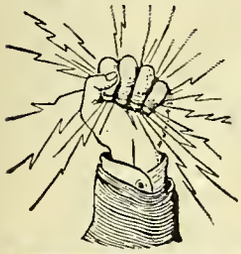
Every customer receives prompt delivery, fair prices, efficient and durable Motors, satisfaction,—where will your money buy more?

THE ROBBINS & MYERS CO.
MAIN OFFICE AND WORKS: SPRINGFIELD, OHIO

FRANK N. PHILLIPS, Pres. EUGENE R. PHILLIPS, V. P. C. H. WAGENSEIL, Treas. C. R. REMINGTON, Jr., Sec.

AMERICAN ELECTRICAL WORKS,

PROVIDENCE, R. I.



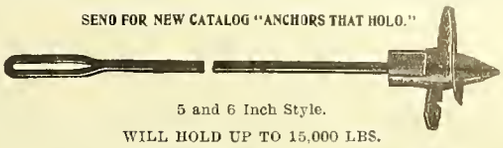
BARE AND INSULATED ELECTRIC WIRE,

ELECTRIC LIGHT LINE WIRE,
INCANDESCENT AND FLEXIBLE CORDS,
Railway Feeder and Trolley Wire,
AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.
CABLES FOR AERIAL AND UNDERGROUND USE.

NEW YORK STORE, W. J. Watson, 26 Cortlandt St.
CHICAGO OFFICE, F. E. Donohoe, 135 Adams St.
MONTREAL BRANCH, Eugene F. Phillips' Electrical Works.
MAIN OFFICES AND FACTORIES, PHILLIPSDALE, R. I.

STORAGE BATTERIES!
(THE "X-CELL")
Complete Battery Plants for Any Purpose
Telephone Power Plants a Specialty
TOLEDO STORAGE BATTERY & ELECTRIC CO., 111 Ottawa St., Toledo, O.

OUR PROPOSITION
WE WILL SHIP ON 30 DAYS TRIAL
ANY NUMBER OF
STOMBAUGH GUY ANCHORS
OVER TWELVE
IF SATISFACTORY PAY FOR THEM, OTHERWISE, RETURN CHARGES COLLECT
WE PREPAY FREIGHT ON INITIAL ORDERS
SEND FOR NEW CATALOG "ANCHORS THAT HOLD."



5 and 6 Inch Style.
WILL HOLD UP TO 15,000 LBS.
W. N. MATTHEWS & BRO.
MANUFACTURERS
203 N. 2nd St. ST. LOUIS, MO.

"Diamond H" Switches
Trade H Mark
This Trade-Mark guarantees quality.
The Hart Mfg. Co., Hartford, Conn.
New York Boston Chicago Toronto, Ont.

NATIONAL CODE STANDARD

"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Ideal Wire.
Prices and Samples on Application.
Phillips Insulated Wire Co.
Office and Factory: PAWTUCKET, R. I.

EXPERT IN ELECTRICITY MECHANICS PATENT CAUSES
SOLICITOR OF U. S. & FOREIGN **PATENTS**
FORÉE BAIN, 1652-3 Monadnock Blk., CHICAGO

Electrical Supplies
WRITE FOR PRICES
G. F. SAUTER CO., ELECTRICAL CONTRACTORS
Segel Bldg., Cor. State and Lafayette Sts.
SCHENECTADY N. Y.

YOST SPECIALTIES.

Sockets, Wall Sockets, Weatherproof Sockets, Rosettes, Receptacles, Cord Adjusters.
Catalogue for the asking.
THE YOST ELECTRIC MFG. CO.
TOLEDO, OHIO.

"AMERICAN" STORAGE CELLS
ARE THE BEST. Send for Descriptive Circular.
AMERICAN BATTERY CO.,
EST'D 1892. 171 S. Clinton St., Chicago.

5¢ **TELEPHONE NICKELS**

We have them. Why hunt around or borrow from some one else the necessary **Five-Cent-Piece** to operate your telephone? Always happens when you are in a hurry to use the telephone, no nickel handy. A few of our **Telephone Nickels** always on hand at office or home obviates vexation and delays. Keep track of your telephone calls this way. Use our telephone nickels, made of bright brass. **Can not be spent, only on 'phone.**

50 POSTPAID, 55 CENTS 100 POSTPAID, $1.00
SEND YOUR ORDERS TO
The Turner Brass Works
Manufacturers
Franklin and Michigan Streets, CHICAGO

SELF FLUXING SOLDER

FOR ALL PURPOSES
IN 18-INCH STICKS OR ON REELS
Kester Solder Can't Leak Flux.
CHICAGO SOLDER CO.
R. C. MILLER
St. Louis, Mo.
Cen. Western Agt.
46 N. Union Street, CHICAGO

PREDOMINATES IN 27 States

"IT gives me great pleasure to state, that for 'Gitthereitiveness' your periodical certainly is a winner. As you perhaps are aware, the company I travel for, advertises in all the electrical papers, and it has been a question in my mind whether they reached every central station, as their advertising manager would have our company believe. So, for one year I have kept account of the electrical papers and periodicals subscribed for and received by the manager or superintendent of electric light companies in twenty-seven states, (which has been my territory), and in summing it up, I find that your periodical predominates, three to one. I do not get in many telephone plants, but when I do, I invariably find the 'Western Electrician' staring me in the face."

The letter from which the above is taken, is dated May 8, 1905, and is on file in this office.

WANTED, FOR SALE *and similar* **WANT COLUMN** *advertisements (50 words or less), $1.50 an insertion; additional words 3c each.* **POSITION WANTED** *advertisements (50 words or less), $1.00 an insertion; additional words 2c each.*

POSITION WANTED.

As general manager or electrician in medium-sized plant on or near lake shore. Thoroughly familiar with every detail of plant work. Am at present general manager of a plant operating 24 hours daily, and with good salary, but on account of wife's health desire change of climate. Can come on two week's notice. Address Box 515, care Western Electrician, 510 Marquette Building, Chicago, Ill.

POSITION WANTED

As superintendent of light or power company. Will consider any other good position in the electrical business. At present have charge of a medium-sized plant, but desire a change. Am perfectly familiar with the light and power business from the ground up. Have had 5 years practical experience in the light and power business. Am strictly sober, unmarried and 23 years old. Best of references as to character and ability and will go anywhere. Address box 517, care Western Electrican, 510 Marquette Bldg., Chicago.

POSITION WANTED

By engineer and electrician to take charge of electrical plant. Well versed on Corliss and high speed engines, pumps and boilers and electrical machinery. Would prefer Western state. 20 years' experience. Good references. Salary to start, $100.00 per month. Address Box 518 care of Western Electrician, 510 Marquette Bldg., Chicago.

POSITION WANTED

By young steam engineer in electric light, and power plant, in city of 2 to 10 thousand (population) with view of investing in same if on a profitable basis, or might buy small plant outright. Northern part of Illinois preferred. For further particulars, address Box 520, care of Western Electrician, 510 Marquette Bldg. Chicago.

POSITION WANTED

By young man age 22, in electric light or power plant or with electrical manufacturing company, where I can advance. Have had 3 years college education; have almost finished Scranton Course in electric lighting. Western position preferred. Can furnish references. During past year have installed telephone switchboards and private lighting plants. Willing to begin at bottom. Address box 519 care of Western Electrician, 510 Marquette Bldg., Chicago.

WANTED.

One 60 K. W. new or second-hand alternator 1,100 volts, 133 cycles single phase, also one 110 H. P. engine, give speeds and sizes of pulleys. This machinery must be in first class condition and fully guaranteed. Address HARRY GOOFREY, Clerk, Village of Jonesville, Jonesville, Mich,

WANTED

One chief engineer to take charge of central station, 200 Kw. 3 phase, A. C. generators, 3 horizontal boilers, 2 Corliss engines, 1 amonia compressor; must be capable of making all repairs, installing new machinery, taking charge of the detail management of the mechanical department and operate the plant to 9 P. M. Also want one arc lamp trimmer and wiremau's helper, and one engineer's helper and wiper. State experience, age and salary expected. Address P O. Box 119, Grand Island, Neb.

WANTED.

Several linemen who have had some experience in electric light work. Permanent position. Apply by letter to Post Office Box 618, Highland Park, Ill.

WANTED

Orders for arc lamp designs. Will furnish plans of arc lamps in all essential particulars and for all purposes. Address

A. F. HAMACEK
2014 Kenmore Ave., Chicago, Ill.

PLACE YOUR

"Want" and "For Sale" advertisements in the

WESTERN ELECTRICIAN.

immediate Returns.

ELECTRICAL MATERIAL FROM THE ST. LOUIS WORLD'S FAIR

Over one million dollar's worth of electrical supplies is offered for sale at very low prices. This is an opportunity which you dare not overlook. We are making shipment of this material direct from our St. Louis headquarters. We guarantee everything to be strictly in first-class condition.

RUBBER COVERED WIRE

In long lengths, on coils and reels, carefully selected and guaranteed good as new for further service.

140,000 ft. No. 14	130,000 ft. No. 2
65,000 ft. No. 12	60,000 ft. No. 1
30,000 ft. No 10	25,000 ft. No. 1-0
46,000 ft. No. 8	14,000 ft. No. 2-0
15,000 ft. No. 6	16,000 ft. No. 3-0
100,000 ft. No. 4	48,000 ft. No. 4-0
90,000 ft. No. 3	

75,000 ft. 300, 350, 400, 500 and 600,000 C. M.

Slow Burning Weatherproof Wire

50,000 lbs. No. 16	40,000 lbs. No. 4
50,000 lbs. No. 14	50,000 lbs. No. 3-0
50,000 lbs. No. 12	100,000 lbs. 300,000 C. M.
50,000 lbs. No. 10	175,000 lbs. 400,000 C. M.
35,000 lbs. No. 8	140,000 lbs. 500,000 C. M.
30,000 lbs. No. 6	40,000 lbs. 600,000 C. M.

Weatherproof Wire, Triple Braid, Solid Conductor

60,000 lbs. No. 14	45,000 lbs. No. 4
60,000 lbs. No. 12	10,000 lbs. No. 3
60,000 lbs. No. 10	25,000 lbs. No. 2
25,000 lbs. No. 8	30,000 lbs. No. 1
110,000 lbs. No. 6	

Weatherproof Wire, Triple Braid, Stranded Conductor

160,000 lbs. No. 2-0	40,000 lbs. No. 1-0

LEAD COVERED CABLE

500,000 feet, all sizes from No. 14 to 500,000 C.M. Quick delivery and low prices.

INCANDESCENT LAMPS

200,000 lamps, used a short time, and in good condition for further service. Have been tested. They are 104 voltage, Edison Base, 8 candlepower. In lots of 1000, each 5 cents.

150,000 brand new Incandescent Lamps in original cases of 200, 250 and 400 Lamps, ranging from 100 to 110 voltage, 8 candlepower, General Electric make. Price each in case lots, 10 cents.

200,000 Colored Incandescent Lamps, brand new, never used, General Electric make, 104 voltage, Edison Base; colors, Amber, Green, Opal and Ruby; put up 200 in a case. Price, each 30 cents; are worth 35 cents each.

20,000 Incandescent Lamps, voltage 100 to 120, Edison, T. H. and Westinghouse Base; 8, 10, 16, 20 and 25 candlepower; put up 250 in a case, second selection. Price each in case lots 10½ cts.

WOOD CONDUIT

100,000 Feet, Size 4½ x 4½

MISCELLANEOUS

300,000 No. 9171 Porcelain, Edison Base Receptacles.
50,000 Weatherproof "Bryant" Sockets.
1,000,000 split glazed B. & D. Wiring Knobs.
300,000 Glazed Porcelain B. & D. Wiring Knobs, sizes 3½, 4½ and 5½.
20,000 No. 8 Standard Porcelain Knobs.
200,000 Single Wire glazed Porcelain Cleats.
15,000 Porcelain Cut-outs.
26,000 Plugs.
2,000 000 unglazed Porcelain Tubes.
40,000 Glass Insulators.
20,000 Porcelain Cleats.
All kinds of switches and instruments.

Ask for our Special Catalogue No. 567.

CHICAGO HOUSE WRECKING COMPANY, 35th and Iron Sts., CHICAGO

FOR SALE.

One single phase alternator, 1100 volts, Fort Wayne, 50 K. W. ampermeter, rheostat and exciter for same, in good condition. Will guarantee in every respect. Reason for selling, increase of business necessitates our having a larger machine. Mauston Electric Service Co., Mauston, Wis.

FOR SALE

At a bargain, complete equipment for an 80 K. W. light plant. Buckeye Eng. Brush, generator, Brush arching machine, 3 boilers. Fully guaranteed. Write Bolton Bros. Electric Co., Aledo, Ill.

FOR SALE.

$200.00 1-45 K. W. 133 Cycle 1,600 R. P. M. Westinghouse alternator with sub-base and exciter and station instruments all in good operating condition. AMBOY LIGHT & POWER CO., Amboy, Ills.

Automatic Engines

FOR SALE AT GREAT SACRIFICE

2—200 H. P. 13-in. & 26-in. x 16-in. Armington & Sims tandem compound. Wheels 8-ft. x 22-in. face.

1—150 H. P. 15½-in. x 16½-in. Dick & Church center crank. Wheels 6-ft. x 16½-in. face.

1—125 H. P. 11-in. & 18-in. x 16-in. McEwan tandem compound. Wheel 64-in. diameter x 12½-in. face.

1—15 H. P. 7-in. x 8-in. Payne center crank. Wheels to suit purchaser.

THOMAS P. CONARD
119 So. Fourth St. Philadelphia, Pa.

EVERY COMFORT

Attends the Traveler between

Chicago Indianapolis Cincinnati & Louisville

Who Travels via the

MONON ROUTE

Consult Your Local Ticket Agent

As your ad in the Western Electrician will be read, you will never be blue.

"LIGHTING FRANCHISE EXPIRES"

The lighting franchise held by a private company in the City of Ashland, Wisconsin, expires in June, 1907. This franchise is exclusive for public and private lighting and the company is now seeking a renewal of such franchise, under an agreement to make a reduction of rates.

According to the sworn annual report the company's net income on public and private lighting for the year 1904, was $13,256.04, and the population of the city, according to the 1905 census, is 15,000.

The city authorities are desirous of inviting competition that may wish to enter this field and will be glad to enter into communication with investors or promoters who would like to submit propositions.

As the question of the city constructing and owning its own lighting plant has also entered into the discussion on this subject, manufacturers and contractors who might wish to equip such a plant are invited to correspond as well, for the attitude of the city authorities is to take such steps as will be for the best interest of the municipality and public.

Those wishing to correspond with a view of submitting proposals or information along any of these lines are requested to address their letters to

BURT WILLIAMS
MAYOR
ASHLAND, WISCONSIN

We are Headquarters for

ELECTRICAL REPAIR WORK We operate the largest repair shops in America and have exceptional facilities for quick work. We repair all kinds of electrical apparatus and save our customers weeks in time in comparison with sending the work to the manufacturers direct. We have just reduced our prices and ask you to get our quotations on

Armatures Rewound, Commutators Refilled, Transformers Rewound, Etc.

Send for our monthly "Bargain Sheet," showing net prices on our stock of second-hand dynamos, motors, meters, transformers and supplies. Every article a bargain.

GREGORY ELECTRIC CO.
54-62 S. Clinton Street - CHICAGO

TWO YEAR COURSES IN

Steam and Machine Design, Applied Electricity and Applied Chemistry

PRATT INSTITUTE, - BROOKLYN, N. Y.

Write for catalogue and particulars.

PROPOSALS.

SANITARY DISTRICT OF CHICAGO.

TO CONTRACTORS.

Sealed Proposals addressed to the Board of Trustees of the Sanitary District of Chicago and indorsed:

"PROPOSALS for furnishing electrical apparatus and materials and for the installation of the same in the Power House of the Sanitary District of Chicago, near Lockport, Illinois, and transmission line along the Right of Way of the said District to the City of Chicago," will be received by the Clerk of the said Sanitary District at Room 1110 Security Building, Chicago, Ill., until 12 m. (standard time) on Wednesday, the 11th day of October, A. D. 1905, and will be publicly opened by the said Board of Trustees at a meeting of the Board held on that day.

The work for which said tenders are invited is as follows:

Division A—Main Switchboard and Instruments.
Division B—Transfer Boards Oil Circuit-breaker Switches and Knife Switches.
Division C—Remote-controlled Rheostats for Generators.
Division D—Bus Bars and Bus bar and Circuit Compartments.
Division E—Conduits, Service Wiring, Transformer and Generator Connections.
Division F—Transformers and Lightning Arresters.
Division G—Transmission Line Towers or Poles.
Division H—Erecting Towers or Poles.
Division I—Copper and Aluminium Conductors.
Division J—Erection of Cable.
Division K—High Tension Insulators.
Division L—Electric Traveling Crane.

For the purpose of receiving proposals in part and as a whole the specifications are made in Divisions designated in letters A, B, C, etc. Proposals must be made separately on each Division, and as a whole on the total number of Divisions covered by the proposal.

Each bid must be accompanied by a certified check or cash to the amount of five (5%) per cent of the aggregate proposals submitted.

All certified checks must be drawn on some responsible bank doing business in the City of Chicago and shall be made payable to the Clerk of the Sanitary District of Chicago. Said amounts deposited with bids will be held by the Sanitary District until all the respective bids for said work have been canvassed and the contracts awarded and signed. The return of said checks or cash to the bidders to whom the award of said work shall be made shall be conditioned upon their appearing within ten (10) days after receiving notice of such award with bondsmen and executing a contract with the Sanitary District for the work so awarded to them or each of them and giving a bond or bonds satisfactory to the Board of Trustees for the performance of the work contracted for in amounts equal to fifty (50%) per cent of the contract price noted in the proposal.

All proposals must be on blank forms furnished with the specifications, inclosed in blank envelopes and indorsed "Proposal for Divisions A, B, C," or such Division as may be covered by proposal. All specifications must be returned with the proposals.

No bid will be considered unless the party making it shall furnish evidence satisfactory to the Board of Trustees of his experience and ability in this class of work and his financial ability to prosecute said contract in case the same shall be awarded to him. Plans and specifications are on file in the office of the Chief Engineer, Room 1010 Security Building, Chicago.

Contractors are required to state in their bid their individual names and places of residence in full.

The Board of Trustees reserves the right to reject any and all bids.

SANITARY DISTRICT OF CHICAGO,
By Zina R. Carter,
President of Its Board of Trustees.
Attest: S. D. Griffin, Clerk.
Chicago, August 9, 1905.

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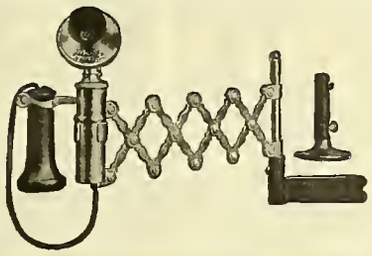

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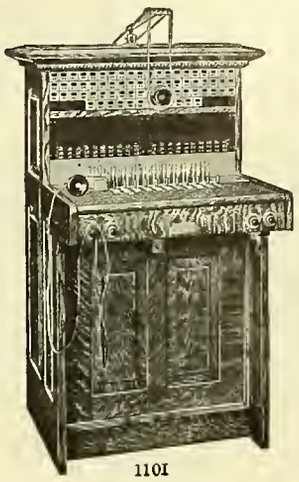

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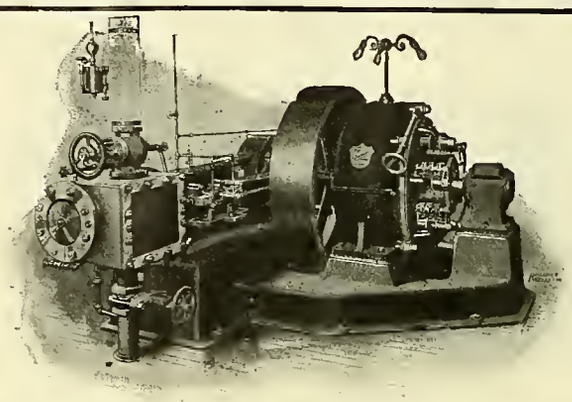

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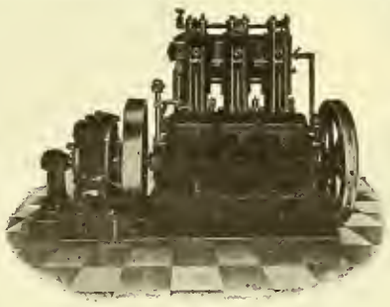

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⅞	13.79	101	223	296	85.01%
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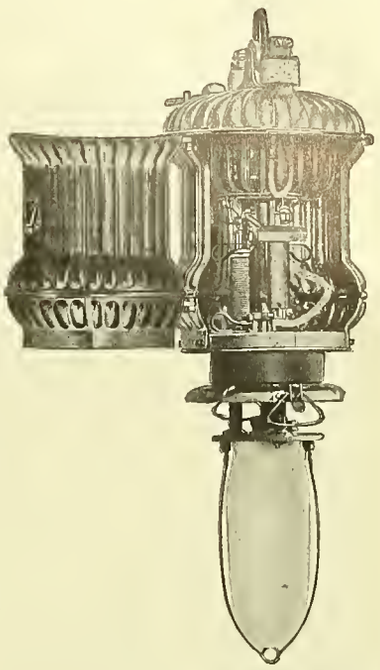

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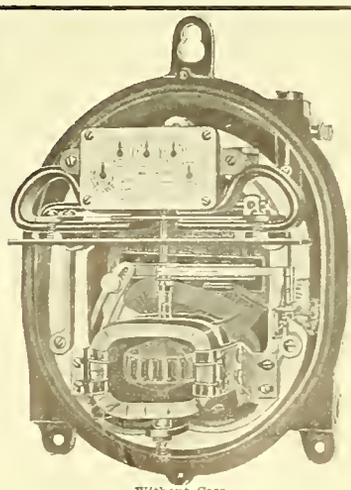

Without Case.

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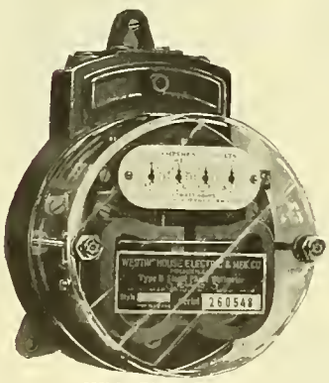
Type "B" Integrating Wattmeter

A Few Words as to Bearings

With Metal Cover.



With Glass Cover.

The Upper End of the Shaft

which carries the moving element of the Type "B," is drilled concentrically to receive the pin which is attached to the upper screw. A bushing reduces the diameter at the bottom of the hole to form a bearing for the pin. Below the bushing is a disc of oil-impregnated felt that lubricates the bearing by capillary attraction, reducing friction and preventing noise.

The Lower End of the Shaft

terminates in a ball and cup bearing, the ball being hardened steel, the bearings sapphire jewels. It will be readily seen that the shaft resting perpendicularly upon the ball, turns with the least possible frictional resistance, and that the ball rolling lightly between two highly polished sapphire jewels, at half the speed of the moving element, constantly presents new contact points on both ball and jewels, so that even after long service no wear is perceptible.

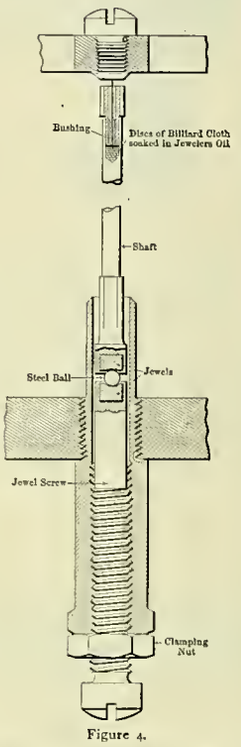


Figure 4.

Upper and Lower Bearing of Shaft.

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TYPE K FORM SAA WATTMETER

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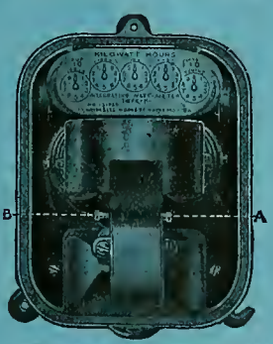

TYPE K FORM SAA WATTMETER
With Case Removed—Front View

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Reduce friction, and keep it reduced, and permanent accuracy is the result. Minimum bearing surface means minimum friction. Type "K" pivot jewel bearings have minimum bearing surface which is not increased with age.

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TYPE K FORM S A D WATTMETER
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THE PLATE

Western Electrician

Technology Quarterly
Mass. Inst. of Technology
Boston, Mass.

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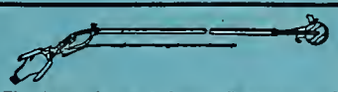
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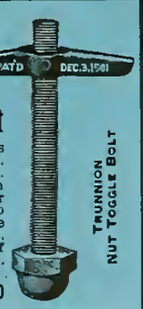

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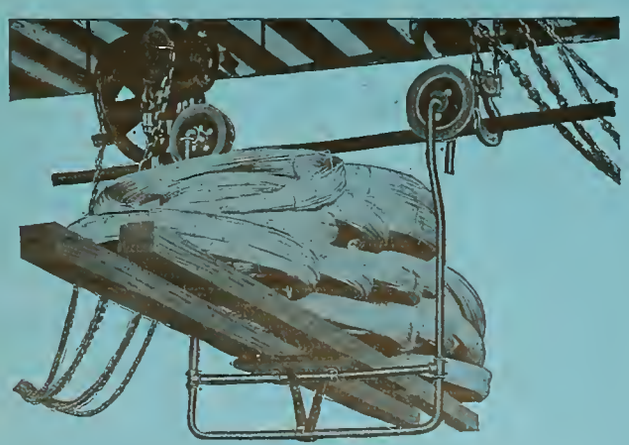

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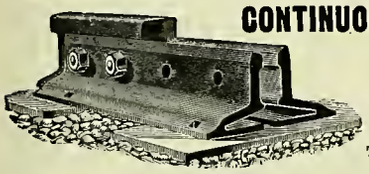

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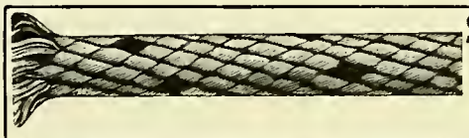

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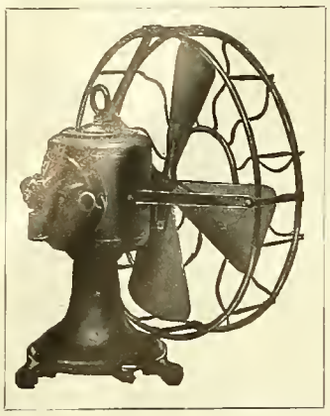

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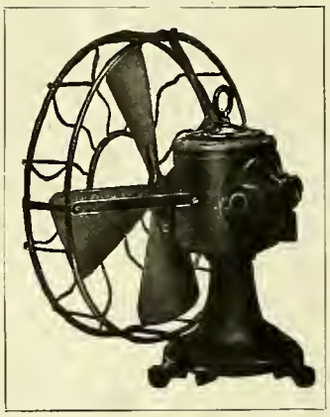
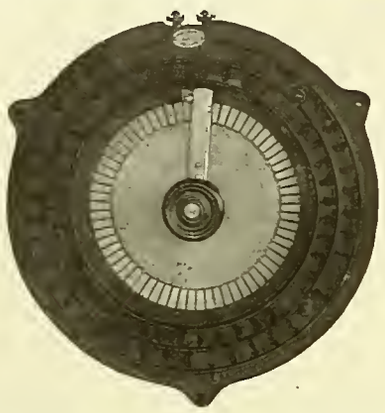




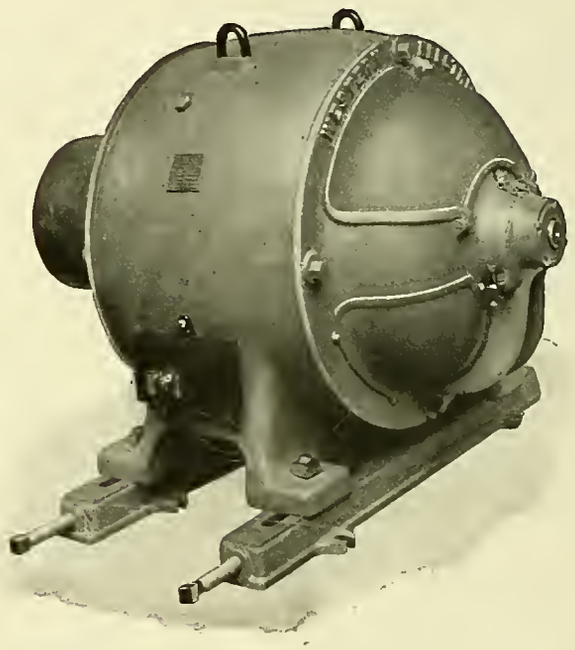
Daily Demonstrates Its Worth

THE thousands of this type of field regulator in use daily demonstrate its efficiency in service. They demonstrate that the material of which the base is made precludes possibility of grounding; that overloads do not disintergrate it; that it readily radiates and conducts heat, and that it is a perfect insulator. Having no small insulating parts or contacts that can become loosened, it prevents trouble from these sources. Its handle allows of easy operation, yet prevents its being moved by jar of machinery. Its appearance is pleasing and its price is moderate. Bulletin 32 describes it; read it, if you have it, if not, send for it.

The Cutler-Hammer Mfg. Co.

MILWAUKEE, WISCONSIN
NEW YORK BOSTON PITTSBURG CHICAGO

Correctly — — Rated



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GENERAL WESTERN AGENTS

207-209-211 East Jackson Boulevard, CHICAGO

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"Diamond H" Switches

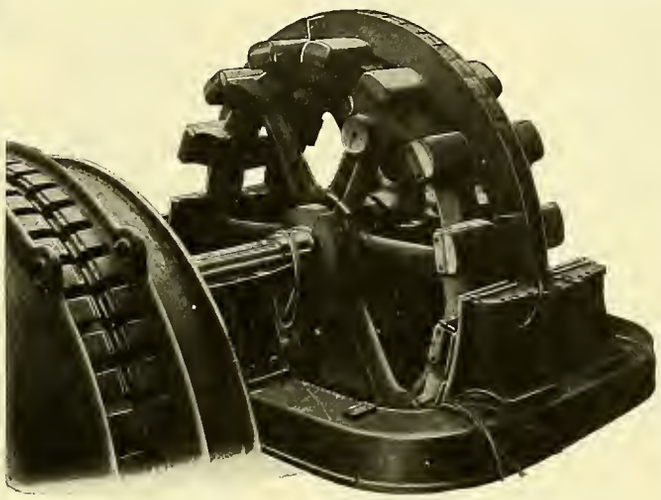
Trade H Mark

This Trade-Mark guarantees quality.

The Hart Mfg. Co., Hartford, Conn.

New York Boston Chicago Toronto, Ont.

The Inductor Generator



The illustration is of a 2,000 kilowatt generator in course of erection and shows the field-coil and inductor exposed.

Stationary Field. Stationary Armature. Neither brushes, collectors nor moving conductors of any kind. The S. K. C. inductor type of generator is entirely free from complication. Wear and tear are only such as can result from the simplest known mechanical movement—a shaft revolving in bearings. There is no "theory" about paralleling S. K. C. machines. They simply do it. We make a full line of Induction Motors.

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The less money you spend in advertising the less money you have.

STANLEY INSTRUMENT CO., GREAT BARRINGTON, MASS.

ARE NOW MANUFACTURING AND SOLICIT ORDERS FOR

MODEL H-6 ROTATED JEWEL BEARING STANLEY WATTMETERS

For Alternating Current, Single Phase and Polyphase Service constructed to conform strictly to the suggestion contained in the following language quoted from the opinion filed September 9th, 1904, in the

UNITED STATES CIRCUIT COURT OF APPEALS FOR THE FIRST CIRCUIT:

"If the device stopped with "a metallic rotating body" and some method other than a counting machine operated by it was used for determining the number of its revolutions, we might not be able to charge the respondent with infringing. We might then well apply the proposition of the respondent that a mere meter is in a different art from a motor. ***** "Therefore, as it may well be that, if the counting mechanism was of a kind not operated by the "metallic rotating body," we should not be compelled to find infringement, we hesitate in view of the minute amount of energy exerted."

The Train Registration, or Counting Mechanism in Model H-6 Wattmeters is independently operated and positively driven by a spring; the disc or rotating body does not and cannot operate the counting mechanism; train friction removed from rotating body of meter.

Jewel Surface always new—Spring Supported Pivot overcomes vibration.

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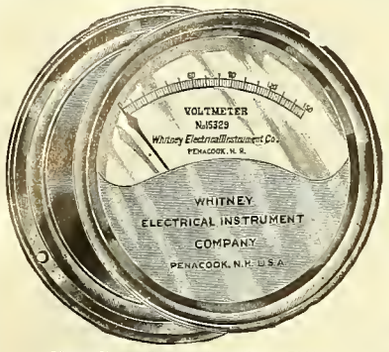

Diam. of body, 6 in., of base flange 7½ in.

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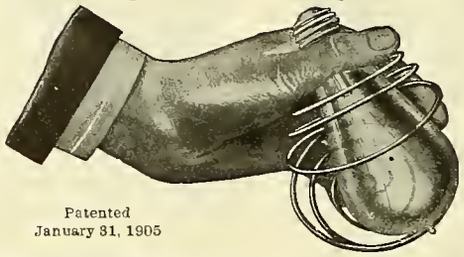

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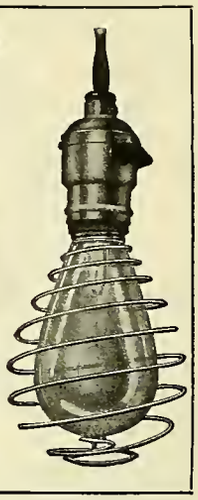
January 31, 1905



DIRECTIONS—Insert lamp (*small end first*) between the *largest* helices in the manner shown above, and place the tip of lamp in the eye of the guard. **"IT'S SPRINGY ALL OVER"**

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ELECTRIC STORAGE BATTERY CO. vs. NATIONAL BATTERY COMPANY

In the suit brought by the Chloride against the National, under Patent No. 441818, on January 26, 1905, in which the Chloride manufacturers asked for an immediate injunction, but which suit was withdrawn by them when it came to a hearing, their complaint contained an affidavit from Mr. Louis Duncan, electro-chemical expert, in which Mr. Duncan, after reciting his experience in battery work, states his opinion regarding the National Battery Company's staggered grid, in the following terms:

> Mr. Louis Duncan, electro-chemical expert, "swears and deposes that the staggered grid" (used by the National Battery Company in their negative unit accumulator plate, as well as in their positive and negative automobile plates), "shows openings through the opposite faces of the plate, which openings alternate with one another; and that these openings serve to receive the active material, while the ribs and bars form a rigid structure and lock the long pencils of active material into the plate: in this way the structure allows a large proportion of active material to the total weight of the plate. It securely locks in the active material, without necessitating its sub-division into small masses. It gives an excellent contact between the active material and the support plate, so the current may be easily led to and from the active material. It allows the expansion of the active material without distorting or buckling the plate as a whole, and it gives the greatest possible rigidity for a given weight of support plate."

"The type of plate is one in which the active material is mechanically applied to, or pasted on, a support plate, in such a way as to give the maximum amount of active material in the plate with the maximum strength of the supporting plate."

Subscribed and sworn to 31st of January, 1905.
LOUIS DUNCAN.

National Battery Company

BUFFALO, N. Y.

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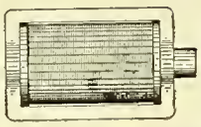

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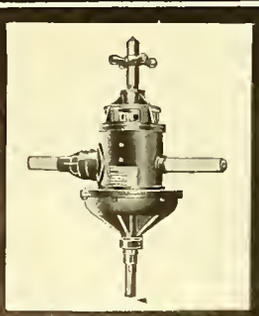

DRILL 1-M-1-10

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AIR-COOLED ELECTRIC DRILLS
Are manufactured in sizes to correspond with our Air Drills. They are invaluable in any machine or repair shop where electric current can be obtained; also office buildings, hotels, steamships, etc., can use them advantageously. Wound for 110 and 220 volts direct current.
OVER 4000 SOLD DURING THE PAST 90 DAYS
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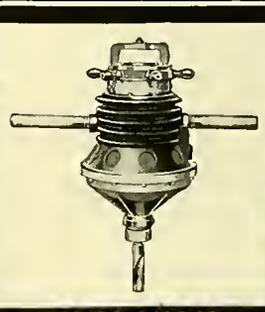

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The Highest Possible Award
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ELECTRA
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HIGHEST GRADE NUERNBERG CARBONS

By the International Jury of Awards, of the Louisiana Purchase Exposition, St. Louis, 1904.

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Just What the World Has Been Waiting For.

NEW "MORRISON" STORAGE BATTERY

THE CELL

This plate is so strong electrically and mechanically that no amount of electrical abuse or of vibration in traction service can dislodge even the slightest particle of its active material.

Lowest internal resistance of any storage battery in the world.

The weight efficiency is conservatively 14 watts per pound total weight, and electrical efficiency unsurpassed . . . .

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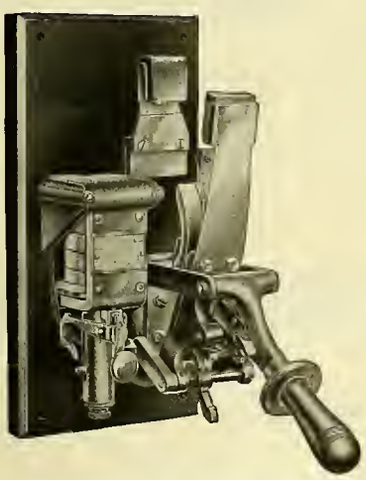
General Electric Company

Automatic Circuit Breakers



Single-Pole C. P. Circuit Breaker Open

CARBON BREAK

1 to 10,000 amperes

250 to 650 volts

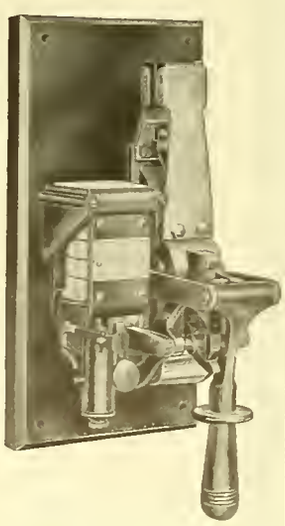
Simple — compact — durable.

All contacts made by direct surface pressure—no blade contacts.

Carbon contacts clamped in jaws—no screws.

Close easily and open quickly without jarring—no springs.

Auxiliary devices easily attached to standard overload breakers to prevent damage due to reversals, underloads or failure in voltage.



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677

LOOK FOR THE LICENSE LABEL IN THE STEM

A LOGICAL, COMMON WHY IT WILL PAY

SHELBY

An ordinary lamp looks - - - -
Looking up at its filament it - -
Another type of ordinary lamp -
Looking up at its filament it - -

An Extraordinary Lamp—the
Looking up at its filament you -
This filament (—) extended - - -
This filament (Z) extended - - -
This filament (M) —the Shelby— -

Now, doesn't your common sense tell you it's better rather than one equal ——— or —? ? ? ? ?

WASTED LIGHT

WHICH WILL ← ———— ?

BRANCHES ALL CITIES

THE SHELBY ELECTRIC CO.

BRANCHES ALL CITIES

100 PINE STREET, SHELBY, OHIO

SENSE EXPLANATION YOU TO BUY LAMPS.

like this

looks like this

looks like this

looks like this

Shelby Lamp—looks like this

see this

looks like this –

looks like this ——

extended looks like this ————

to buy a value (comparatively) equal ————

THEREFORE, you'll see the point in these two pictures:

YOU BUY

? ⟶

USEFUL LIGHT

BRANCHES ALL CITIES

THE SHELBY ELECTRIC CO.

BRANCHES ALL CITIES

100 PINE STREET, SHELBY, OHIO

IF you are using Commutator Type Meters we can help you out of your trouble. The Sangamo Direct Current Wattmeter, without commutator, brushes or damping magnets, is the greatest advance that has ever been made in the art. It needs no adjustment; will remain accurate indefinitely; jewel trouble is eliminated; light weight; easily installed. Made for 110, 220 and 500 volt two-wire Circuits.

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Can be Obtained Promptly

Extensive Factory Facilities and Large Stocks insure quick and accurate delivery.

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All Types and Varieties
Regular Multiple Lamps
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HARRISON, N. J.

(477)

The insulation is the most important part of your machine—be sure you buy only the best. Cheap insulation cannot be good insulation.

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CHICAGO MICA CO. : : : Valparaiso, Ind.

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EASY TO TAKE CARE OF
ALWAYS IN GOOD ORDER
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You Who are Troubled with Sparking and Cutting of Commutators to Use

The only article that will PREVENT SPARKING. Will keep the commutator in good condition and PREVENT CUTTING.

Absolutely Will Not Gum The Brushes . . .

It will put that high gloss on the commutator you have so long sought after.

50 Cts. per Stick. $5.00 per Dozen
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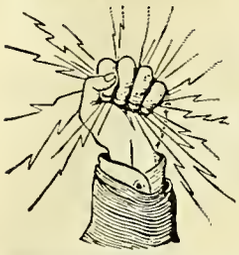

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WE PREPAY FREIGHT ON INITIAL ORDERS

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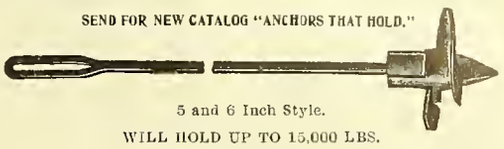

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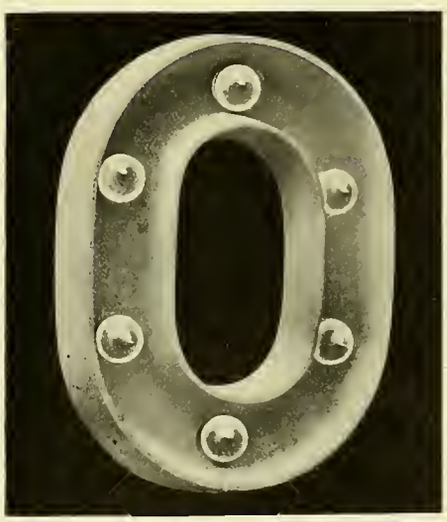

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That pleases him.

It would please you, Mr Electric Contractor or Mr. Central Station Manager, if you were in his place, wouldn't it?

Your interest is his satisfaction; his satisfaction, your profit.

Colonial Sign Letters

are made of a new and vitreous porcelain, which at night "light up" from 2 c. p. lamps making the most distinct sign in existence. In the daytime the letters "stand out" white and clean—easy reading.

A sign of beauty is our white face porcelain letters.

Write for prices.

THE COLONIAL SIGN & INSULATOR CO.
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Manufacturers under U. S. Pat. No. 698,256

PREDOMINATES IN 27 States

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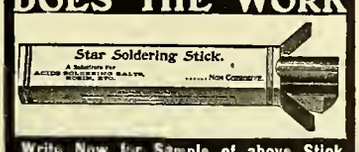
The letter from which the above is taken, is dated May 8, 1905, and is on file in this office.

DOES THE WORK



Write Now for Sample of above Stick

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We also make the famous Crolius Commutator Compound; eliminates sparking and all commutator troubles. Send for sample.

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Orders for arc lamp designs. Will furnish plans of arc lamps in all essential particulars and for all purposes. Address

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Also several 125 cycle, 5 ampere, 110 volt, Guttman integrating Watt Meters.

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2 66-inch x 20-ft. Return Tubular Boilers built for 130 lbs. working pressure.

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Water-Wheel Governors

Our new mechanical governors co-operate with the inertia effect on the water and the momentum of the plant.
They have cut the cost of good government in two. Guaranteed in every particular.

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ECONOMICAL ELECTRIC LIGHTING

219

NORTHERN DYNAMOS **SIMPLE COMPACT**

We build them for direct connection to any type of engine, or to be driven by belt. Northern Apparatus readily adapted to any service

Bulletin No. 2546

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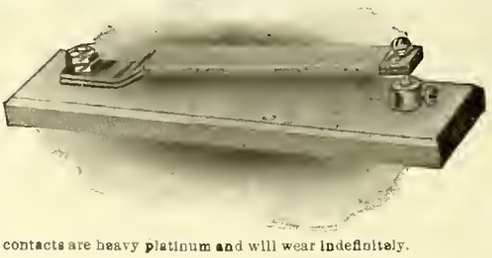

Automatically operates three 16, six 8, twelve 4 c.-p. lamps or less, on either direct or alternating current.

Easily connected. Flash can be regulated. It saves electricity. It requires absolutely no attention and has nothing to get out of order. The contacts are heavy platinum and will wear indefinitely.

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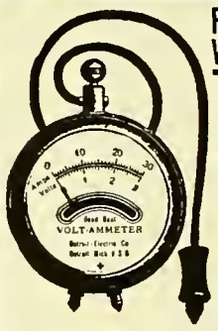

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30 Amperes.

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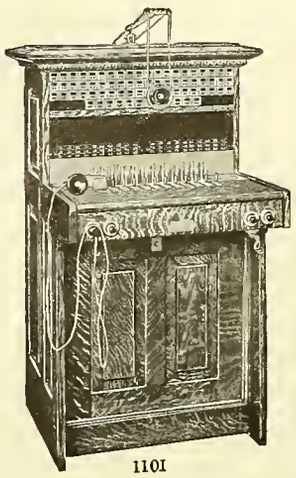

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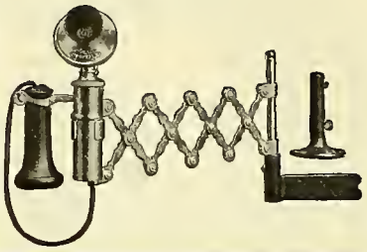

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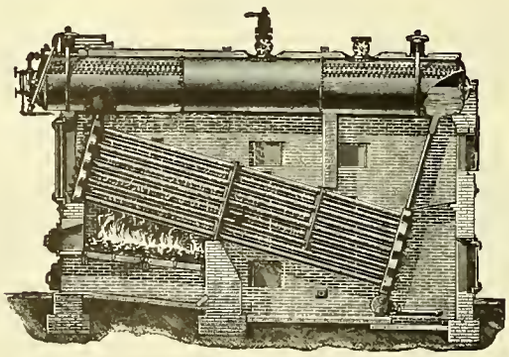

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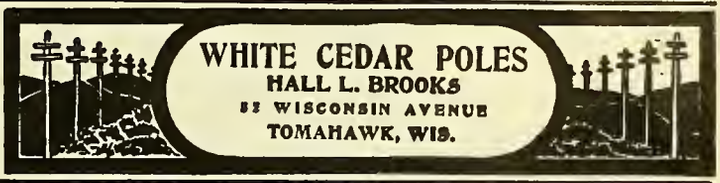

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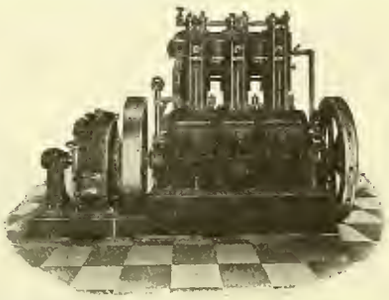

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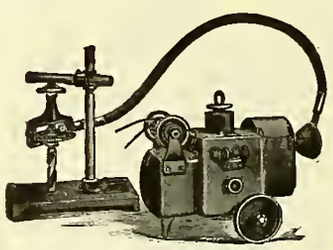

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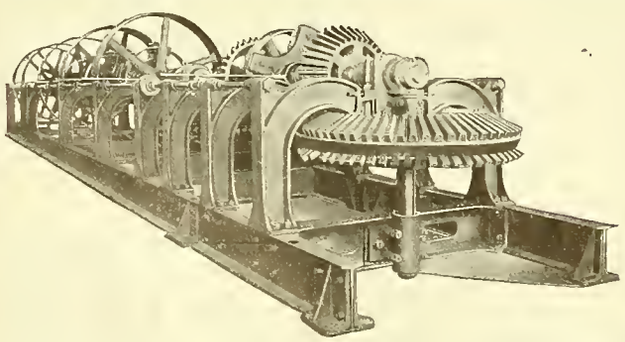

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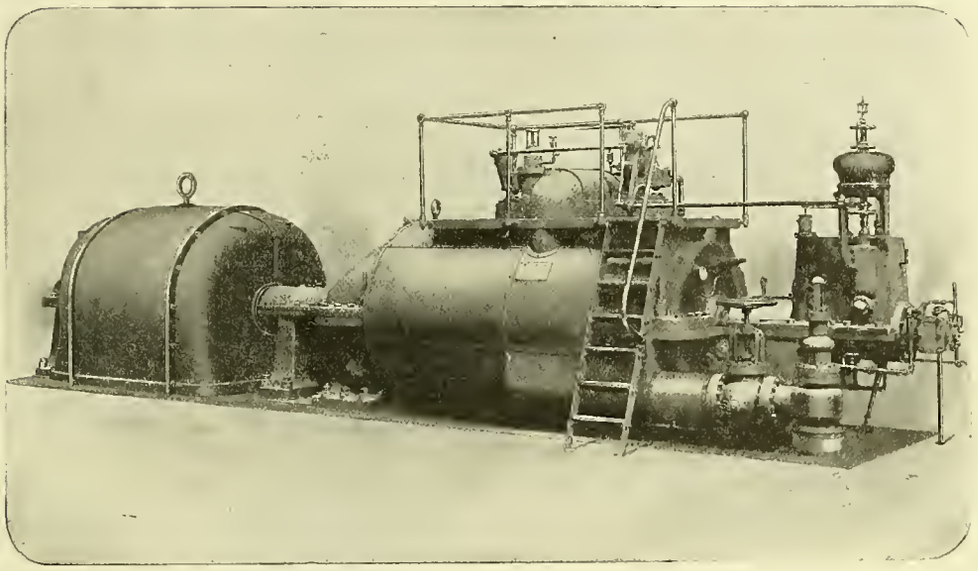

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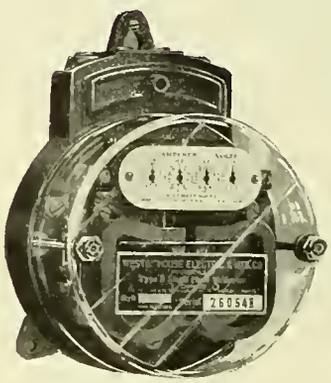
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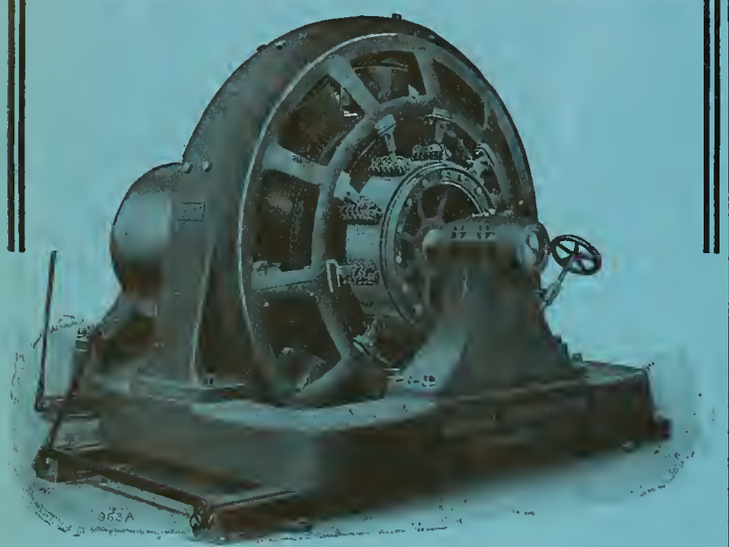

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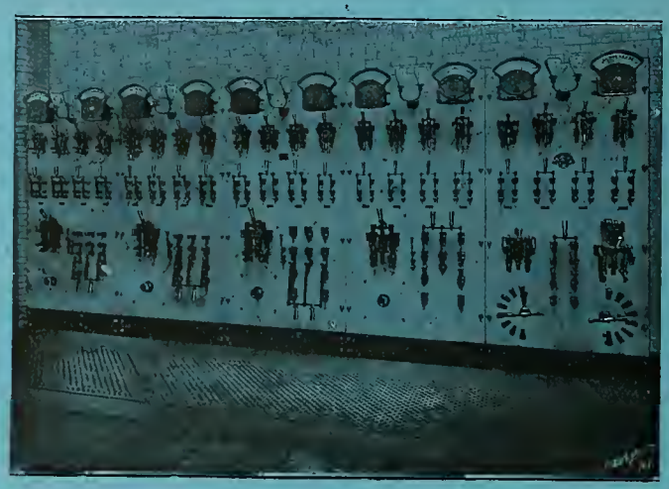

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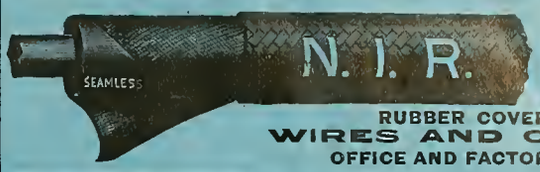

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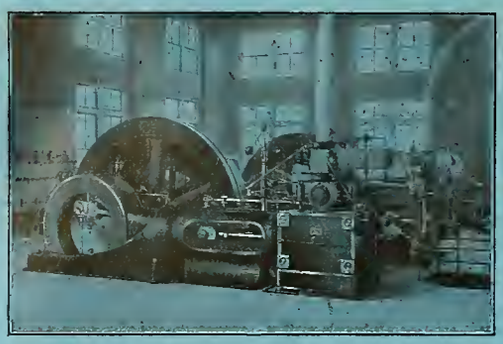

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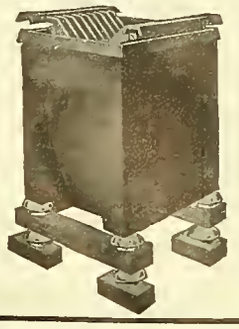

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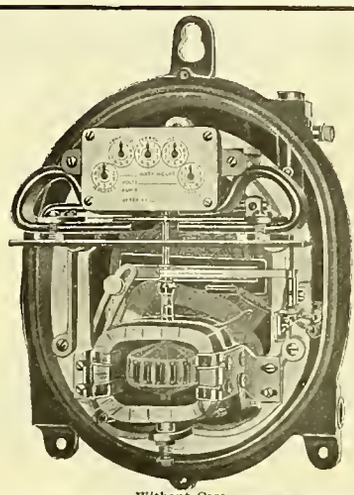

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Yost Electric Mfg. Co. 4, 11

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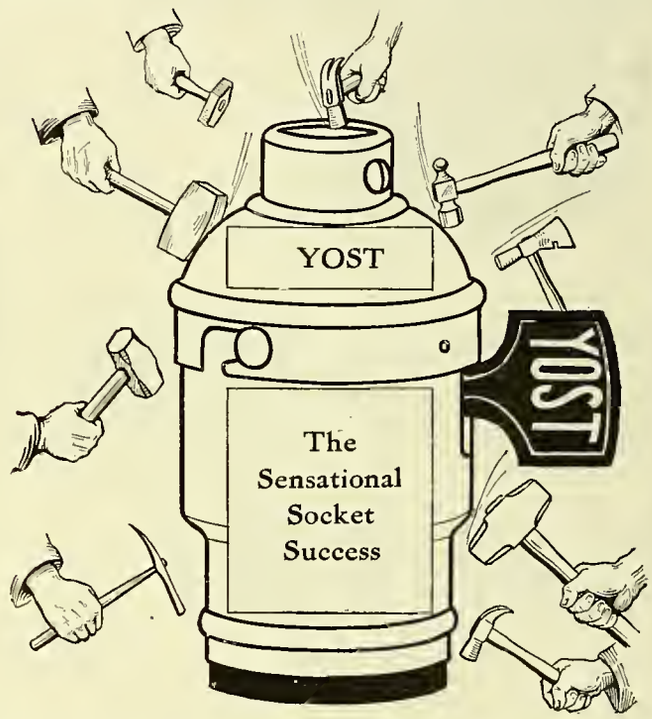

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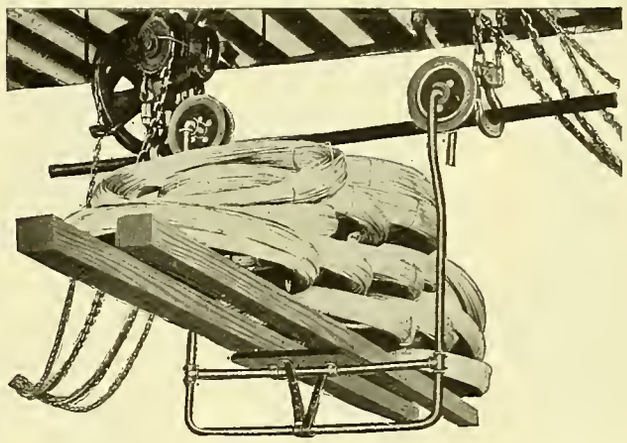

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MODEL H-6 ROTATED JEWEL BEARING STANLEY WATTMETERS

For Alternating Current, Single Phase and Polyphase Service constructed to conform strictly to the suggestion contained in the following language quoted from the opinion filed September 9th, 1904, in the

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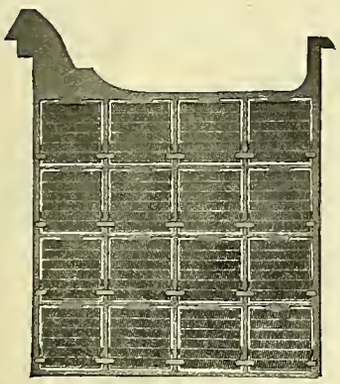

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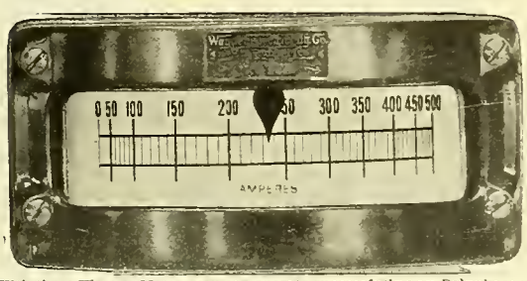

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SMEAR with FRES-KO Paste—apply the iron—the Paste does the rest.

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Operating on CRUDE or FUEL Oil

Guaranteed Fuel Consumption

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Especially adapted to Electric Service, either belted or direct connected to generators

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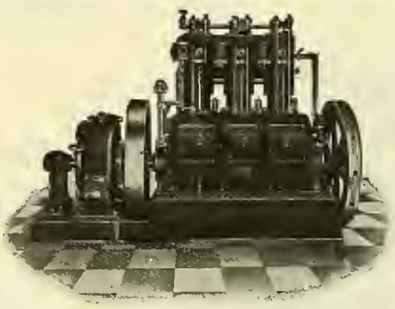

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Steam Fuel

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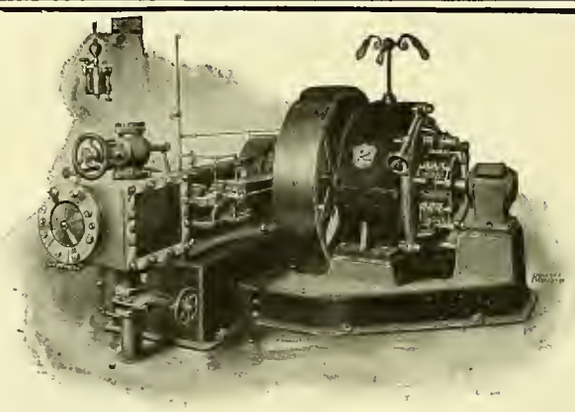

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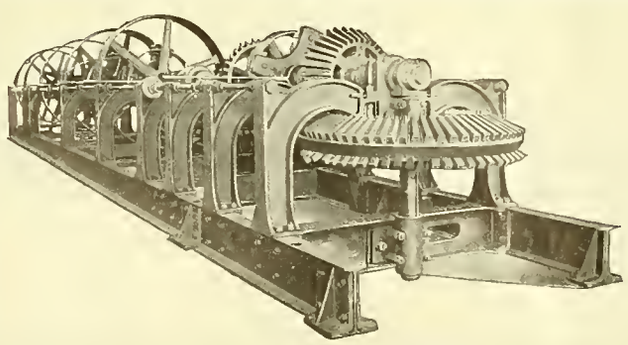

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General Electric Company

Thomson Recording Wattmeter—Type C

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Type C

A new design on old principles. Large legible dials, tubular shaft, aluminum disc and spherical armature on a paper shell make extremely light and strong moving parts. Ribbon wire field coils with small air gap give exceptionally high torque. Gravity brushes on small commutator give minimum amount of friction.

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693

IF you are using Commutator Type Meters we can help you out of your trouble. The Sangamo Direct Current Wattmeter, without commutator, brushes or damping magnets, is the greatest advance that has ever been made in the art. It needs no adjustment; will remain accurate indefinitely; jewel trouble is eliminated; light weight; easily installed. Made for 110, 220 and 500 volt two-wire Circuits.

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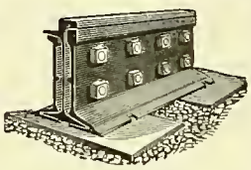
OVER 20,000 MILES IN USE
Highest Award at Paris Exposition, 1900, Buffalo, 1901, and St. Louis, 1904.



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For testing Batteries and Battery Circuits, Locating Faults, Grounds, etc.
RELIABLE. ACCURATE.
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SEND FOR 88-PAGE CATALOGUE
"UNIT" ENAMELED RHEOSTATS
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The only article that will PREVENT SPARKING. Will keep the Commutator in good condition and PREVENT CUTTING.
Absolutely Will Not Gum The Brushes.
It will put that high gloss on the Commutator you have so long sought after.
50 Cents per Stick. $5.00 per Dozen.
SEND FOR FREE SAMPLE STICK
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Manufacturers of
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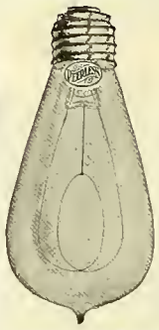

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EASY TO TAKE CARE OF
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Over 1,000,000 Annually Shipped to Users
All types, every variety.
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EDISON DECORATIVE AND MINIATURE LAMP DEPARTMENT
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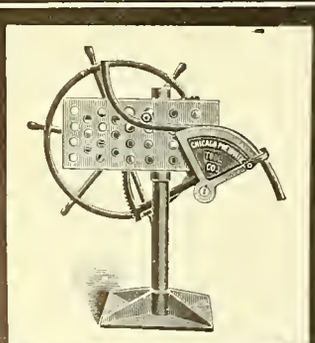

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Is invaluable for all kinds of pipe and ornamental iron work, as well as for the bending of electrical conduits. Bends piping of steel, iron, brass, copper or other material, cold, up to two inches diameter with one man.
One man can bend a piece of two-inch pipe to an S bend in three minutes, no other assistance or device being necessary or needed.
It is well adapted for the use of special dies that can be readily attached for bending light angles, flats, or tee bars to any desired radius as easily as bending pipe.
Full particulars furnished on application.
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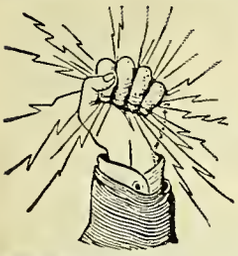

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Complete Battery Plants for Any Purpose
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WE WILL SHIP ON 30 DAYS TRIAL
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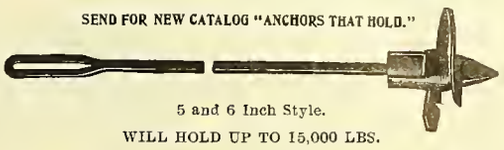

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This Trade-Mark guarantees quality.

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EDISON FUSE PLUGS

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"Peru" plug is the only all-porcelain plug on the market, and does not throw out sparks when fuse blows. As safe for open work as enclosed fuse type.
Write us at once for prices and circulars.

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The letter from which the above is taken, is dated May 8, 1905, and is on file in this office.

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By young steam engineer in electric light, and power plant, in city of 2 to 10 thousand (population) with view of investing in same if on a profitable basis, or might buy small plant outright. Northern part of Illinois preferred. For further particulars, address Box 520, care of Western Electrician, 510 Marquette Bldg, Chicago.

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Western party with considerable experience wishes position of responsibility and corresponding pay in private plant. Address box 521 care of Western Electrician, 510 Marquette Bldg., Chicago.

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Experienced up to date electrician wants position with construction company, or contractor doing inside wiring and installing plants either in or out of the city. Position must be permanent; am sober and reliable, thoroughly understand the work and can give good references. State hours and wages. JOHN C. JOHNSON, 273 Oak St. Chicago.

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WANTED.

Graduate of a technical college familiar with Electro Chemistry. Address Box 522 care of Western Electrician, 510 Marquette Bldg., Chicago.

FOR SALE.

$200.00 1-45 K. W. 133 Cycle 1,600 R. P. M. Westinghouse alternator with sub-base and exciter and station instruments all in good operating condition. AMBOY LIGHT & POWER CO., Amboy, Ills.

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FOR SALE AT GREAT SACRIFICE

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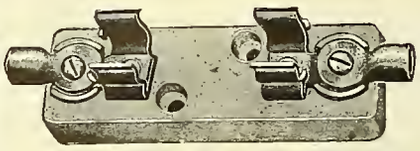

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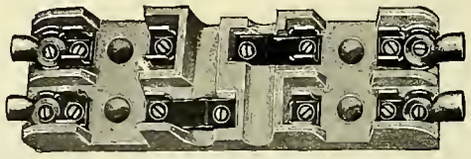

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Built for service in industrial plants, to operate in isolated industries, etc. Its simplicity favors Northern Apparatus for this work, and users and those familiar with it favor Northern Apparatus also.

DIRECT CURRENT DYNAMOS AND MOTORS

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that we have made special arrangements to take care of the great rush of the Fall trade? We invite your rush orders and the manner in which we fill them will deserve your further patronage. Remember us for attractive prices and **PROMPT DELIVERIES.**

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SECOND-HAND MACHINERY

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2 120 K. W. General Electric 125 Cycle, 1100 Volt, Type A. S. 1070 R. P. M. All complete with exciters—self-oiling bearings.
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1 270 K. W. T. H. 550 Volt Railway Generator, 600 R. P. M.
1 A. 70 Armature newly rewound.
1 20 K. W. 250 Volt Westinghouse Generator direct coupled to 7x10 Ideal Automatic Engine, new.
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2 66-inch x 20-ft Return Tubular Boilers built for 130 lbs. working pressure.

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Cincinnati & Louisville
Who Travels via the
MONON ROUTE
Consult Your Local Ticket Agent

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Correspondence Solicited.

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FIRST CLASS EQUIPMENT
THROUGHOUT

Dynamos, Armatures, Motors, Arc Lamps, Fans, Instruments.

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We Guarantee All Work

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we will send you a
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Every lighting man should have one.

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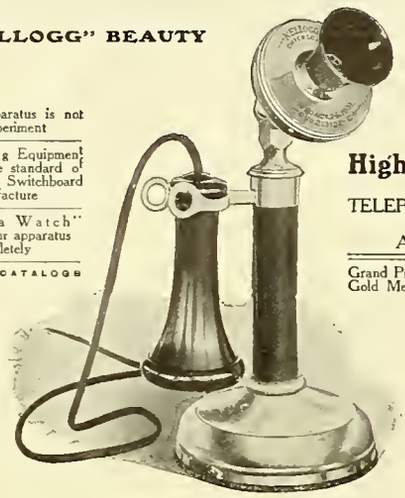

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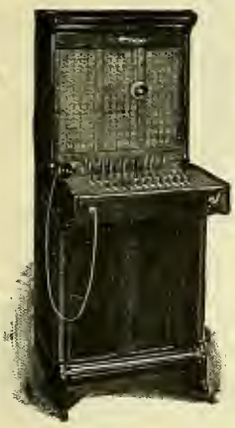

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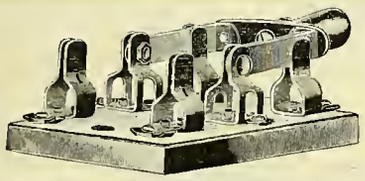

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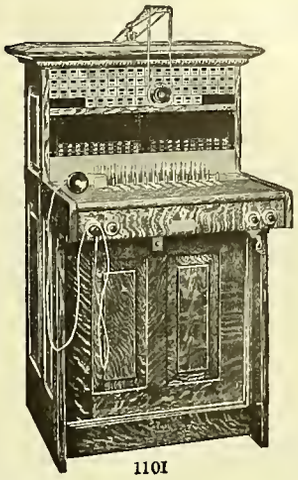

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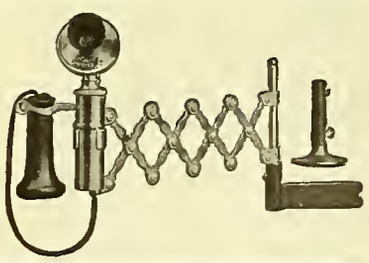

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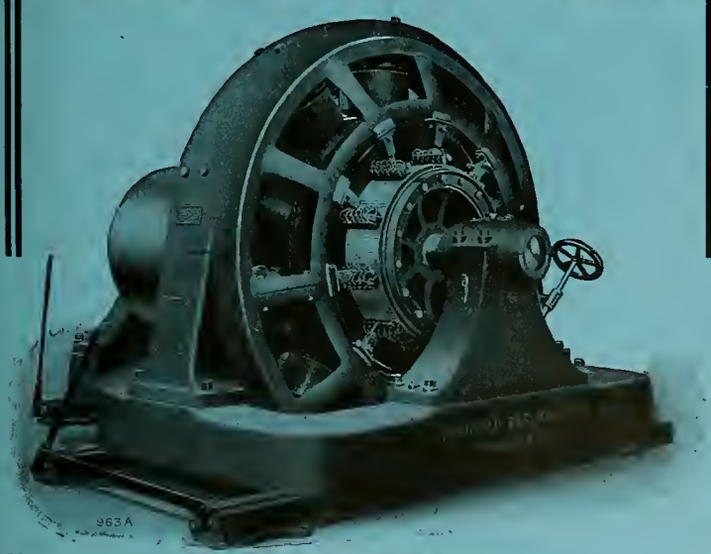

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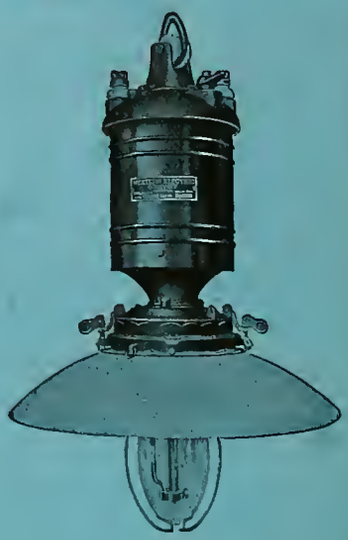

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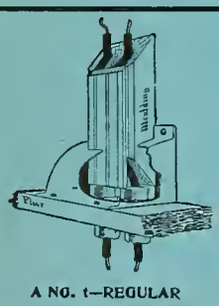

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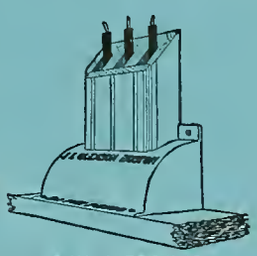

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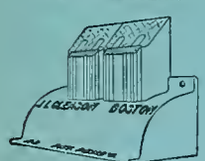

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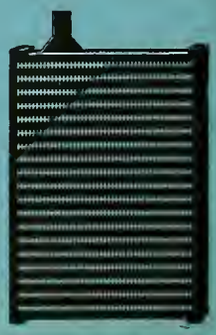

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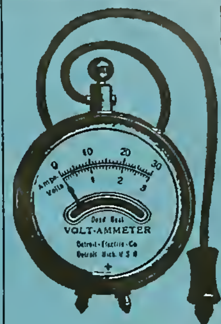

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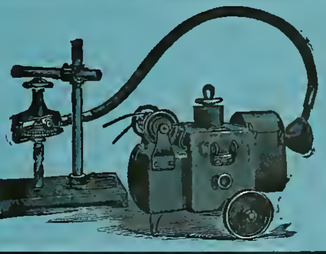

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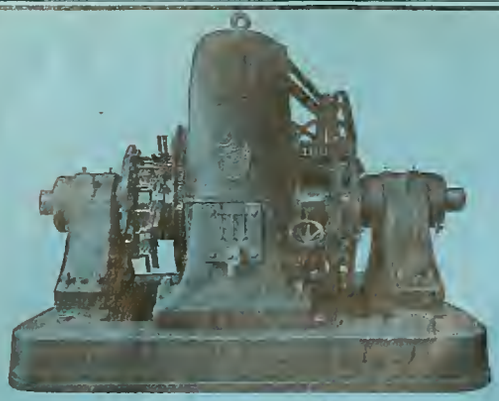

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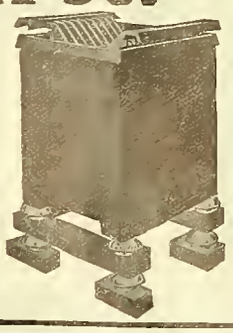

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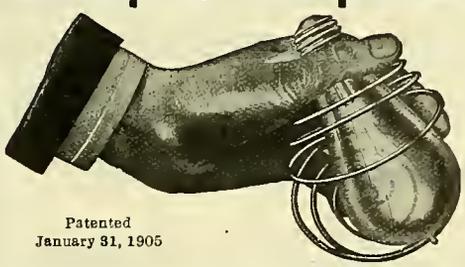

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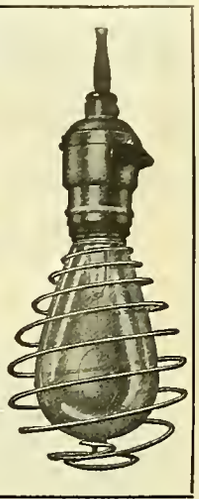

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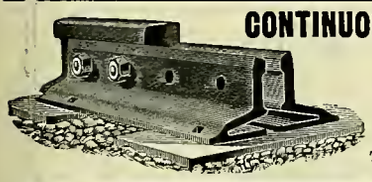

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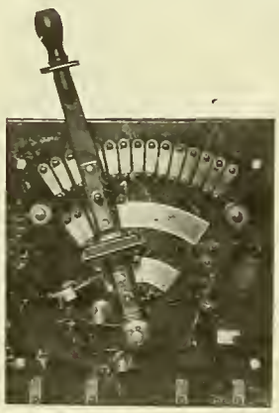

THIS printing press controller is designed for use with small presses. As can be seen by a glance, its construction is simple as possible. It provides for reducing the speed of a press from normal to one-half of normal through armature resistance. It also provides for two reverse speeds.

Bulletin No. 62 describes it in detail.

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Grooved or channel type letters to order on short notice.

Complete ***Electric Signs*** and Displays.

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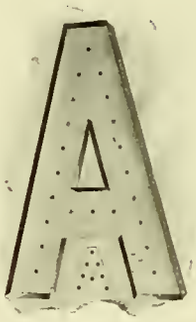
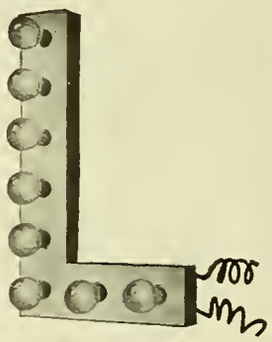


Grooved Letter.



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No Dead or Reclaimed Rubber Used in Okonite Tape **No Shoddy or Rags used in Manson Tape**

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The WESTERN ELECTRICIAN of September 23, 1905, will be the ANNUAL FALL TRADE NUMBER. It will be an excellent issue for all manufacturers and dealers who are especially desirous of placing the merits of their product before the many Fall buyers. This number will also be distributed at the annual meeting of the

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To be held in Philadelphia, September 25th to 30th. A large, attractive advertising announcement in this number will prove beneficial to your business. Send us your order and copy today.

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ARE NOW MANUFACTURING AND SOLICIT ORDERS FOR

MODEL H-6 ROTATED JEWEL BEARING STANLEY WATTMETERS

For Alternating Current, Single Phase and Polyphase Service constructed to conform strictly to the suggestion contained in the following language quoted from the opinion filed September 9th, 1904, in the
UNITED STATES CIRCUIT COURT OF APPEALS FOR THE FIRST CIRCUIT:
"If the device stopped with "a metallic rotating body" and some method other than a counting machine operated by it was used for determining the number of its revolutions, we might not be able to charge the respondent with infringing. We might then well apply the proposition of the respondent that a mere meter is in a different art from a motor. ***** "Therefore, as it may well be that, if the counting mechanism was of a kind not operated by the "metallic rotating body," we should not be compelled to find infringement, we hesitate in view of the minute amount of energy exerted."
The Train Registration, or Counting Mechanism in Model H-6 Wattmeters is independently operated and positively driven by a spring; the disc or rotating body does not and cannot operate the counting mechanism; train friction removed from rotating body of meter.
Jewel Surface always new—Spring Supported Pivot overcomes vibration.
PERMANENT ACCURACY AT ALL LOADS
PRICES CONSIDERABLY LESS TO ALL PURCHASERS THAN HERETOFORE PREVAILING
SPECIAL VERY LOW PRICES FOR ENTIRE REQUIREMENTS OR QUANTITY
ORDERS PROMPTLY FILLED

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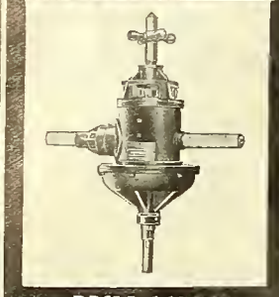

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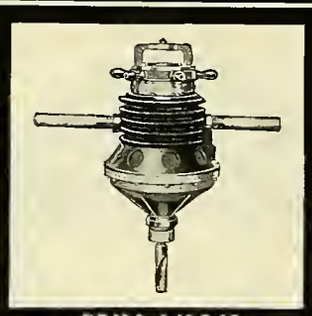
THE DUNTLEY
AIR-COOLED ELECTRIC DRILLS

Are manufactured in sizes to correspond with our Air Drills. They are invaluable in any machine or repair shop where electric current can be obtained; also office buildings, hotels, steamships, etc., can use them advantageously. Wound for 110 and 220 volts direct current.

OVER 4000 SOLD DURING THE PAST 90 DAYS

FULL PARTICULARS, ETC., ON REQUEST.



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Manhattan Elec. Supply Co.
Wesco Supply Co.
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Leather Preserver Mfg. Corp.

Belting.
Leather Preserver Mfg. Corp.

Blow Torches.
Turner Brass Works.

Blowers.
Green Fuel Economizer Co.

Boiler Compounds.
Dearborn Drug & Chem. Wks.

Boilers.
Babcock & Wilcox Co.
Brownell Co., The

Bolts, Toggle.
Wrigley Co., Thos.

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Electrician Publishing Co.
Van Nostrand Co., D.

Boxes, Junction.
Bossert Elect. Const. Co.

Boxes, Moulding.
Gleason, John L.

Brass, Sheet and Rod.
Plume & Atwood Mfg. Co.

Brushes.
Central Electric Co.
Holmes Fibre-Graphite Co.
Western Electric Company.

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Bissell Co., B. F.
Wesco Supply Co.
Western Electric Co.

Cabling Machinery.
Aiton Machine Co.

Cables (See Wires and Cables)

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Electric Appliance Co.
National Carbon Co.
Reisinger, Hugo.
Wesco Supply Co.

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Parsell & Weed

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Plume & Atwood Mfg. Co.

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Western Electric Company.
Westinghouse El. & Mfg. Co.

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Plume & Atwood Mfg. Co.

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Orollus & Son, E. R.
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Slusser Bros.

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National India Rubber Co.
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(See Wires and Cables.)

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Mica Insulator Co.
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Western Electric Co.
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Motors. (See Dynamos and Motors.)

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Klein & Sons, Mathias.

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Torrey Cedar Co.
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Century Electric Co.
Chicago Edison Co.
Electric Appliance Co.
Manhattan Elect'l Supply Co
Wesco Supply Co.
Western Electric Co.

Switches.
See Cut-outs and Switches.)

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Bissell Co., The F.
Central Electric Co.
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Kellogg Switchb. & Sup. Co.
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Wesco Supply Co.
Western Electric Co.

Time Switches.
Bissell Co., The F.
Campbell Bros.

Toggle Bolts.
(See Bolts, Toggle.)

Tools.
Klein & Sons, Mathias.

Tools, Pneumatic.
Chicago Pneumatic Tool Co.

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Wagner Electric Mfg. Co.
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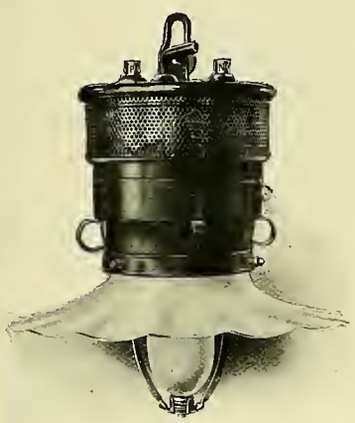

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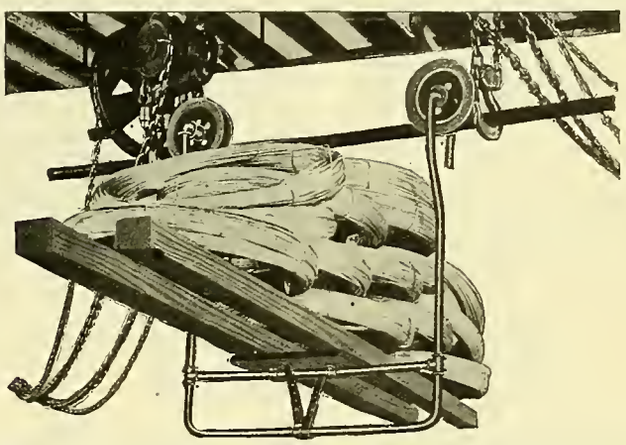

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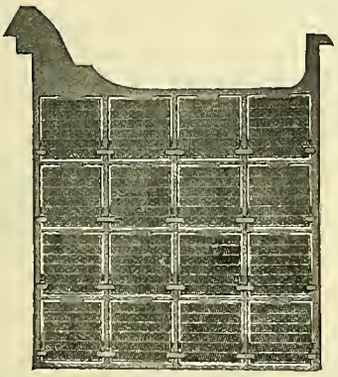

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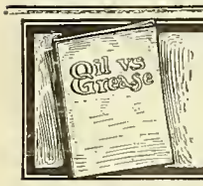

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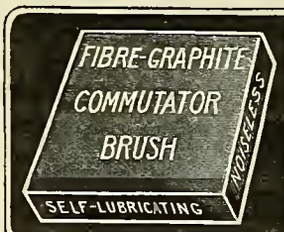

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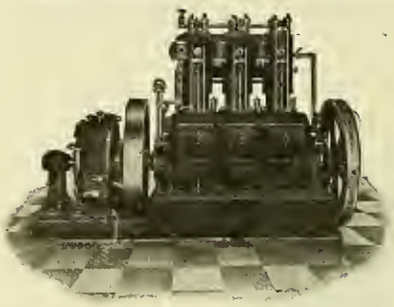

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⅞	16.56	188	92	147	84.78 %
¾	17.33	178	84	138	83.88 %
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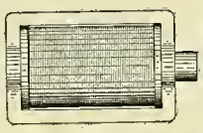

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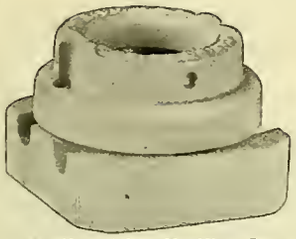

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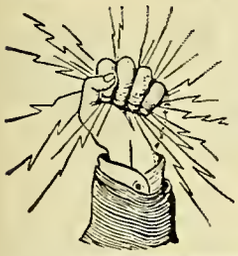

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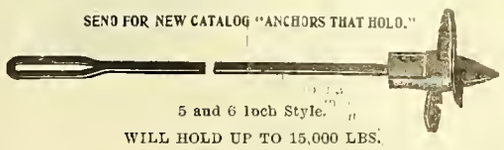

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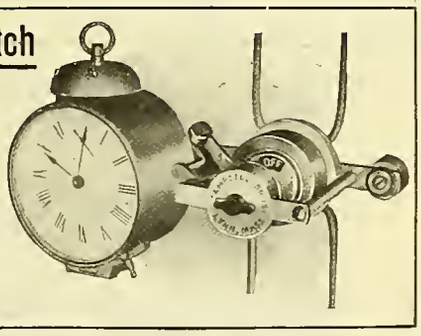

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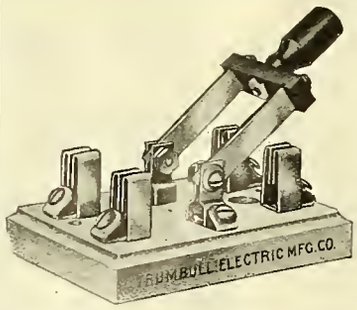

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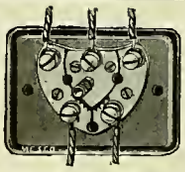

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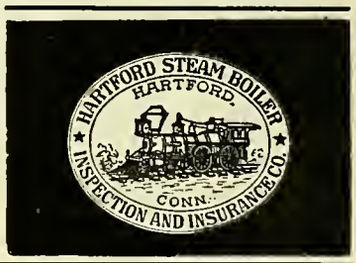

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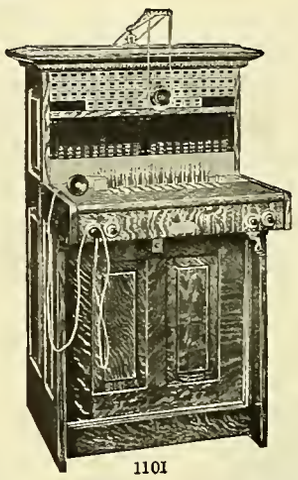

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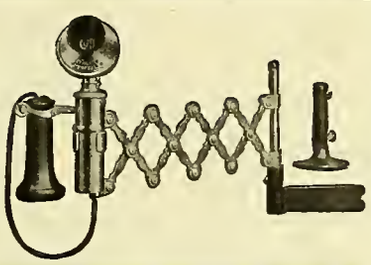

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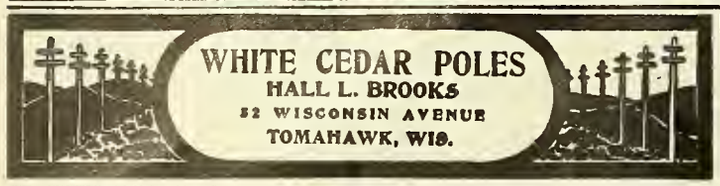

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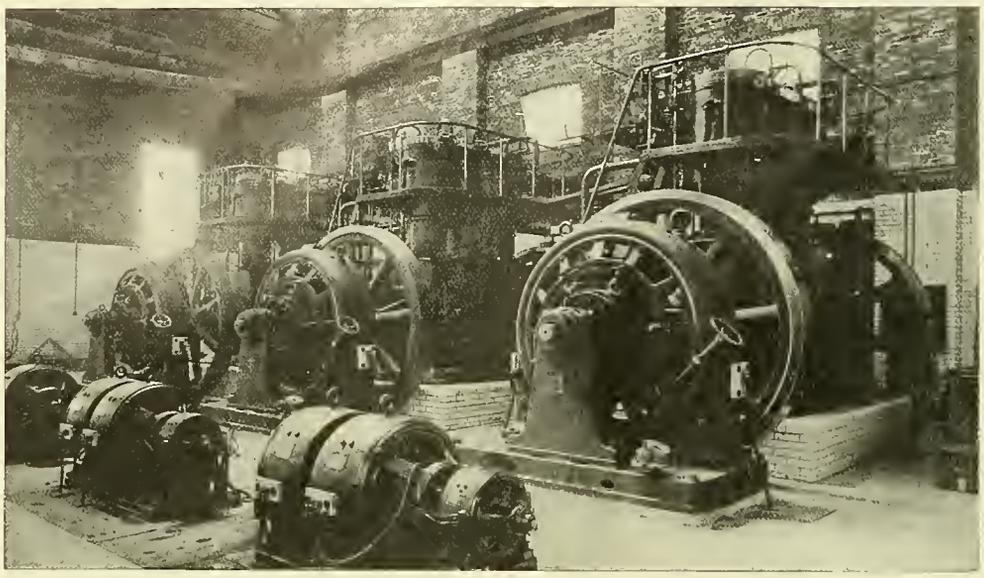

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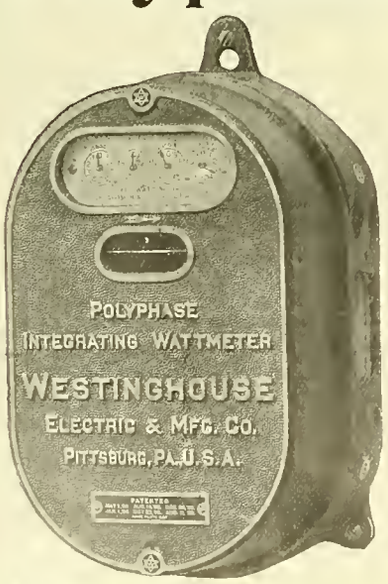

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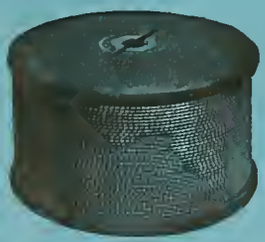

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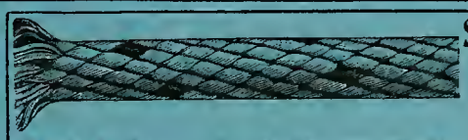

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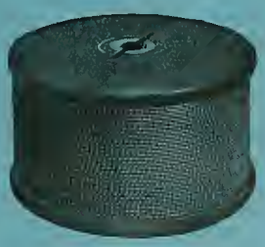

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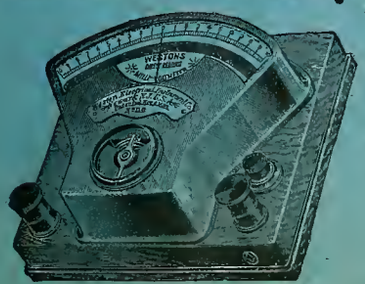

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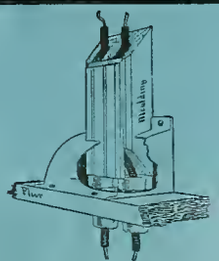

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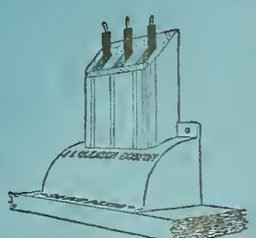

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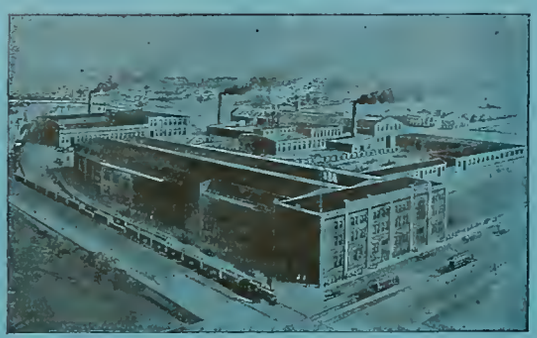

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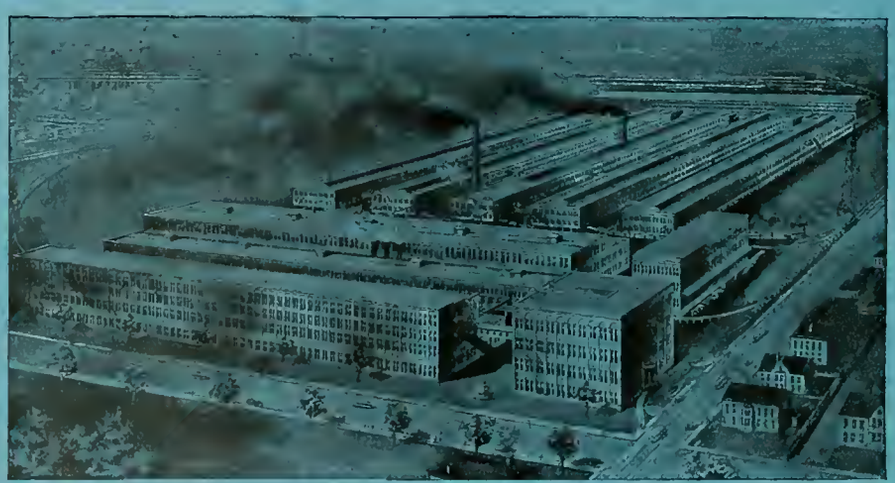

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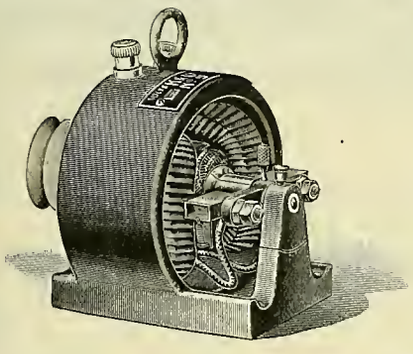

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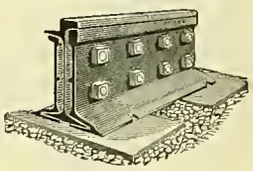

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If you want Wires or Cables insulated with the HIGHEST CLASS INDIA RUBBER INSULATION you should buy . . . . . .

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Complete stock of all sizes constantly on hand and for sale at lowest market prices by

CHICAGO EDISON COMPANY,

WRITE FOR PRICES.

139 ADAMS STREET, CHICAGO.

Street Railway Convention

REPORT NUMBERS

The Western Electrician of September 30th and October 7th will contain a complete report of the Street Railway Convention.

These numbers offer advertisers an excellent opportunity to place the merits of their product before the buyers of the world.

A large attractive announcement will prove exceedingly beneficial to your business. Copy should be sent immediately.

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510 Marquette Bldg., Chicago

AWARDED "GRAND PRIZE" ST. LOUIS EXPOSITION

COLUMBIA CARBONS

USED IN OVER 90% OF THE CENTRAL STATIONS IN THE U.S.

NATIONAL CARBON CO., CLEVELAND, OHIO.

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INSULATING, CABLING, RUBBER AND HYDRAULIC MACHINERY.

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OKONITE

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WHEN YOU WANT RUBBER-COVERED WIRE YOU WANT OKONITE—IT'S THE STANDARD

OKONITE IT NEVER DISAPPOINTS

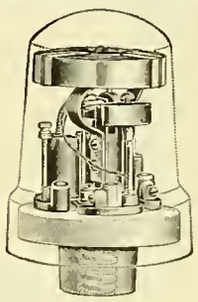
Central Electric Company,
GENERAL WESTERN AGENTS
207-209-211 East Jackson Blvd., CHICAGO

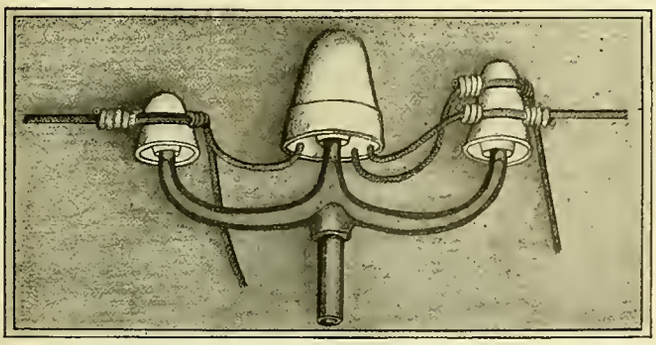
OKONITE IT NEVER DISAPPOINTS

PROTECTIVE FEATURES

OF THE

Hamacek Automatic Series Cut-Out





No. 1. Series Automatic Cut-Out with Porcelain Housing

Will protect against lightning and disruptive discharge of current.
Will protect shunt coils.
Will cut-out ground lamps and broken lamp loops.
Will insure continuous lighting service and thereby save many times its cost in rebate bills.
Will locate a break immediately.
Let us send sample on approval—its work will be a pleasant surprise.

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2014 Kenmore Avenue CHICAGO

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The more a man advertises, the greater his business. The greater his business, the more he advertises.

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In Sheet or Wire for all Purposes.
SCRAP PURCHASED.
AMERICAN PLATINUM WORKS
251 to 255 New Jersey R. R. Ave., Newark, N. J.

STANLEY INSTRUMENT CO., GREAT BARRINGTON, MASS.

ARE NOW MANUFACTURING AND SOLICIT ORDERS FOR

MODEL H-6 ROTATED JEWEL BEARING STANLEY WATTMETERS

For Alternating Current, Single Phase and Polyphase Service constructed to conform strictly to the suggestion contained in the following language quoted from the opinion filed September 9th, 1904, in the
UNITED STATES CIRCUIT COURT OF APPEALS FOR THE FIRST CIRCUIT:
"If the device stopped with "a metallic rotating body" and some method other than a counting machine operated by it was used for determining the number of its revolutions, we might not be able to charge the respondent with infringing. We might then well apply the proposition of the respondent that a mere meter is in a different art from a motor. ***** "Therefore, as it may well be that, if the counting mechanism was of a kind not operated by the "metallic rotating body," we should not be compelled to find infringement, we hesitate in view of the minute amount of energy exerted."
The Train Registration, or Counting Mechanism in Model H-6 Wattmeters is independently operated and positively driven by a spring; the disc or rotating body does not and cannot operate the counting mechanism; train friction removed from rotating body of meter.
Jewel Surface always new—Spring Supported Pivot overcomes vibration.
PERMANENT ACCURACY AT ALL LOADS
PRICES CONSIDERABLY LESS TO ALL PURCHASERS THAN HERETOFORE PREVAILING
SPECIAL VERY LOW PRICES FOR ENTIRE REQUIREMENTS OR QUANTITY
ORDERS PROMPTLY FILLED

STANLEY INSTRUMENT CO., GREAT BARRINGTON, MASS.

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GOULD VEHICLE BATTERIES HAVE:

EXTREMELY LONG LIFE
VERY LITTLE SEDIMENT
ECONOMICAL CHARGING RATES
AMPLE CAPACITY
UNQUESTIONED MERIT AND
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Indiana Rub. & Ins. Wire Co
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Kellogg Switch. & Sup. Co.
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Roebling's Sons Co., J. A.
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Simplex Electrical Co.
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Wesco Supply Co.
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Woodwork, Telephonic.
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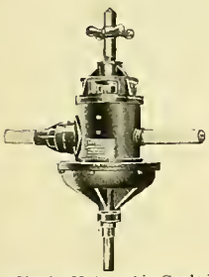
Chicago Pneumatic Tool Co.'s Specialties

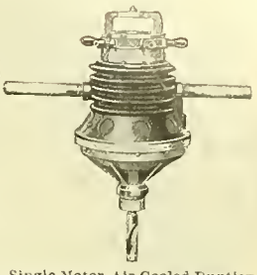
THE DUNTLEY AIR-COOLED ELECTRIC DRILLS



Single Motor, Air-Cooled Duntley Electric Drill, 1-M-1-10. Capacity, ½-in steel.

Are manufactured in sizes to correspond with our Air Drills. They are invaluable in any machine or repair shop where electric current can be obtained; also office buildings, hotels, steamship, etc., can use them advantageously. Wound for 110 and 220 volts direct current.

Full particulars, etc., on request.

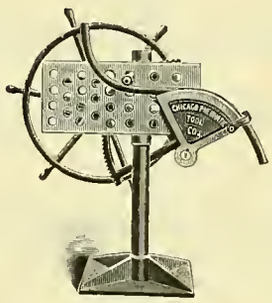


Single Motor, Air-Cooled Duntley Electric Drill 1-M-1-10, 1-M-1-12, 1-M-1-20.

The Chicago Pipe Bending Machine

Is invaluable for all kinds of pipe and ornamental iron work, as well as for the bending of electrical conduits. Bends piping of steel, iron, brass, copper, or other material, cold, up to two inches diameter with one man.

Full particulars furnished on application.



One man can bend a piece of two-inch pipe to an **S** bend in three minutes, no other assistance or device being necessary or needed.

It is well adapted for the use of special dies that can be readily attached for bending light angles, flats or tee bars to any desired radius as easily as bending pipe.

Little Giant Storage Batteries

"Little Giant" Battery for Electric Vehicles.

For all Purposes

are sold under our usual guarantee, and our prices will be found reasonable.

Now is the time to contract for present and future requirements.

Let us quote you.

"Little Giant" Sparking Battery.

MANUFACTURED BY

CHICAGO PNEUMATIC TOOL CO.

Fisher Building, CHICAGO **95 Liberty Street, NEW YORK**

Seattle San Francisco Denver Detroit Cleveland Toronto Boston Pittsburg Philadelphia Norfolk

We Want Your Business

AND MEAN TO GET IT IF

AMERICAN ELECTRICAL SUPPLY COMPANY

Large Stock
Best Prices
Prompt Shipments
and
Fair Treatment
can do it

We are especially prepared to handle your fall rush orders and can save you time and money on anything in the electrical line.

A trial order will add your name to our list of satisfied customers.

Write us for our new catalog.

AMERICAN ELECTRICAL SUPPLY CO.

83-85-87 Fifth Avenue **Chicago**

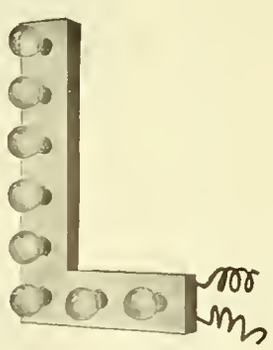
WE have on hand for immediate shipment, a large stock of 10-in., 12-in. and 16-in. raised ***metal letters,*** wired complete. Also several ***signs,*** reading: ***CAFE, DRUGS, BAR,*** and others.

Grooved or channel type letters to order on short notice.

Complete ***Electric Signs*** and Displays.

Sign Lamps, Flashers, Time Switches, Rubber Rings.

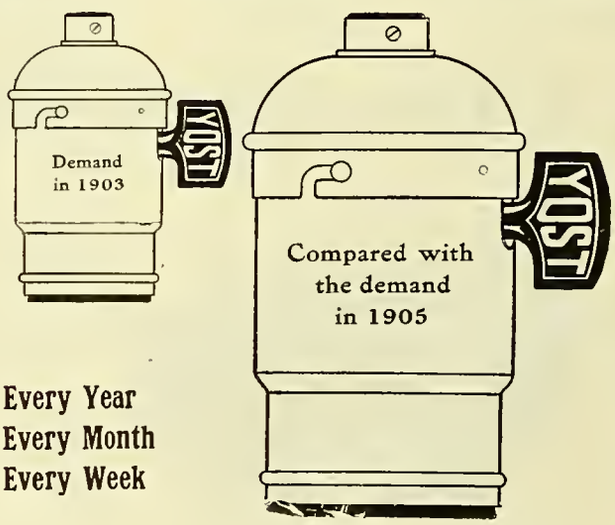
Grooved Letter.



Raised Letter.

Haller Machine Co.

128 Fulton St. *CHICAGO*



Every Year
Every Month
Every Week

shows a decided increase in the demand for

Yost Sockets

demonstrating they are of

MORE THAN ORDINARY MERIT

Is there **one good** reason why **you** do not use YOST SOCKETS?

The Yost Electric Mfg. Co.
TOLEDO, OHIO

COLUMBIA LAMPS
GIVE MOST LIGHT

For SIXTEEN YEARS Columbia Lamps have been well and favorably known. If you are interested in **Quality** rather than **First Cost** order Columbias. A Columbia label on an incandescent lamp signifies careful and accurate selection for candle power, voltage and efficiency. **Order now.**

The Columbia Incandescent Lamp Co.

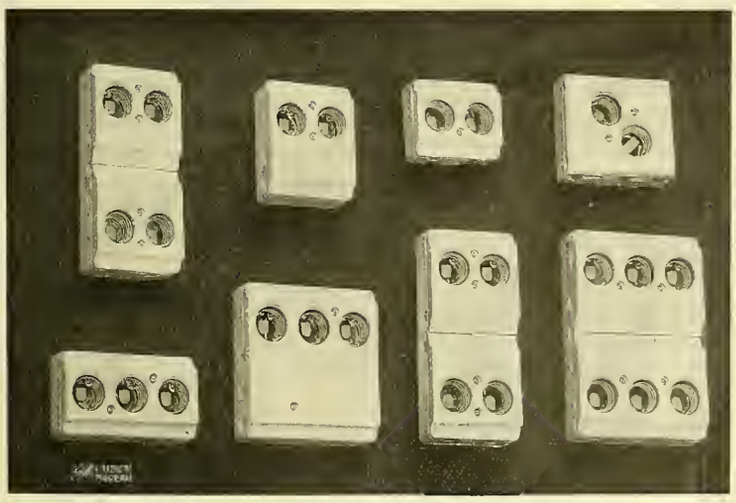
2115-17-19 Locust St., ST. LOUIS, MO.

NEW YORK OFFICE: 1311 Havemeyer Bldg.
PHILADELPHIA: 1227 Real Estate Trust Bldg.
CHICAGO: Central Electric Co.
MINNEAPOLIS: 638 Boston Block
MEXICO: Monterey, Van Voorhis Hnos.
SAN FRANCISCO: Paul Seller Electrical Works
MEMPHIS: 302 Scimitar Bldg.

General Electric Company

New Plug Cut-Outs With Porcelain Covers

are the best because in addition to all the good features of other cut-outs they have substantial porcelain covers which protect all metal parts. This eliminates any danger of accidental short circuits.



Complete Line of New Plug Cut-Outs
3 to 30 Amperes, 250 Volts

It is impossible when inserting the fuse plugs to touch any live part of the cut-out.

The connection strips, which are all on the front of the base, are insulated by porcelain blocks or bridges where they cross under the main wire slots.

The center and screw shell contacts are similar to those of the standard receptacles.

Principal Office: SCHENECTADY, N. Y.

Chicago Office: MONADNOCK BLDG.
Sales Offices: In All Large Cities.

(707)

NOVELTY CABLE SLEEVE—Made also in two and three way branches.

SPLICES AND POT HEADS

NOVELTY CABLE POT HEAD

Can be made by any man who can handle a soldering iron, better and cheaper than by any lead joint wiper. And tho' absolutely permanent, they can be opened at any time for inspection or repair and again re-stored. How much money would this have saved *your* exchange? Details in Catalogue 125-A.

Trade Mark

Made by THE F. BISSELL COMPANY TOLEDO, O.

WATTMETER REPAIR WORK

Of all classes. Burned out meters repaired and calibrated on INDUCTIVE or NON-INDUCTIVE loads. Frequency and voltages changed as required.

We will repair any meter at reasonable prices and guarantee satisfaction.

RELIANCE INSTRUMENT CO.

Manufacturers of Switchboard Instruments for A. C. and D. C. Circuits

60-68 West Van Buren Street, CHICAGO

Practical Running of Dynamos.

A little booklet on the care and the locating and remedying of troubles in dynamos and motors.

Price, 10 Cents.

Catalogue of mechanical and electrical books free.

ELECTRICIAN PUBLISHING COMPANY.
510 Marquette Bldg., Chicago.

ALWAYS READY AND DOES THE WORK. WILL MAKE THE SOLDER FLOW WHERE YOU WANT IT, AND STAY WHERE YOU PUT IT. IN COLLAPSIBLE TUBES AND TIN BOXES.

"NEW IDEA" SOLDERING PASTE SAMPLE FREE

NEW IDEA SOLDERING PASTE CO., 214 Hibbard Ave., Detroit, Mich.

You will confer a favor upon the advertiser by telling him—when you write him—that you saw his ad. in the Western Electrician.

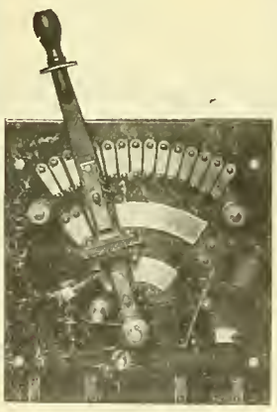
LATEST DESIGNS of well made and ARTISTIC LIGHTING FIXTURES

Our Catalogue NO. 9 contains ELECTRIC FIXTURES only
Our No. 10 has COMBINATION, ELECTRIC and GAS FIXTURES
Which will you have? Your request will bring it
Sent free, express prepaid, to dealers only.

BEARDSLEE CHANDELIER MFG. CO.,
253-254 S. CANAL STREET, - - - CHICAGO

Continuous and judicious advertising is the magic wand which converts a little business into a big business.

A Controller for Small Printing Presses



THIS printing press controller is designed for use with small presses. As can be seen by a glance, its construction is simple as possible. It provides for reducing the speed of a press from normal to one-half of normal through armature resistance. It also provides for two reverse speeds.

Bulletin No. 62 describes it in detail.

THE CUTLER-HAMMER MFG. CO.

Electric Controller Manufacturers and Electrical Engineers

MILWAUKEE, WIS.

NEW YORK BOSTON CHICAGO PITTSBURG

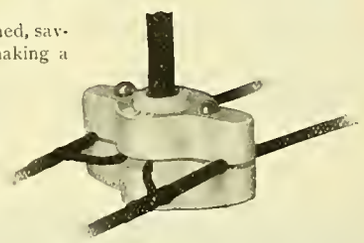
Save Money by Using "PERU" TIE BUTTONS

A Cleat and Tie-Button combined, saving half the time in wiring and making a more workmanlike job.

NATIONAL CODE STANDARD

Made for cleat, concealed and moulding work.

Get Prices and Samples



No. 467 Cleat.

PERU ELECTRIC MFG. CO. Peru, Ind.

SELF FLUXING SOLDER

FOR ALL PURPOSES

IN 18-INCH STICKS OR ON REELS

Kester Solder Can't Leak Flux.

CHICAGO SOLDER CO.

R. C. MILLER
St. Louis, Mo.
Gen. Western Agt.

46 N. Union Street, CHICAGO

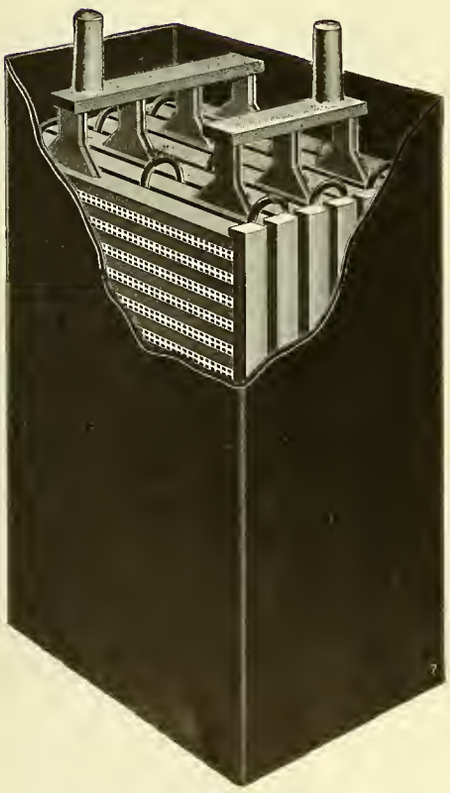
Inner Globe Wisdom

"Won't Black" the advertisement read;
"All Black" the angry buyer said;
He raved and swore with a big D—
"Hereafter 'Phœnix Quality' for me"!
Buys only Inners of world-wide fame
Each one stamped with "Phœnix" name!
And now he restful sleeps at night,
With a "Phœnix" Inner in each light,
And on his face a sweet smile plays.
Peaceful his nights—serene his days.
No fancy name, with higher price—
A truly meaningless device—
Just "Phœnix" Inners good and true,
That give the service they are claimed to do.
No care or nightmare disturbs his rest;
Using only "Phœnix" Inners he's truly blest.
This lesson learn, its meaning probe;
No INNER EQUALS THE "PHŒNIX" GLOBE.

To further prove they *are* the BEST,
"Phœnix" Inners stand the vacuum test!

THE PHŒNIX GLASS COMPANY
New York ⌄ Pittsburgh ⌄ Chicago

THE NEW "MORRISON" STORAGE BATTERY

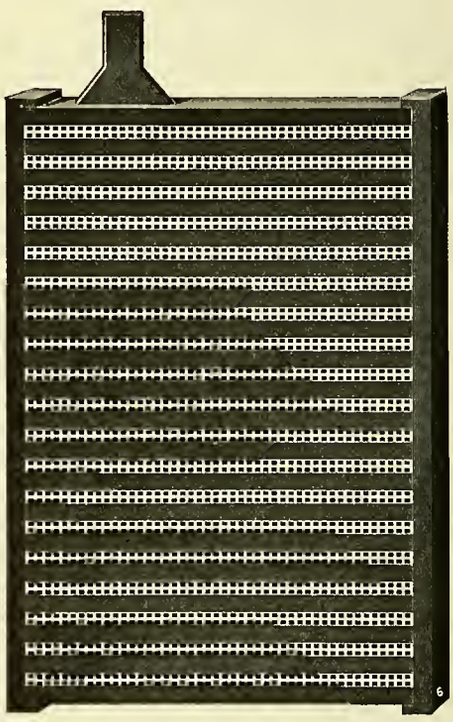


THE CELL

This plate is so strong electrically and mechanically that no amount of electrical abuse or of vibration in traction service can dislodge even the slightest particle of its active material.

Lowest internal resistance of any storage battery in the world.

The weight efficiency is conservatively 14 watts per pound total weight, and electrical efficiency unsurpassed.



THE PLATE

Universal Electric Storage Battery Co.

INCORPORATED

Office: 1355 Railway Exchange Building

Factory: 36-38 Union Park Place

Chicago, Illinois

Buckeye Incandescent Lamps

THE STANDARD OF QUALITY

BETTER **31**

BUY **RIGID**

BUCKEYE **INSPECTIONS**

There is profit in using Buckeye Lamps. The prizes are cash and are paid continually day by day to the user of BUCKEYE LAMPS.

A trial order will convince you of their SUPERIORITY. Order direct or from stocks of the following agents:

Dunham, Carrigan & Hayden, San Francisco. Casstarphen Electric Co., Denver.
Hide Leather & Belting Co., Indianapolis. H. F. Reynolds Electric Co., Marion, Ind.
Henry L. Walker Co., Detroit, Mich. B. & C. Electrical Construction Co., Utica, N. Y.
The Post Glover Electric Co., Cincinnati. The Erner-Hopkins Co., Columbus, Ohio.
Union Electric Co., Pittsburg. Duncan-Hobson Co., Dallas-Houston, Texas.
Lee Bros., Memphis, Tenn. Chas. E. Sharp, Special Agent Republic of Mexico, Security Bldg., St. Louis.

LOOK FOR THE LICENSE LABEL IN THE STEM

BUCKEYE ELECTRIC CO.

LOOK FOR THE LICENSE LABEL IN THE STEM

MAIN OFFICE AND WORKS:

CLEVELAND, OHIO

PITTSBURG OFFICE:
1102 Empire Building

CHICAGO OFFICE:
1537 Monadnock

Don't Go Bargain-Hunting

for your Incandescent Lamps. It won't pay. The bargain will be with the other man and not you. Consider carefully. Choose wisely. Then promptly buy

Packard Lamps

Lamps of high repute. Lamps whose light-giving qualities, whose saving qualities have put them and kept them first of all Incandescent Lamps these many years.

ELECTRIC APPLIANCE COMPANY
Chicago and San Francisco

PEERLESS LAMPS LEAD

LOOK FOR THE LICENSE LABEL IN THE STEM

all others in EFFICIENCY, LENGTH OF LIFE, CURRENT CONSUMPTION and SUSTAINED CANDLE POWER.

A practical test and our contract prices will show you how you can save money.

WESCO

The Wesco Supply Co.
Fort Worth St. Louis

WORKS QUICK AND EASY. KEEPS ITS LUSTER. HOLDS OLD TRADE AND MAKES NEW. DOES NOT DETERIORATE. ESTABLISHED 16 YEARS. SOLD BY AGENTS AND DEALERS ALL OVER THE WORLD

3 Ounce Box 10 Cents
Samples Sent Free

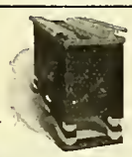
U.S. METAL POLISH GEO. W. HOFFMAN

POLISHES ALL METALS. BRANCHES NEW YORK, CHICAGO, SAN FRANCISCO. 295 E. WASHINGTON ST. INDIANAPOLIS, IND.
HIGHEST AWARD. CHICAGO WORLD'S FAIR, 1893. LOUISIANA PURCHASE EXPOSITION 1904.

The insulation is the most important part of your machine—be sure you buy only the best. Cheap insulation cannot be good insulation.

IF IT'S MICABOND YOU CAN BE SURE YOU HAVE THE BEST—OUR GUARANTEE IS BEHIND IT

CHICAGO MICA CO. : : : Valparaiso, Ind.



BIJUR "HIGH-DUTY" STORAGE BATTERIES

GENERAL STORAGE BATTERY CO.
42 Broadway, New York

MICA

Of all Qualities, in any Form at Lowest Prices
EUGENE MUNSELL AND CO.
NEW YORK and CHICAGO

INSULATION That Is.

Micanite, Linotape, M. I. C. Compound, Empire Cloth and Paper. For Years the Standard.

MICA INSULATOR CO., Originators
NEW YORK and CHICAGO

WANTED

You Who are Troubled with Sparking and Cutting of Commutators to Use

The only article that will PREVENT SPARKING. Will keep the commutator in good condition and PREVENT CUTTING.

Absolutely Will Not Gum The Brushes . . .

It will put that high gloss on the commutator you have so long sought after.

50 Cts. per Stick. $5.00 per Dozen
For Sale by all Supply Houses, or
FREE, Sample Stick.

K. McLENNAN & CO.,
Sole Manufacturers,
Room 411, Inter Ocean Bldg., 130 Dearborn St., CHICAGO, ILL.

FOREE BAIN
Patent Lawyer and Expert in Electricity and Mechanics
29 Years' Practical Experience as Electrical and Mechanical Engineer and Expert in Patent Causes

Telephones
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GEORGE T. MAY, JR.
Patent Lawyer and Solicitor of U. S. and Foreign Patents

FOREE BAIN & MAY Suite 947-48-49 Monadnock Block CHICAGO **PATENTS**

Trade Marks, Labels, Copyrights—Corporations. Patent and Trade Mark Causes

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Commercial National Bank
Chicago
Hon. Edw. S. Lacey
Ex-U. S. Comptroller of Currency
Bankers National Bank, Chicago
Hon. Charles G. Dawes
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Central Trust Co. of Ill., Chicago
Hon. Hoke Smith
Ex-U. S. Secretary of the Interior
Atlanta, Ga.

American Terra Cotta and C. Co.
Chamber of Commerce Bldg.
American Locomotive Equip. Co.
and H. H. Gross, Prest., Chicago
Atlas Railway Supply Co. and
Jas. G. McMichael, Prest., Chicago
Automatic Fire Protection Co.
Chicago
Chicago Battery Co., Chicago
Bankers National Bank, Chicago

Swedish-American Telephone Co.
West Jackson Boul., Chicago
Barth Manufacturing Co.
Elevators, Milwaukee, Wis.
The Knickerbocker Company,
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Twin City Rapid Transit Company
Minneapolis, Minn.
Adams-Bagnall Electric Company
Cleveland, Ohio

CENTURY ELECTRIC CO.

MANUFACTURERS OF
SINGLE-PHASE SELF-STARTING MOTORS AND CEILING FANS
ST. LOUIS, MO.

VOLT - AMMETERS

POCKET SIZE
For testing Batteries and Battery Circuits, Locating Faults, Grounds, etc.
RELIABLE. - ACCURATE.
Send for Circular.
L. M. PIGNOLET
78-80 Cortlandt St., NEW YORK, N. Y.

INSURE

RELIABLE LIGHTING RESULTS

BY ORDERING EDISON LAMPS.

LOOK FOR THE LABEL IN THE STEM

Exclusively used by most discriminating purchasers.

All types and varieties
Regular Multiple Lamps
Street Series Lamps
Miniature Lamps.

General Electric Company
MAIN LAMP SALES OFFICE
Harrison, N. J.

(487)

The Turner Improved Lower Bushing
Price 50 Cents Each

REPAIR PARTS FOR T.H. Arc Lamps and Carbon Holders

FOR MANY STYLES OF ARC LAMPS

Catalog No. 2312 Illustrating the Above Articles Mailed on Request

THE TURNER BRASS WORKS

23 North Franklin St., CHICAGO

ELECTRICAL REPAIRING

We Guarantee All Work

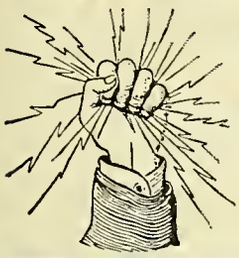
DYNAMOS, ARMATURES, MOTORS, ARC LAMPS, INSTRUMENTS, GENERAL REPAIRING. Correspondence Solicited.
NEW AND SECOND-HAND MACHINERY FOR SALE

SOUTHWESTERN ELECTRIC CO., ST. LOUIS.

FRANK N. PHILLIPS, Pres. EUGENE R. PHILLIPS, V.P. C. H. WAGENSEIL, Treas. C. R. REMINGTON, Jr., Sec.

AMERICAN ELECTRICAL WORKS,

PROVIDENCE, R. I.



BARE AND INSULATED ELECTRIC WIRE,

ELECTRIC LIGHT LINE WIRE,
INCANDESCENT AND FLEXIBLE CORDS,
Railway Feeder and Trolley Wire,
AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.
CABLES FOR AERIAL AND UNDERGROUND USE.

NEW YORK STORE, W. J. Watson, 26 Cortlandt St.
CHICAGO OFFICE. F. E. Donohoe, 135 Adams St.
MONTREAL BRANCH, Eugene F. Phillips' Electrical Works.
MAIN OFFICES AND FACTORIES, PHILLIPSDALE, R. I.

STORAGE BATTERIES!

(THE "X-CELL")

Complete Battery Plants for Any Purpose
Telephone Power Plants a Specialty

TOLEDO STORAGE BATTERY & ELECTRIC CO., 111 Ottawa St., Toledo, O.

Our Business With Street Railways Has Increased 63% This Year

THIS PROVES THAT THE

Stombaugh Guy Anchor

Is becoming more and more popular with STREET RAILWAYS

Stombaugh Guy Anchors Save Them Money, Labor and Time

WE WILL BE AT THE A. S. R. A. CONVENTION, PHILADELPHIA

W. N. MATTHEWS & BRO.

219 N. 2nd St. MANUFACTURERS ST. LOUIS

"Diamond H" Switches

Trade H Mark

This Trade-Mark guarantees quality.

The Hart Mfg. Co., Hartford, Conn.

New York Boston Chicago Toronto, Ont.

NATIONAL CODE STANDARD

WEATHER-PROOF TRADE MARK "O.K." LINE AND HOUSE WIRES

"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Ideal Wire.

Prices and Samples on Application.

Phillips Insulated Wire Co.

Office and Factory: PAWTUCKET, R. I.

Electrical Supplies

WRITE FOR PRICES

G. F. SAUTER CO., ELECTRICAL CONTRACTORS
Segel Bldg., Cor. State and Lafayette Sts.
SCHENECTADY N. Y.

"AMERICAN" STORAGE CELLS

ARE THE BEST. Send for descriptive Circular.

AMERICAN BATTERY CO.,
ESTD 1889. 171 S. Clinton St., Chicago.

ROCK ISLAND DRY CELLS

ARE THE BEST
JUST TRY THEM
THAT'S ALL WE ASK

R.I. BAT

ROCK ISLAND BATTERY CO.

GEORGE W. CONOVER
135 Adams Street,
Chicago Representative

ROCK ISLAND, ILL.
U. S. A.

PREDOMINATES
IN
27 States

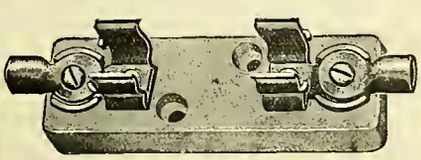
"IT gives me great pleasure to state, that for 'Gitthereitiveness' your periodical certainly is a winner. As you perhaps are aware, the company I travel for, advertises in all the electrical papers, and it has been a question in my mind whether they reached every central station, as their advertising manager would have our company believe. So, for one year I have kept account of the electrical papers and periodicals subscribed for and received by the manager or superintendent of electric light companies in twenty-seven states, (which has been my territory), and in summing it up, I find that your periodical predominates, three to one. I do not get in many telephone plants, but when I do, I invariably find the 'Western Electrician' staring me in the face."

The letter from which the above is taken, is dated May 8, 1905, and is on file in this office.

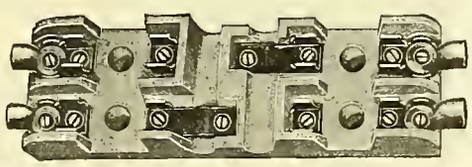
"UNION" ENCLOSED FUSES

TESTED FUSE WIRE

OLD AND NEW CODE STYLES



New Code Blocks



Catalog No. 16 with illustrations is ready and is as plain as a primer. You see what you want at a glance

Our Trade Mark stands for good goods in all Electrical Fuses and Fuse Wire

CHICAGO FUSE WIRE & MFG. CO.

Chicago, Buffalo
New York

WANTED, FOR SALE *and similar* **WANT COLUMN** *advertisements (50 words or less), $1.50 an insertion; additional words 3c each.* **POSITION WANTED** *advertisements (50 words or less), $1.00 an insertion: additional words 2c each.*

POSITION WANTED

Party with considerable experience wishes responsible position and corresponding pay. Address Box 531, care Western Electrician, 510 Marquette Bldg., Chicago.

POSITION WANTED.

As superintendent of electric light plant in city of about 15,000 inhabitants. Have had twenty years practical experience in all branches of the business. Am at present employed and can furnish first class references. Address Box 523 care of Western Electrician, 510 Marquette Bldg., Chicago.

WANTED.

A young man of technical education to act as selling engineer and figure wiring installations for a large Chicago company. Call at 309 Merchants Loan and Trust Building.

WANTED.

An experienced designer of Alternating Current Generating Machinery. Must be a technical graduate. Write fully, giving age, qualifications, experience and salary expected. Address Box 529, care Western Electrician, 510 Marquette Bldg., Chicago.

WANTED.

State charter and local franchise for electric light, heat and power company wants capital to develop it, or will sell at fair price. Town of 2,000, good location, 2,000 lights wired and much business waiting for company to build. Street and commercial lighting. Prospects good. Address Box 528, care Western Electrician 510 Marquette Bldg., Chicago.

FOR SALE.

$200 00 1-45 K. W. 133 Cycle 1,500 R. P. M. Westinghouse alternator with sub-base and exciter and station instruments all in good operating condition. AMBOY LIGHT & POWER CO., Amboy, Ills.

FOR SALE.

A first-class repair shop doing good business. A short distance from Chicago. Present owner unable to give it necessary attention. Address Box 525, care Western Electrician, 510 Marquette Bldg., Chicago.

TELEPHONE ENGINEERS.

Engineers of experience with telephone manufacturers will gain information to their interest by writing to Box 1732 General Post Office, New York City, in regard to business openings. State nature of present work and name of employer as well as age, experience and salary expected.

ELECTRICAL AND OTHER INDUSTRIES ARE OFFERED LOCATIONS WITH Satisfactory Inducements, Favorable Freight Rates, Good Labor Conditions, Healthful Communities, ON THE LINES OF THE ILLINOIS CENTRAL R. R. AND THE YAZOO & MISSISSIPPI VALLEY R. R.

For full information and descriptive pamphlet address

J. C. CLAIR, Industrial Commissioner
1 Park Row, Chicago, Ill.

Security Distributing Panels

This shows that these panels are insulated on hard rubber. The contacts are riveted to the rubber, countersunk into it, and the holes filled with insulating compound. The ground strip is held by screws, which do enter the wood holding the hard rubber in position. As the ground strip is connected to the earth anyway, this one contact of metal to wood is of no importance.

Panels have been made with contacts mounted directly on plain wood, and the insulation has been fair under favorable circumstances. Security Panels are of kiln-dried oak, heavily varnished, and themselves of high insulation, but we do not trust to that alone. Experience proves that the brass contacts should be on hard rubber, and on that only, and we build them that way.

We believe that panels made differently are not so good. Perhaps they sell cheaper (they certainly should), but our price of ten cents per wire, including the fuse, is cheap enough for any distributing panel.

TRADE MARK.

THE F. BISSELL COMPANY
TOLEDO, O.

151

NORTHERN SPHERICAL MOTORS

Are being standardized by numerous progressive machine manufacturers for equipping their mechanisms because the motors are

Compact, Simple, Economical in Operation, Readily Applied to Any Apparatus and Merge into the General Design of Machinery, Making Efficient, Handsome Unit

We want to discuss this matter with builders and users of machines and machine tools
Motor Bulletin No. 2535

NORTHERN ELECTRICAL MANUFACTURING COMPANY
ENGINEERS Madison, Wis., U. S. A. MANUFACTURERS
425 Monadnock Block, Chicago Ill.

BOSSERT'S BOXES

Drawn steel. One blow of a hammer gives clean round hole. No filing.
SAVE TIME, BOXES AND MONEY
Be up to date. Use them. Write for bulletin giving full particulars.
Bossert Electric Construction Co., UTICA N.Y.

YOST SPECIALTIES.

Sockets, Wall Sockets, Weatherproof Sockets, Rosettes, Receptacles, Cord Adjusters.

Catalogue for the asking.

THE YOST ELECTRIC MFG. CO.
TOLEDO, OHIO.

BOOK ORDERS
GIVEN PROMPT ATTENTION
Electrician Publishing Co.,
Suite 510 Marquette Bldg., CHICAGO

EVERY COMFORT
Attends the Traveler between
Chicago Indianapolis
Cincinnati & Louisville
Who Travels via the
MONON ROUTE
Consult Your Local Ticket Agent

FOR SALE

1,500 Telephone Transmitters with arms at 35c each.
5,000 Cast Bronze Push Buttons from 5c up.
15,000 lbs. Annunciator and Office Wire at 17½c per lb.
We job in all kinds of Electric Supplies and Material. Send for samples.

AMBER ELECTRIC CO.
Monroe and Clinton Sts., CHICAGO

REPAIRS

We are Headquarters for
ELECTRICAL REPAIR WORK We operate the largest repair shops in America and have exceptional facilities for quick work. We repair all kinds of electrical apparatus and save our customers weeks in time in comparison with sending the work to the manufacturers direct. We have just reduced our prices and ask you to get our quotations on

Armatures Rewound, Commutators Refilled, Transformers Rewound, Etc.

Send for our monthly "Bargain Sheet," showing net prices on our stock of second-hand dynamos, motors, meters, transformers and supplies. Every article a bargain.

GREGORY ELECTRIC CO.
54-62 S. Clinton Street - CHICAGO

LOOK FOR THE LICENSE LABEL ON THE LAMP

9

WANTED
ON COMMISSION
AGENTS and SALESMEN
For High-Grade, Refilled
INCANDESCENT LAMPS
3.1 WATT LAMPS A SPECIALTY
EAGLE LAMP CO INC.
MIDDLETON, MASS.

SECOND-HAND MACHINERY

1 A. 70 T. H. 125 Cycle, 1100 Volt Alternator, 1070 R. P. M.
2 120 K. W. General Electric 125 Cycle, 1100 Volt, Type A. S. 1070 R. P. M. All complete with exciters—self-oiling bearings.
1 150 K. W. General Electric, 2 Phase, 60 Cycle, 2200 Volt, compensated revolving field alternator, 500 R. P. M.
1 270 K. W. T. H. 550 Volt Railway Generator, 600 R. P. M.
1 A. 70 Armature newly rewound.
1 20 K. W. 250 Volt Westinghouse Generator direct coupled to 7x10 Ideal Automatic Engine, new.
1 24x18 Ideal Automatic Engine.
2 66-inch x 20-ft Return Tubular Boilers built for 130 lbs. working pressure.
The above is all in first class operating condition and is offered subject to prior sale.

Springfield Light, Heat & Power Company
Springfield, Ill.

CHICAGO EDISON COMPANY REPAIR SHOPS
76 MARKET STREET, CHICAGO. TELEPHONE MAIN 1280
FIRST CLASS EQUIPMENT THROUGHOUT
High-Grade Machine Work of All Kinds
Correspondence Solicited.
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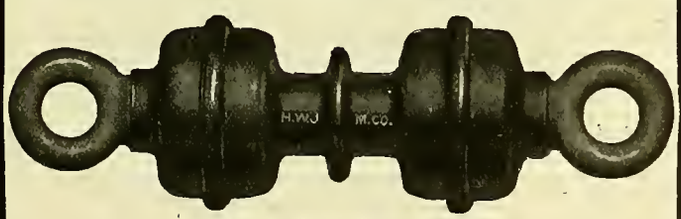

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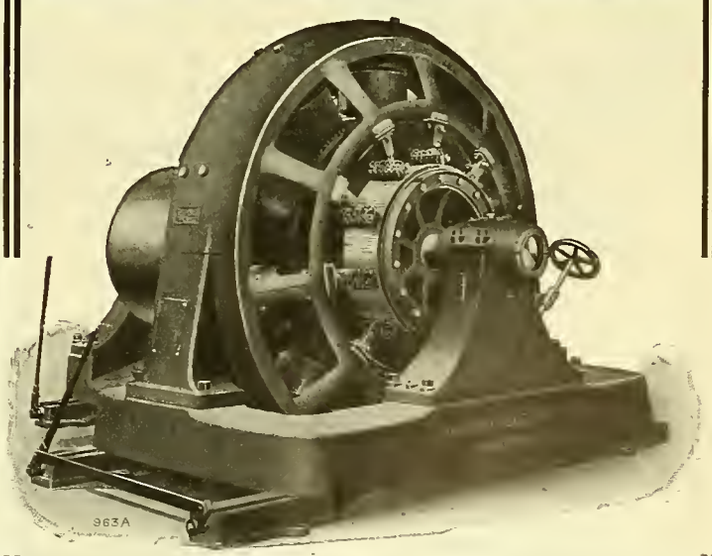

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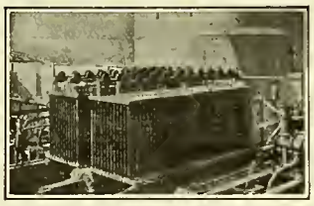

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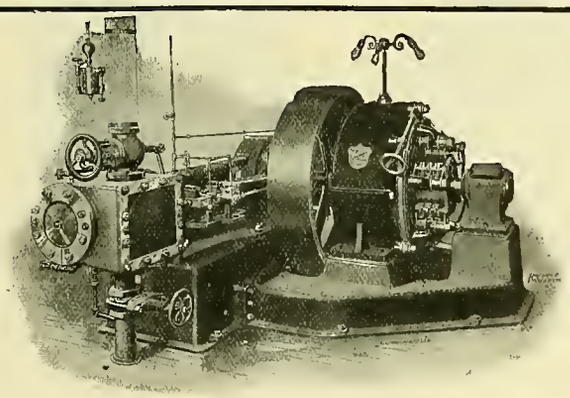

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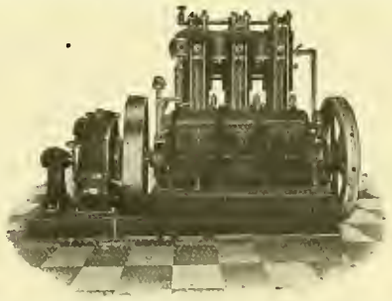

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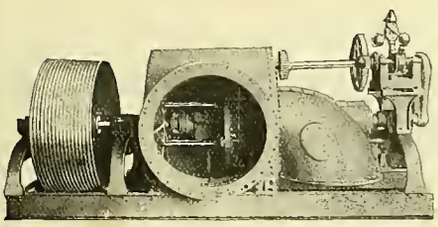

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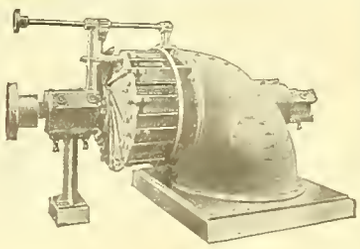

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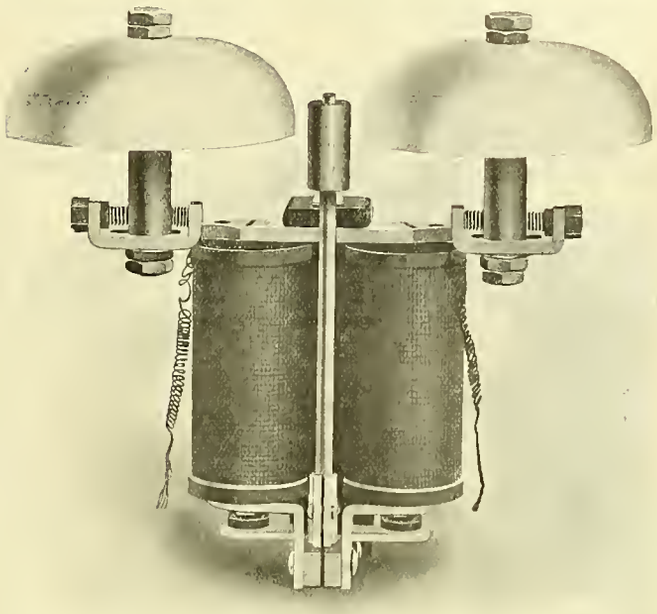

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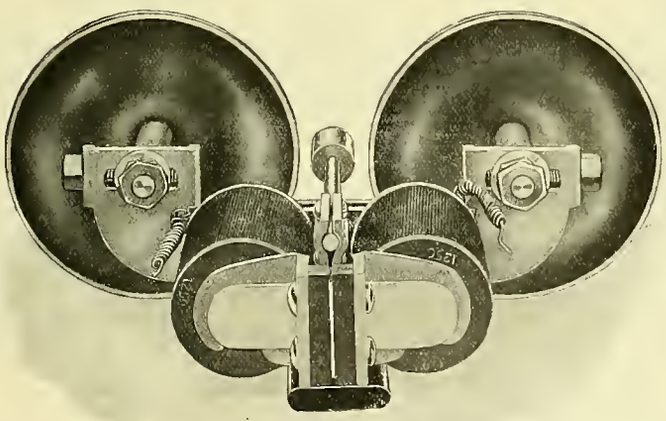

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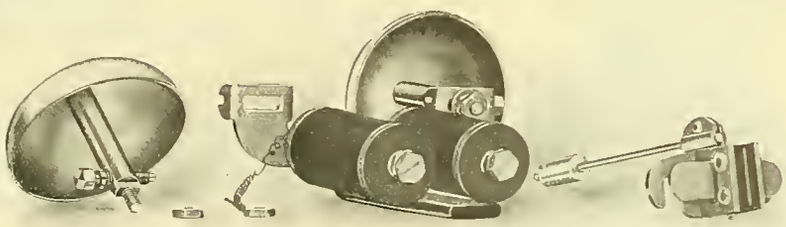

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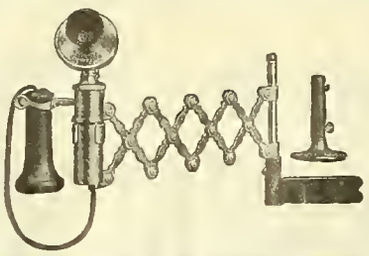

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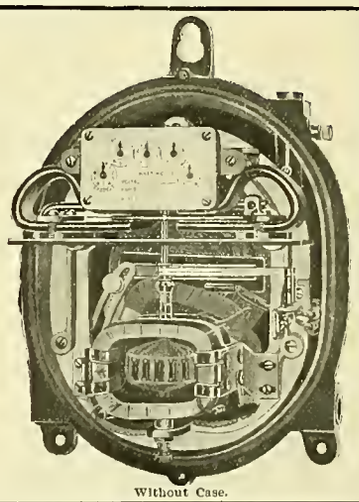

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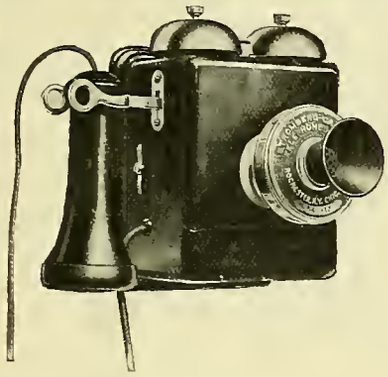

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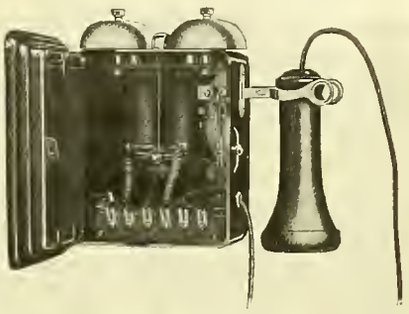

Fig. 2.

Fig. 3.

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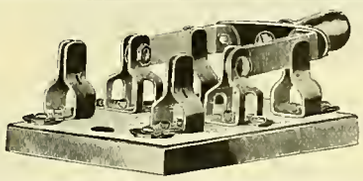

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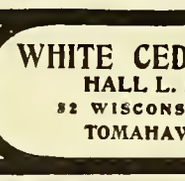

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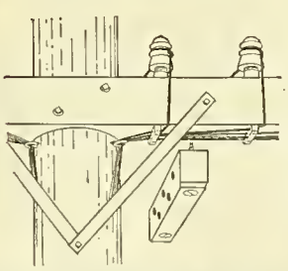

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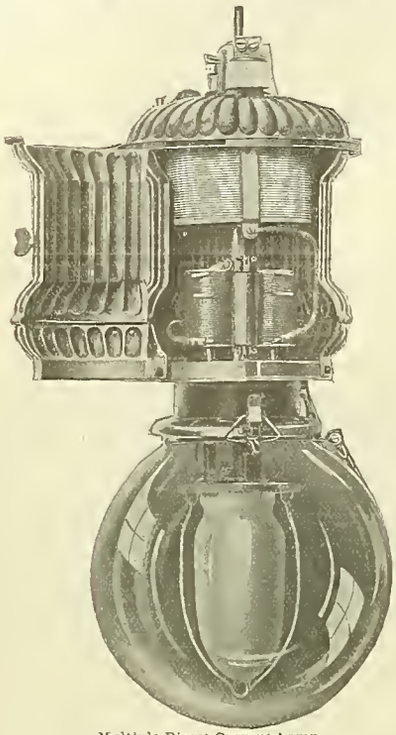

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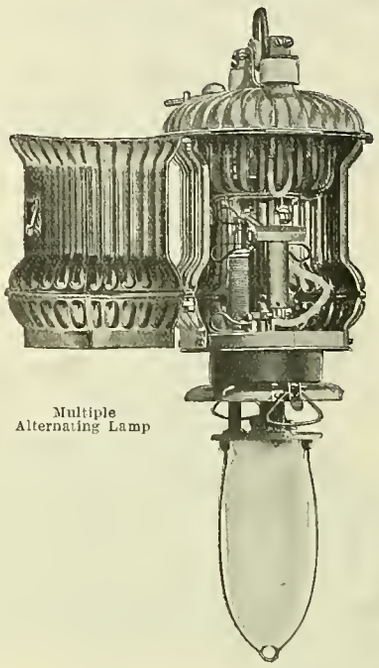

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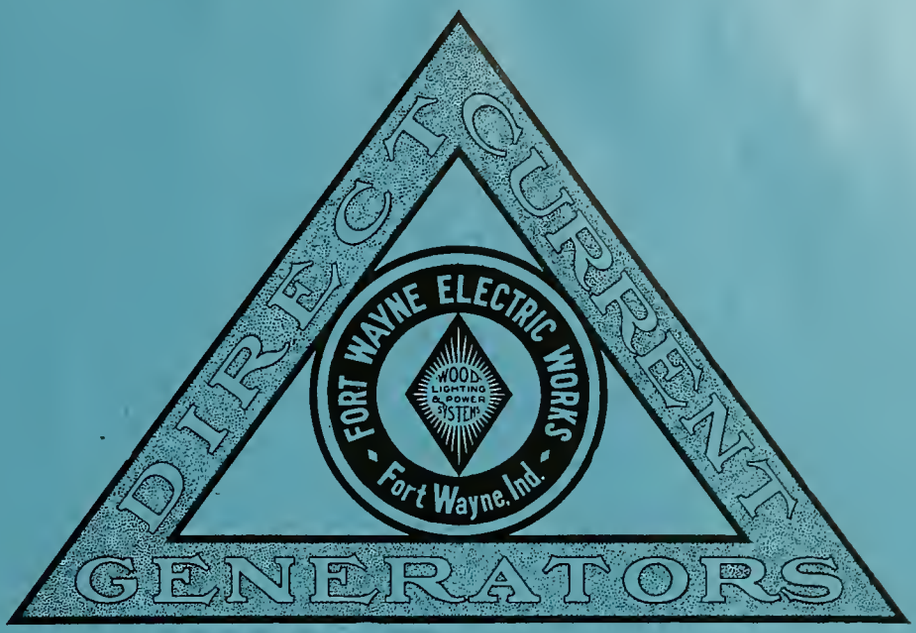

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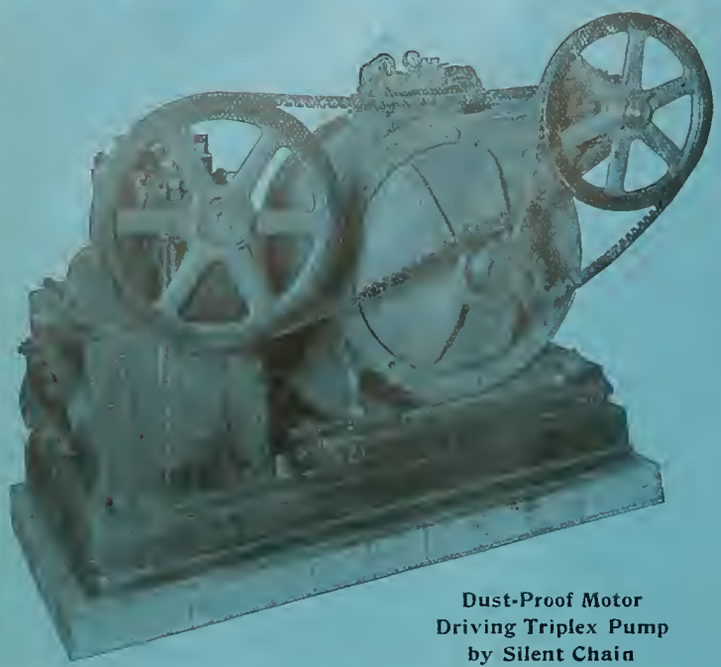

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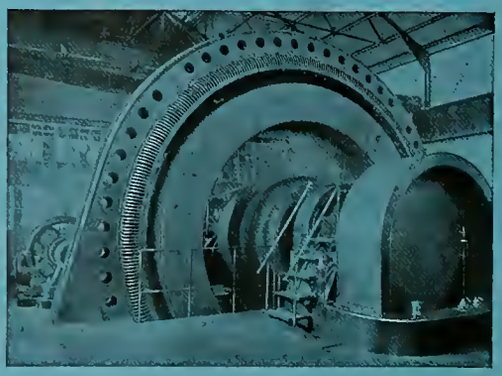

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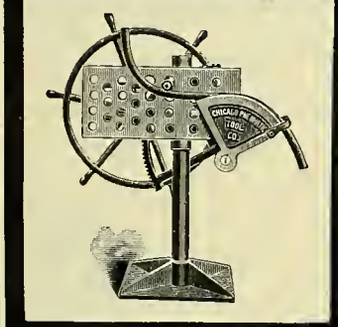

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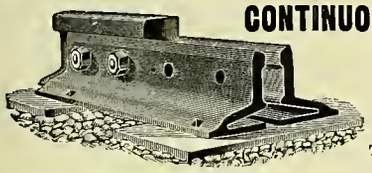

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Switches,
Arc Lamps,
Circuit Breakers, Etc., Etc.

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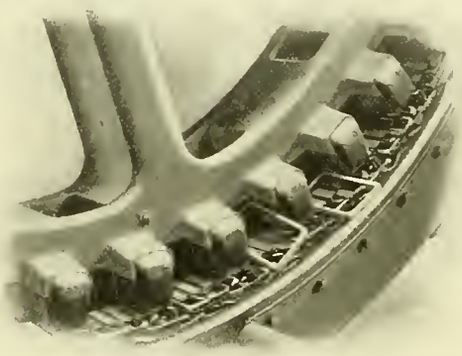
A shaft revolving in bearings. No brushes, collectors, nor moving wires of any kind.

The Inductor Generator

for simplicity is comparable to the Induction Motor. The field is stationary, the armature is stationary—the only moving part being the "Inductor," which is merely a mass of metal.



Illustrating the facility with which a coil may be removed from the Inductor generator.

If it were possible to derive electrical energy from a mass of metal by merely connecting wires thereto; such would be the ideal generator. In the **Inductor Generator** the elimination of all mechanical complications makes this type approximate the ideal more closely than any other electrical generating apparatus extant.

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PITTSFIELD MASSACHUSETTS

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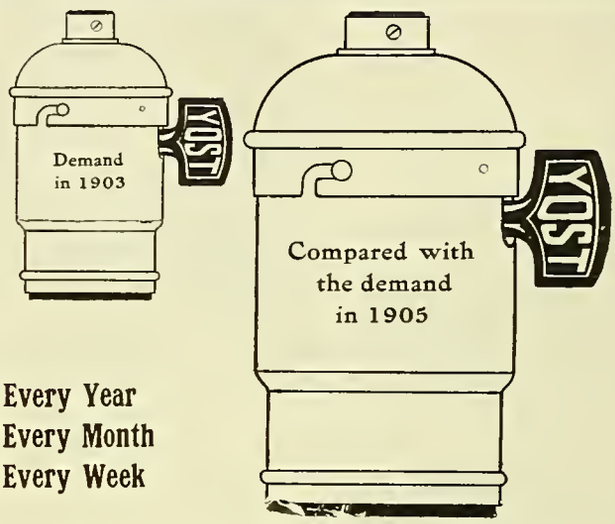

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Is there **one good** reason why **you** do not use YOST SOCKETS?

The Yost Electric Mfg. Co.
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The "REFLECTRIC"

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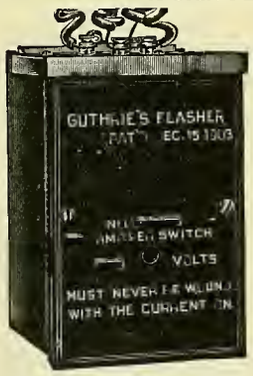
It Can't Be Beat—The Guthrie Flasher

A SIGN FLASHER WITHOUT A MOTOR



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We have overcome this and are putting out an article that meets a long felt want.

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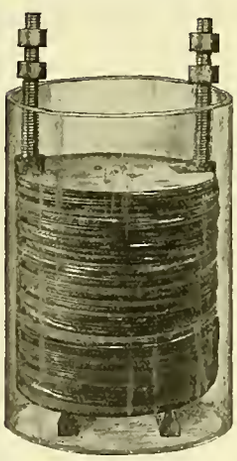

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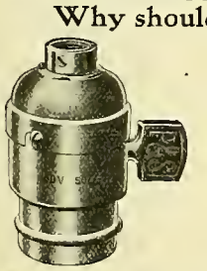

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2012

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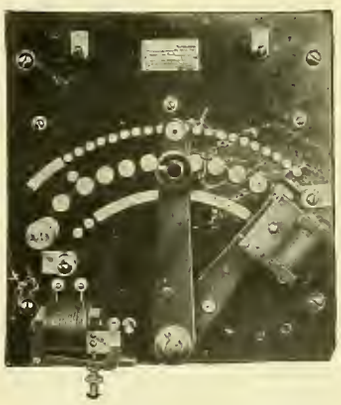

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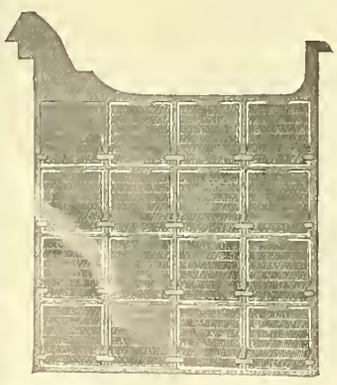

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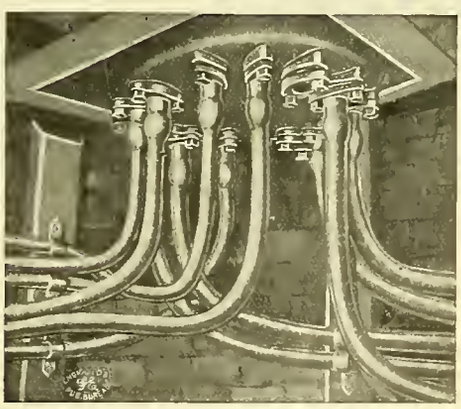

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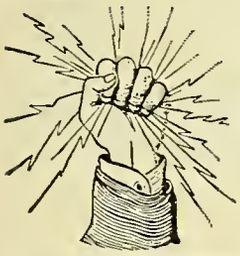

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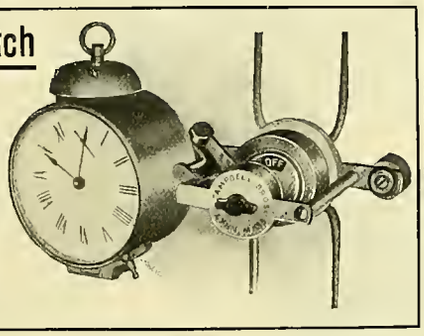

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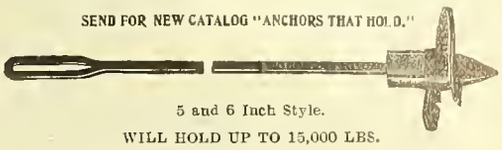

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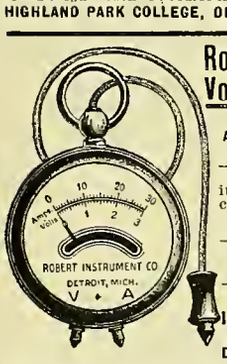

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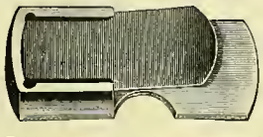

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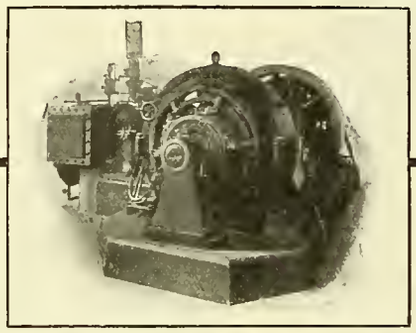

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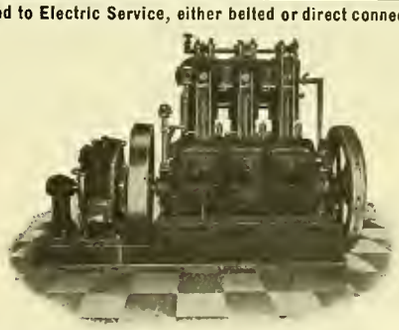

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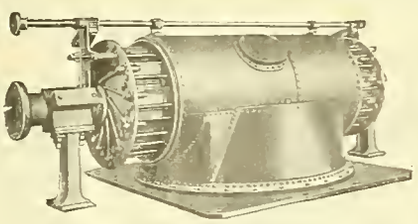

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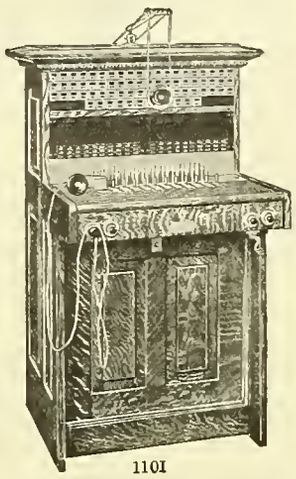

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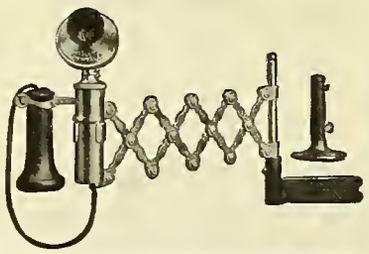

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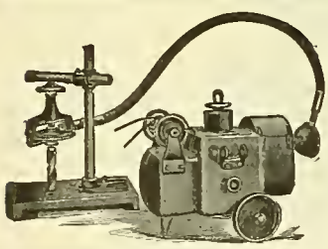

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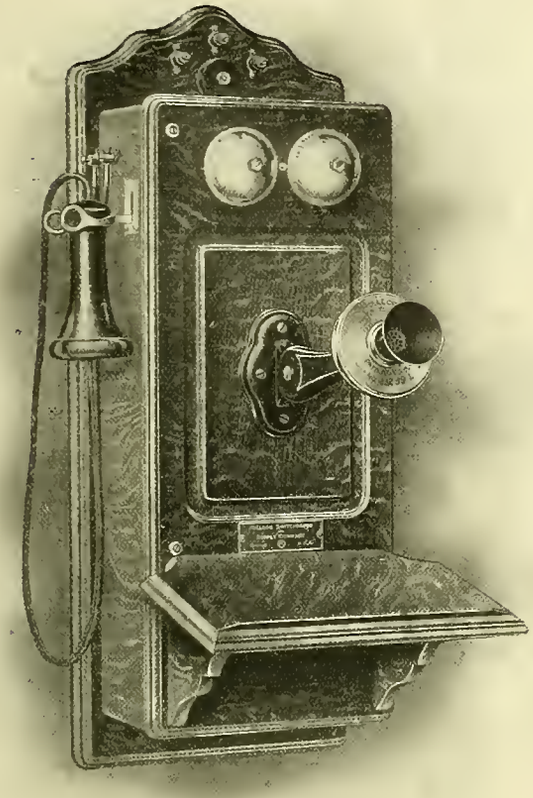

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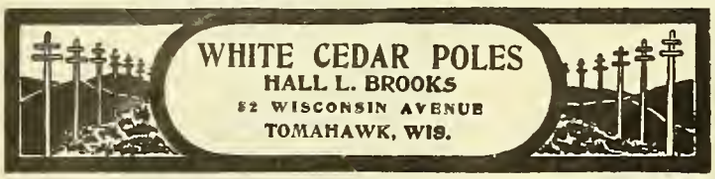

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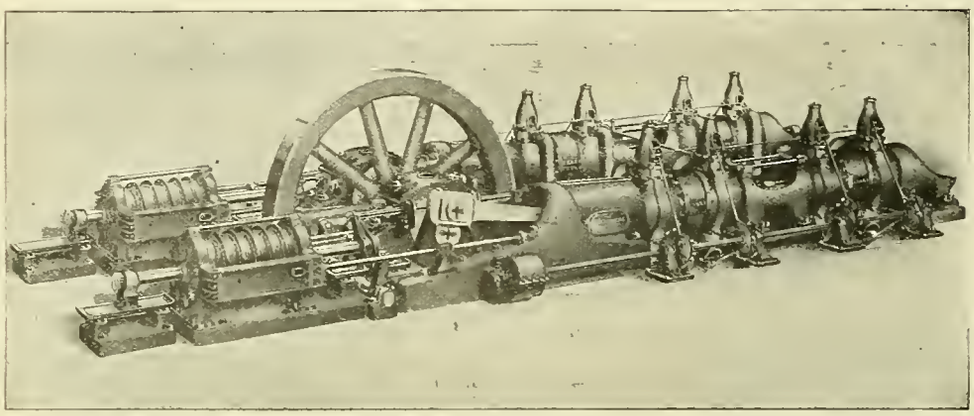

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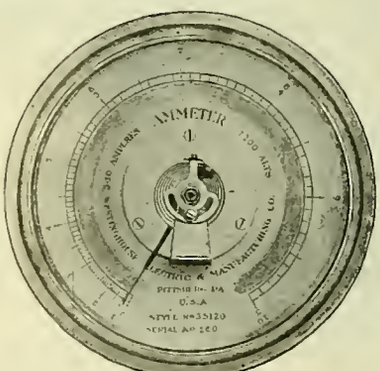

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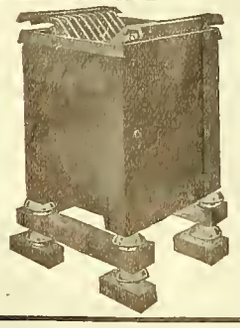

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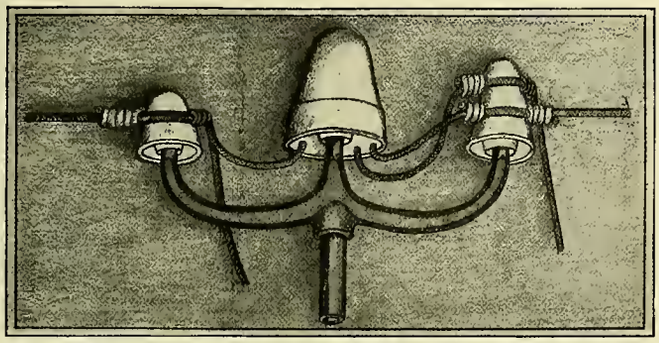

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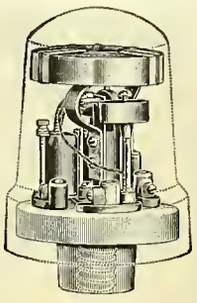

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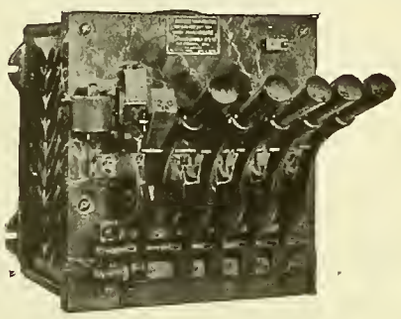

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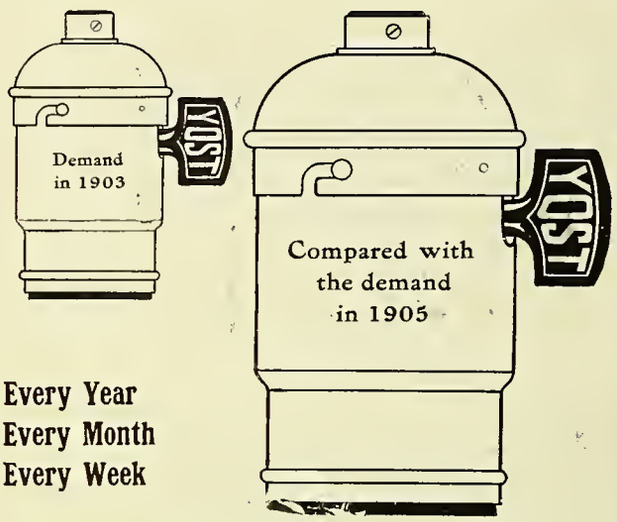

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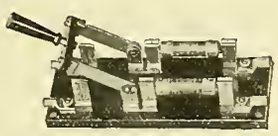

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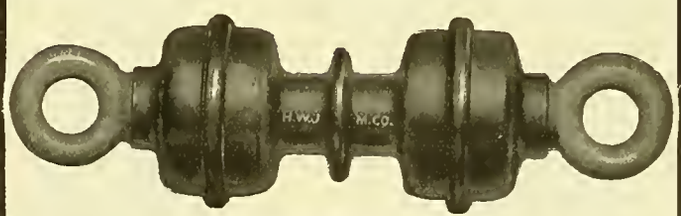

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Jackson, D. C. & W. B.
Kohler Brothers.
Northern Electrical Mfg. Co.
Ruebel & Wells.
Sargent & Lundy.
Schott, W. H.
Stanley—G. I. Elec. Mfg. Co.
Stanton, LeRoy W.
Underhill, Chas. R.
Willis, G. M.

Electrical Instruments.
(Recording and Testing.)
Bissell Co., The F.
Central Electric Co.
Diamond Meter Co.
Duncan Elec. Mfg. Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Machado & Roller.
Pignolet, L. M.
Reliance Instrument Co.
Robert Inst. Co., The.
Stanley—G. I. Elec. Mfg. Co.
Stanley Instrument Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co
Weston Electrical Inst. Co.

Electro-Plating Mach'y
Crocker-Wheeler Co.
General Electric Co.

Elevators-Conveyors.
Jeffrey Mfg. Co.

Engines, Corliss.
Allis-Chalmers Company.

Engines, Gas and Gasoline.
Allis-Chalmers Company.
Marinette Gas Engine Co.
Westinghouse Machine Co.

Engines, Oil.
American Diesel Engine Co.

Engines, Steam.
Allis-Chalmers Company.
Brownell Co., The.
Westinghouse Machine Co.

Fans and Fan Motors.
Central Electric Co.
Century Electric Co.
Crocker-Wheeler Co.
Edison Mfg. Co.
General Electric Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Fans, Exhaust and Ventilating.
Green Fuel Economizer Co.

Fibre.
Kartavert Mfg. Co.
Vulcanized Fibre Co.

Fittings.
Plume & Atwood Mfg. Co.

Fixtures, Gas and Elec.
Beardslee Chandelier Mfg. Co.

Flashers.
Bissell Co., The F.
Doxsee-Harrere Electrical Co.
Haller Machine Co.
Reynolds El. Flasher Mfg. Co.
Schneider & Co., C. O.
Wesco Supply Co.

Flexible Shafts.
Stow Mfg. Co.

Fuses and Fuse Wire.
Bissell Co., The F.
Central Electric Co.
Chicago Fuse Wire & Mfg. Co.
D. & W. Fuse Company.
Electric Appliance Co.
Johns-Manville Co., H. W.
Manhattan Elec. Supply Co.
Peru Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Company.

Glassware, Electric.
Addison Glass Co.

Globes, Reflectors and Shades.
Addison Glass Co.
Haller Machine Co.
Phœnix Glass Co.
Wesco Supply Co.
Western Electric Co.

Governors, Water Wheel.
Replogle Governor Works.

Graphite Specialties.
Dixon Crucible Co., Jos.
Holmes Fibre-Graphite Co.

Heating (Exhaust Steam).
Amer. District Steam Co.

Holders, Inc. Lamps.
Electric Appliance Co.
Incandescent Electric Light Manipulator Co.

Hydraulic Machinery.
Alton Machine Co.
Allis-Chalmers Company.

Indicators
Robertson & Sons, Jas. L.

Inspection & Insurance
Hartford Steam Boiler Inspection & Insurance Co.

Insulating Machinery.
Alton Machine Co.

Insulators and Insulating Materials.
American Electrical Works.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
Indiana Rub. & Ins. Wire Co.
Johns-Manville Co., H. W.
Kartavert Mfg. Co.
Manhattan Elec. Supply Co.
Mica Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Vulcanized Fibre Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Iron Castings.
Alton Machine Co.

Lamps, Arc.
Bissell Co., The F.
Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Gregory Electric Co.
Manhattan Elec. Supply Co.
Stanley—G. I. Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamps, Incandescent.
Bissell Co., The F.
Bryan-Marsh Company.
Buckeye Electric Company.
Central Electric Co.
Chicago Edison Co.
Columbia Incan. Lamp Co.
Eagle Lamp Co.
Edison Decorative & Miniature Lamp Dept.
Electric Appliance Co.
General Electric Co.
McCandless, R. W
Sunbeam Incan. Lamp Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamps, Incandescent—Replacers & Cleaners.
Inc. El. Lt. Manipulator Co.

Letters, Metal, Sign.
Haller Machine Co.

Lightning Arresters.
Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Manhattan Elec. Supply Co.
Minnesota Electric Co.
Stanley—G. I. Elec. Mfg. Co.
Tornquist Elect'l. Mfg. Co.
Wesco Supply Co.
Western Electric Co.

Linemen's Climbers.
Klein & Sons, Mathias.

Magnet Wires.
(See Wires and Cables.)

Mechanical Draft.
Green Fuel Economizer Co.

Mica.
Chicago Mica Co.
Mica Insulator Co.
Munsell & Co., Eugene.

Mining Apparatus, Elec.
Allis-Chalmers Company.
(Bullock El. Mfg. Co.)
Crocker-Wheeler Co.
General Electric Co.
Jeffrey Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Mining Machinery,
Allis-Chalmers Company.

Motors. (See Dynamos and Motors.)

Nippers and Pliers.
Klein & Sons, Mathias.

Overalls.
Carhartt & Co., Hamilton.

Patent Attorneys.
Hain, Foree & May.
Stevens & Co., Milo B.

Phosphor Bronze.
Phosphor Bronze Sm. Co. Ltd.

Pipe Bending Machines.
Chicago Pneumatic Tool Co.

Platinum, Wire and Sheet.
Amer. Platinum Works.
Baker & Co., Inc.

Poles and Ties.
Berthold & Jennings.
Brooks, Ball L.
Duluth Log Co.
Fowler, John H.
Kellogg Switch. & Sup. Co.
Lindsley Bros. Co.
Loud's Sons Co., H. M.
Maltby Cedar Co.
Minneapolis Cedar & Lbr. Co.
Mueller Company, William.
Pacific Coast Pole Co.
Pillsbury-Watkins Co.
Pittsburg & L. S. Iron Co.
Porter Cedar Company.
S. E. Missouri Cypress Co.
Sterling & Son, W. C.
Torrey Cedar Co.
Valentine-Clark Co., The.
Western Lumber & Pole Co.
Worcester Co., C. H.

Polish (Metal).
Hoffman, Geo. W.

Porcelain Specialties.
Pass & Seymour, Inc.
Peru Electric Mfg. Co.

Portables.
Plume & Atwood Mfg. Co.

Power Transmission Machinery.
Allis-Chalmers Company.
Jeffrey Mfg. Co.

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Tornquist Elec. Mfg. Co.

Rail Joints.
Continuous Rail Joint Company of America.

Railway Supplies.
Wesco Supply Co.

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Chicago Edison Co.
Gregory Electric Co.
Southwestern Elec. Co.

Rheostats.
Cutler-Hammer Mfg. Co.
General Electric Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Rubber Machinery.
Alton Machine Co.

Schools and Colleges.
Highland Park College.

Second-Hand Mach'y.
Amber Elec. Co.
Bissell Co., The F.
Gregory Electric Co.
Southwestern Elec. Co.
Matthews & Bro., W. N.

Signs, Electric.
Haller Machine Co.
Western Display Co.

Sockets & Receptacles.
Pass & Seymour.
Sauter Co., G. F.
Yost Elec. Mfg. Co.

Soldering Sticks, Salts and Paste.
Chicago Solder Co.
Collins & Son, E. R.
New Idea Soldering Paste Co.
Western Electric Co.

Solenoids.
Underhill, Chas. R.

Speaking Tubes.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Co.

Specialties, Electrical Mfrs. and Designers.
Haller Machine Co.

Speed Indicators.
Weston Electrical Inst. Co.

Stokers.
Westinghouse Machine Co.

Storage Batteries.
American Battery Co.
Chicago Pneumatic Tool Co.
Dayton Mfg. Co.
Electric Storage Battery Co.
General Storage Battery Co.
Gould Storage Battery Co.
Morava Construction Co.
National Battery Co.
Universal Elec. Stor. Bat. Co

Supplies, General Elec.
Amer. Elect'l Supply Co.
Bissell Co., The F.
Central Electric Co.
Century Electric Co.
Chicago Edison Co.
Electric Appliance Co.
Manhattan Elect'l Supply Co
Wesco Supply Co.
Western Electric Co.

Switches.
(See Cut-outs and Switches.)

Telephones, Telephone Material and Switchboards.
American El. Telephone Co
Automatic Electric Co.
Bissell Co., The F.
Central Electric Co.
Electric Appliance Co.
International Tel. Mfg. Co.
Kellogg Switchb. & Sup. Co.
Manhattan Elec. Supply Co.
Stromberg-Carlson Tel. M. Co.
Wesco Supply Co.
Western Electric Co.

Time Switches.
Bissell Co., The F.
Campbell Bros.

Toggle Bolts.
(See Bolts, Toggle.)

Tools.
Klein & Sons, Mathias.

Tools, Pneumatic.
Chicago Pneumatic Tool Co.

Transformers.
Allis-Chalmers Company.
(Bullock El. Mfg. Co.)
Central Electric Co.
Crocker-Wheeler Co.
Electric Appliance Co.
Ft. Wayne Elec. Works, Inc.
General Electric Co.
Kuhlman Electric Co.
La Fayette Elect'l. Mfg. Co.
National Electric Co.
Stanley—G. I. Elec. Mfg. Co.
Wagner Electric Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Trucks, Electric Car.
General Electric Co.
Westinghouse El. & Mfg. Co.

Turbines, Steam.
Allis-Chalmers Co.
General Electric Co.
Westinghouse Machine Co.

Turbine Water Wheels
Leffel & Co., Jas.

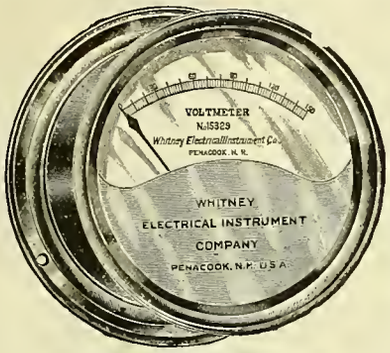
Vulcanized Fibre.
Vulcanized Fibre Co.

Wire Rope Machinery.
Alton Machine Co.

Wires & Cables—Magnet Wires.
American Electrical Works.
Belden Mfg. Co.
Bissell Co., The F.
Central Electric Co.
Crescent Ins. Wire & Cble. Co.
Electric Appliance Co.
General Electric Co.
Hazard Manufacturing Co.
Indiana Rub. & Ins. Wire Co.
India Rubber & Gutta Percha Insulating Co.
Kellogg Switch. & Sup. Co.
Manhattan Elec. Supply Co.
National India Rubber Co
New York Insulated Wire Co.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co
Roebling's Sons Co., J. A.
Safety Ins. Wire & Cable Co.
Simplex Electrical Co.
Standard Underground C. Co.
Wesco Supply Co.
Western Electric Company.

Woodwork, Telephonic.
Telephone Woodworking Co.

For Alphabetical Index of Advertisements See Page 3.



Diam. of body, 6 in., of base flange 7½ in.

THE
"I. P." (ISOLATED PLANT) TYPE
DIRECT-CURRENT
INSTRUMENTS

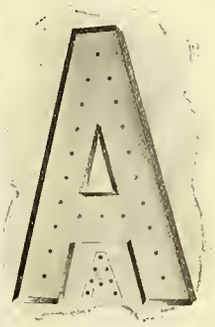
Are winners. Scales are equally divided, indications are dead heat, high range ammeters have separate shunts and the cases are of heavy polished brass.

Prices are right, the list figure for the meter illustrated, for instance, being $16.50.

WRITE FOR DISCOUNTS TO

MACHADO & ROLLER,
203 BROADWAY, NEW YORK CITY, N. Y., Or Your Nearest Supply House.

WE MAKE LARGE... ELECTRIC ROOF SIGNS



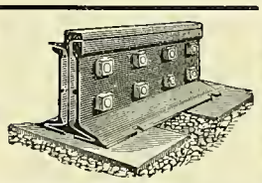
Our 6-foot all-metal grooved letter for roof signs.

consisting of raised or grooved metal letters mounted upon angle iron frame or upon full metal back-ground.

We make any kind of an ELECTRIC SIGN. We prepare your design and make a high-grade sign that will last, that will look well, and that can be read at a good distance and at any angle. You pay us no more than cost of material and labor with a reasonable profit added thereto. Write us.

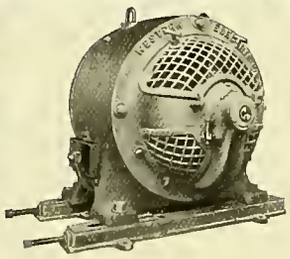
Haller Machine Co.
127 Fulton Street
CHICAGO

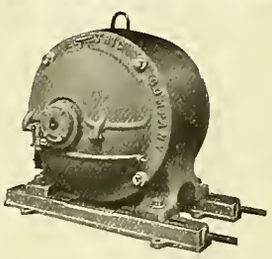
CONTINUOUS RAIL JOINT CO. OF AM.
NEWARK, N. J.
OVER 20,000 MILES IN USE
Highest Award at Paris Exposition, 1900, Buffalo, 1901, and St. Louis, 1904.



ROCK ISLAND DRY CELLS
ARE THE BEST
JUST TRY THEM
THAT'S ALL WE ASK

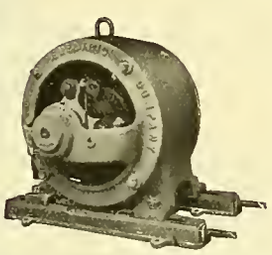
ROCK ISLAND BATTERY CO.
GEORGE W. CONOVER
135 Adams Street,
Chicago Representative
ROCK ISLAND, ILL.
U. S. A.





ALL STYLES AND SIZES

WESTERN ELECTRIC CO.
CHICAGO NEW YORK
OTHER LARGE CITIES



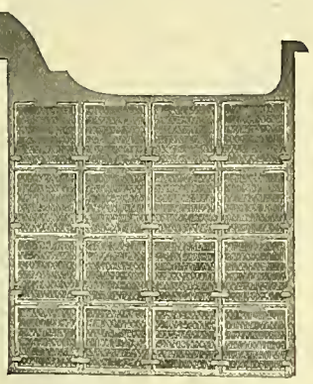
"Diamond H" Switches

Trade H Mark

This Trade-Mark guarantees quality.

The Hart Mfg. Co., Hartford, Conn.

New York Boston Chicago Toronto, Ont.



ABOVE ALL OTHER CONSIDERATIONS

Electric Storage Batteries of the "Unit Accumulator" Type are

RELIABLE

FOR STREET RAILWAYS, CENTRAL STATIONS, TELEPHONE SYSTEMS, ETC.

Descriptive Catalogue and Prices Furnished Upon Application.

Ask for Bulletin on "A WATER POWER SYSTEM."

National Battery Company
BUFFALO, N. Y.

Branch Offices: NEW YORK, CHICAGO

FREE TO

Central Stations

50 FEET

"Oneida" Galvanized Chain

EXPRESS PREPAID.

Suspend an Arc Lamp with this chain and you will see the advantages obtained.

It excels either rope or cable, because it lasts longer!

It works freer!
Is more reliable!

It has no splices or strands to give away!

A perfect chain for the purpose!

"American" Pattern

ONEIDA COMMUNITY, LTD.,

Address all inquiries to "Sales Dept." **ONEIDA, N. Y.**

The more a man advertises, the greater his business. The greater his business, the more he advertises.

Grimshaw

Raven White Core

Raven Black Core

ALL OUR WIRES pass inspection and carry the above **TRADE-MARKS** on our tags. We also manufacture **Grimshaw** and **Competition Tapes** and **Splicing Compounds.**

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MAIN OFFICE: 114, 116 & 118 Liberty St., New York.

BRANCHES: CHICAGO: 192 Desplaines St. BOSTON: 7 Otis St. SAN FRANCISCO: 638 Mission St.

Just What the World Has Been Waiting For.

NEW "MORRISON" STORAGE BATTERY

THE CELL

This plate is so strong electrically and mechanically that no amount of electrical abuse or of vibration in traction service can dislodge even the slightest particle of its active material.

Lowest internal resistance of any storage battery in the world.

The weight efficiency is conservatively 14 watts per pound total weight, and electrical efficiency unsurpassed .˙. .˙. .˙.

THE PLATE

UNIVERSAL ELECTRIC STORAGE BATTERY CO.

INCORPORATED

OFFICE: 1355 RAILWAY EXCHANGE BUILDING FACTORY: 36-38 UNION PARK PLACE

CHICAGO, ILLINOIS

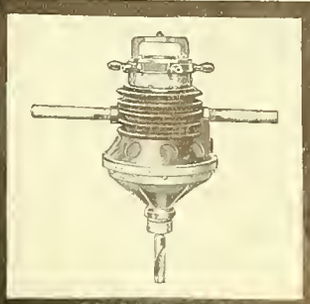
DRILL 1-M-1-10

THE DUNTLEY
AIR-COOLED ELECTRIC DRILLS

Are manufactured in sizes to correspond with our Air Drills. They are invaluable in any machine or repair shop where electric current can be obtained; also office buildings, hotels, steamships, etc., can use them advantageously. Wound for 110 and 220 volts direct current.

OVER 4000 SOLD DURING THE PAST 90 DAYS

FULL PARTICULARS, ETC., ON REQUEST.



DRILL 1-M-2-12

MANUFACTURED BY

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SAN FRANCISCO
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DETROIT
CLEVELAND

CHICAGO PNEUMATIC TOOL CO.

FISHER BUILDING, CHICAGO - - - 95 LIBERTY STREET, NEW YORK

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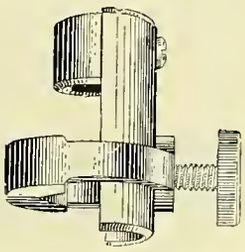
BOSTON
PITTSBURG
PHILADELPHIA
NORFOLK

CARBON HOLDERS

FOR MANY STYLES OF ARC LAMPS

NEW ILLUSTRATED CATALOG 2312 MAILED ON REQUEST



REPAIR PARTS FOR ARC LAMPS

THE TURNER BRASS WORKS

..MANUFACTURERS..

23 NORTH FRANKLIN ST., CHICAGO, U. S. A.

Silvey Type "R" Storage Battery

Can be increased in capacity by adding additional plates. Elements are placed in a horizontal position and porous, absorbent separators placed between plates so that the active material is securely held in place. Our catalogue 126 describes many types of cells.

Bulletin No. 131 on
Isolated Lighting Plants

Has many drawings of switchboards, battery racks, etc., and is full of illustrations. A most valuable pamphlet.

THE DAYTON MFG. CO.
DAYTON, OHIO

General Electric Company

New Porcelain Ceiling Boards
FOR ARC LAMPS

Cat. No. 36850

Cat. No. 36850 is notable for its employment of a snap switch and a ratchet and chain, the lamp and board thus being self-contained and requiring no additional wiring to connect them with a switch. The use on this ceiling board of Edison Plug Cut-Outs, a better means of protection than the general cut-out, makes every lamp on a circuit independent of the others. The lamp hook, mounted by a spring, protects the lamp from jarring, making this board ideal for use on wharves, and in railway stations, factories and mills. The board is furnished for both concealed and cleat wiring.

Cat. No. 36844 may be equipped with N. E. C. S. enclosed fuses, 3 to 30 amperes, 250 volts. The board is compact, and is an excellent auxiliary device for installations using enclosed fuses, as only a few different styles of fuses need be kept in stock.

Cat. No. 36844

Principal Offices: SCHENECTADY, N. Y. Chicago Office: MONADNOCK BLDG.
Sales Offices: In All Large Cities

711

Sangamo Wattmeter
DIRECT CURRENT

Aluminum or glass case. Case being sealed, the meter is dust-proof. Case can be removed without taking meter from the wall. Smallest direct current meter on the market. Nine inches high, 5½ inches wide; projects 4¾ inches from wall. Weight, 10 pounds. Just what the direct current plants have been patiently waiting for.

ELECTRIC APPLIANCE COMPANY
Chicago and San Francisco

PEERLESS LAMPS LEAD

LOOK FOR THE LICENSE LABEL IN THE STEM

all others in EFFICIENCY, LENGTH OF LIFE, CURRENT CONSUMPTION and SUSTAINED CANDLE POWER.

A practical test and our contract prices will show you how you can save money.

WESCO

The Wesco Supply Co.
Fort Worth St. Louis

MICABOND will save you money in your repair work as well as in your new machines. It is good insulation—made out of the best materials and is sold at reasonable prices.
CHICAGO MICA CO. VALPARAISO, IND.

RECO FLASHERS

You can make $25.00, $50.00 or $75.00 per week selling RECO Sign Flashers to the merchants of your city. Easy to sell. Write for particulars and Electric Sign pointers.
Reynolds Electric Flasher Mfg. Co.
221 Fifth Avenue - - - - - CHICAGO

YOU NEED IT!

Cale's Commutator Compound.
The Only Article That Will Prevent Sparking.
Will keep the Commutator in good condition and prevent cutting. Absolutely will not gum the brushes.
50c. per stick. $5.00 per dozen. Send 50c. for trial stick.
FOR SALE BY ALL SUPPLY HOUSES OR
K. McLENNAN & CO., Sole Manufacturers, Room 411, Inter Ocean Bldg., 130 Dearborn St., CHICAGO.

VOLT - AMMETERS
POCKET SIZE
For testing Batteries and Battery Circuits, Locating Faults, Grounds, etc.
RELIABLE. - ACCURATE.
Send for Circular.
L. M. PIGNOLET
78-80 Cortlandt St., NEW YORK, N. Y.

CENTURY ELECTRIC CO.
MANUFACTURERS OF
SINGLE-PHASE SELF-STARTING
MOTORS AND CEILING FANS
ST. LOUIS, MO.

WORKS QUICK AND EASY. KEEPS ITS LUSTER. HOLDS OLD TRADE AND MAKES NEW. DOES NOT DETERIORATE. ESTABLISHED 10 YEARS. SOLD BY AGENTS AND DEALERS ALL OVER THE WORLD
U.S. METAL POLISH 3 OUNCE BOX 10 CENTS. SAMPLES SENT FREE
GEO. W. HOFFMAN
POLISHES ALL METALS. BRANCHES: N. York, Chicago, San Francisco. 295 E. WASHINGTON ST. INDIANAPOLIS, IND.
HIGHEST AWARD. CHICAGO WORLD'S FAIR 1893. LOUISIANA PURCHASE EXPOSITION 1904.

MICA
Of all Qualities, in any Form at Lowest Prices
EUGENE MUNSELL AND CO.
NEW YORK and CHICAGO

INSULATION That Is.
Micanite, Linotape, M. I. C. Compound, Empire Cloth and Paper. For Years the Standard.
MICA INSULATOR CO., Originators
NEW YORK and CHICAGO

Cope's Patent Quick Coupling Conduit Rod

Remember these rods have no lost motion.
These Couplings are of Steel and are made in the best possible manner.

Write for list of persons using these rods—26,000 sold since May 1902. Made in 3 ft. and 4 ft. lengths.
Price, 3 ft., 75 cents, 4 ft. 85 cents.
Patented February 24, 1903.

T. J. COPE
3244 North Fifteenth Street PHILADELPHIA, PA.

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STORAGE BATTERIES
General Storage Battery Company
Works: Boonton, N. J. General Offices: 42 Broadway, N. Y.

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CANDELABRA AND DECORATIVE LAMPS

For ornamental fixtures and sign and decorative lighting. Can be used in regular Edison sockets with our candelabra socket adapter.

We make all kinds of Miniature, Telephone, and Battery Lamps

LOOK FOR THE LABEL IN THE STEM

EDISON DECORATIVE & MINIATURE LAMP DEPARTMENT.
General Electric Company, Harrison, N. J.
(475)

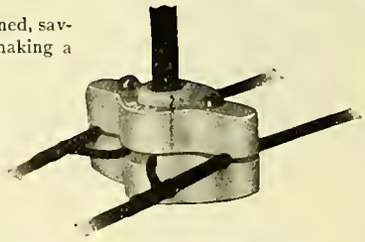
Save Money by Using
"PERU" TIE BUTTONS

A Cleat and Tie-Button combined, saving half the time in wiring and making a more workmanlike job.

NATIONAL CODE STANDARD

Made for cleat, concealed and moulding work.

Get Prices and Samples



No. 467 Cleat.

PERU ELECTRIC MFG. CO. Peru, Ind.

"FRES-KO" SOLDERING PASTE

IT "CREEPS" INTO EVERY CREVICE

Not necessary to wash a job of soldering after FRES-KO Paste

FRES-KO CHEMICAL CO. - Fort Wayne, Ind.

ELECTRICAL REPAIRING

We Guarantee All Work

DYNAMOS, ARMATURES, MOTORS, ARC LAMPS, INSTRUMENTS.
GENERAL REPAIRING. Correspondence Solicited.
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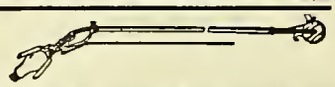

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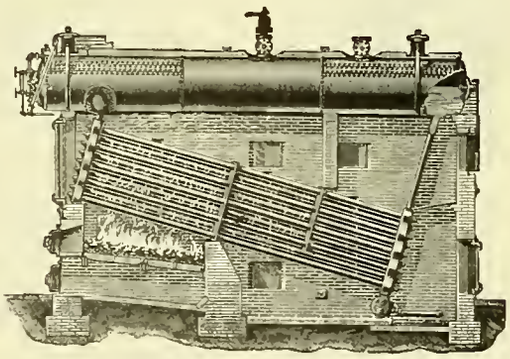

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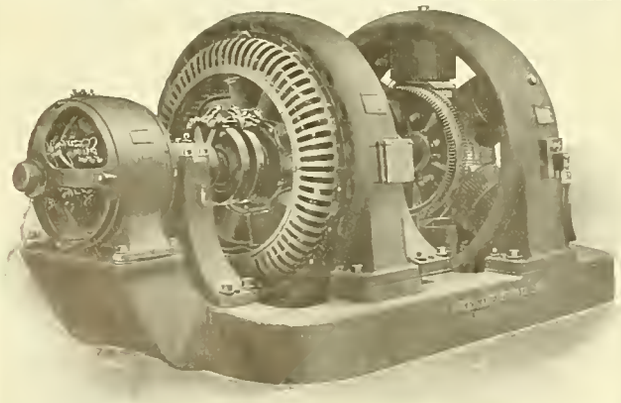

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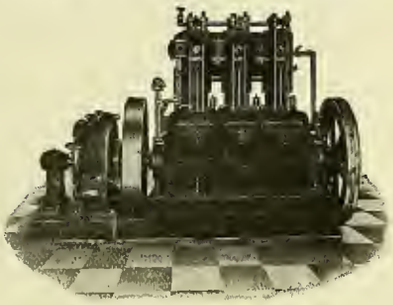

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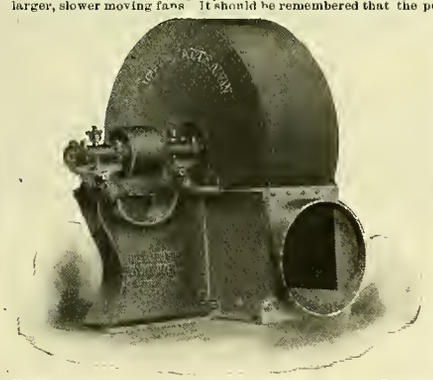

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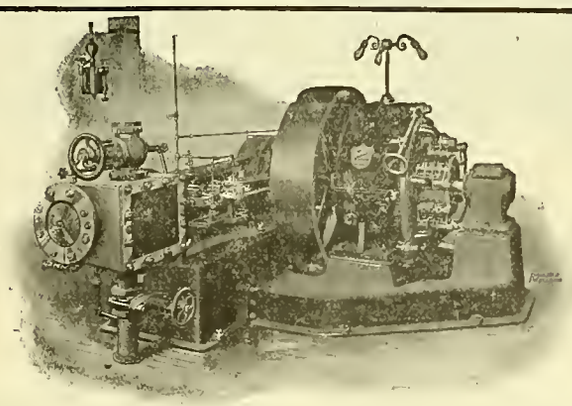

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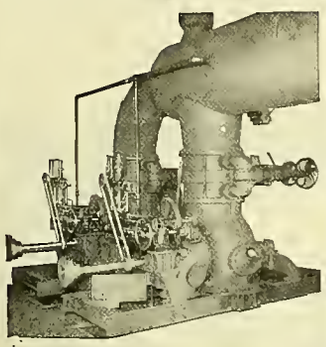

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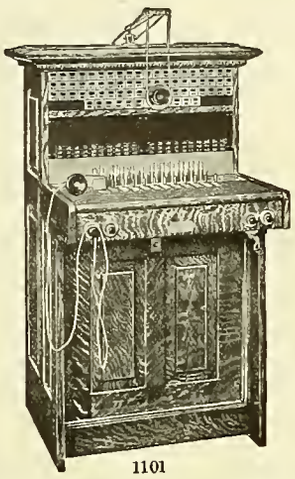

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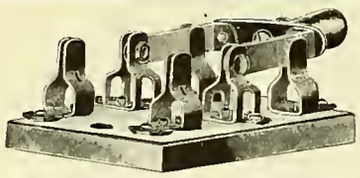

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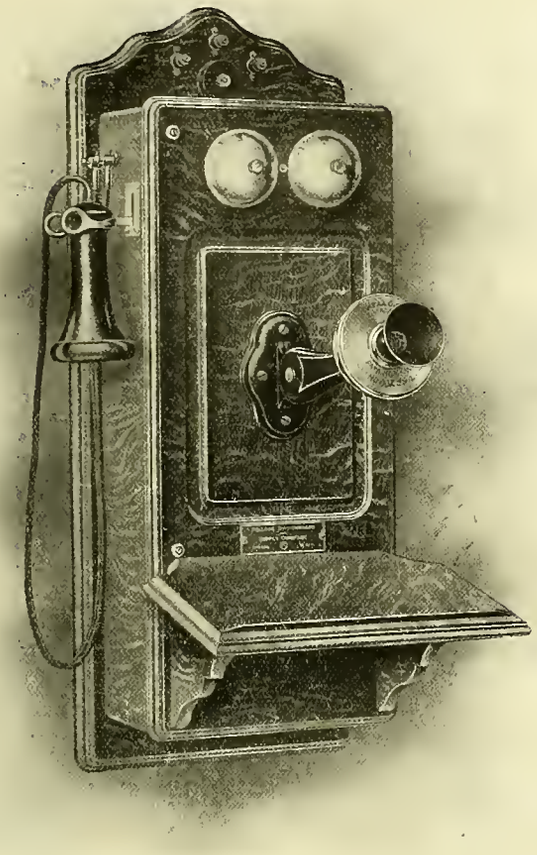

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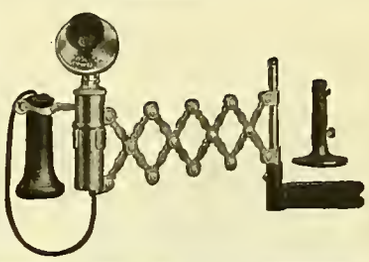

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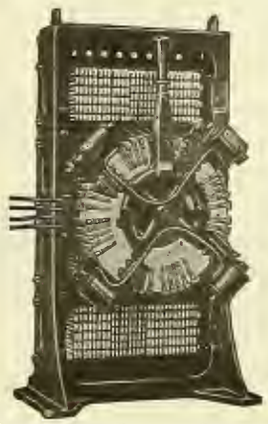

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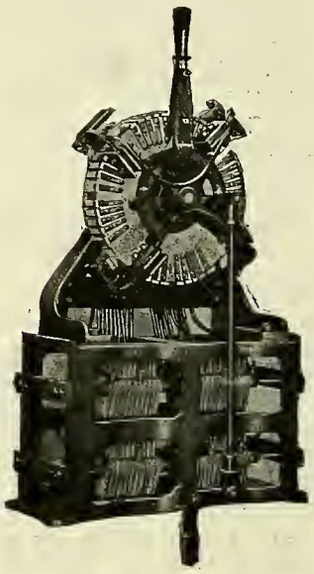

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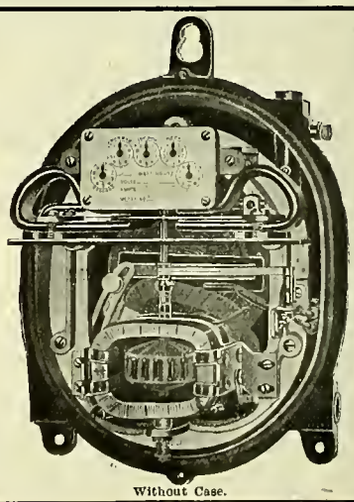

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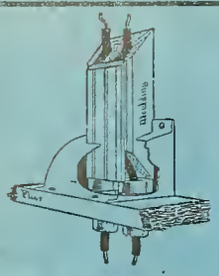
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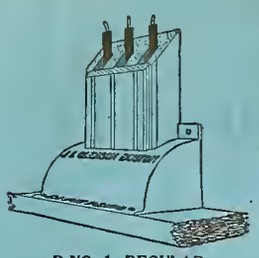
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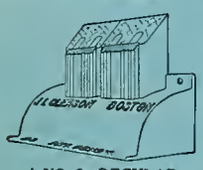
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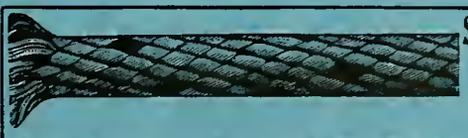

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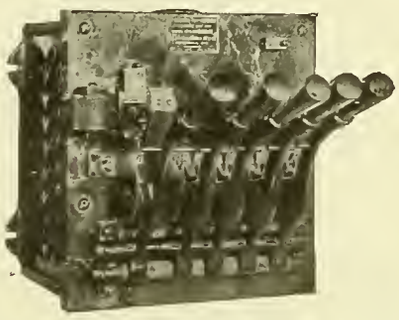

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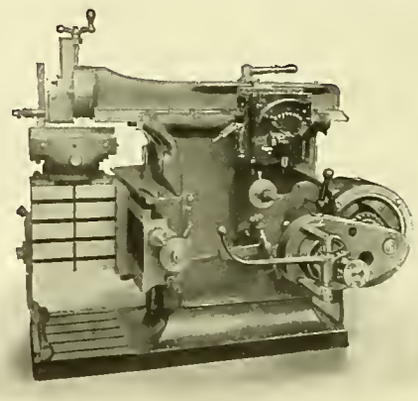

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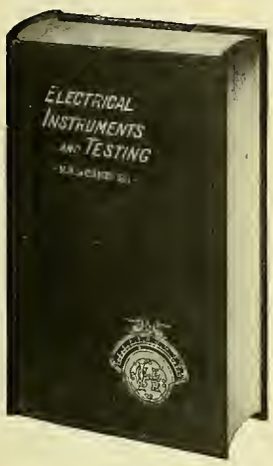

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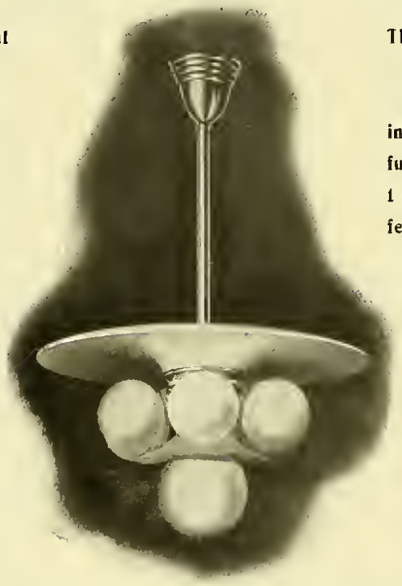

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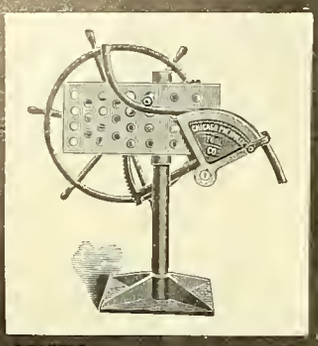

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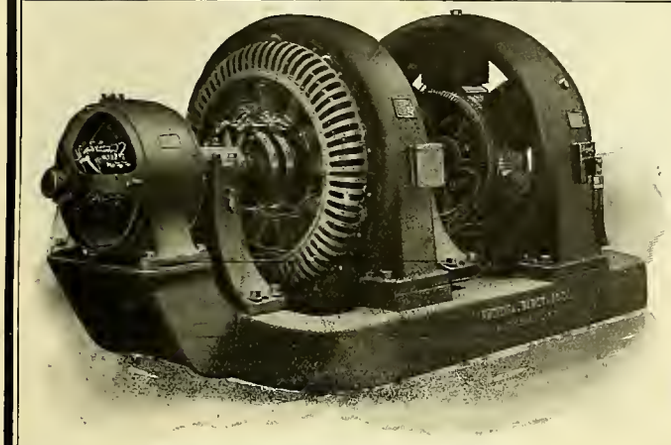

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With a full understanding of modern practice, we have designed and built a complete line of direct and alternating current generators that, in their constructive and operative features, have demonstrated their superiority.

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A SIGN FLASHER WITHOUT A MOTOR

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First.—The Price is lower.
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Simplest and best on the market.
Works on any current.
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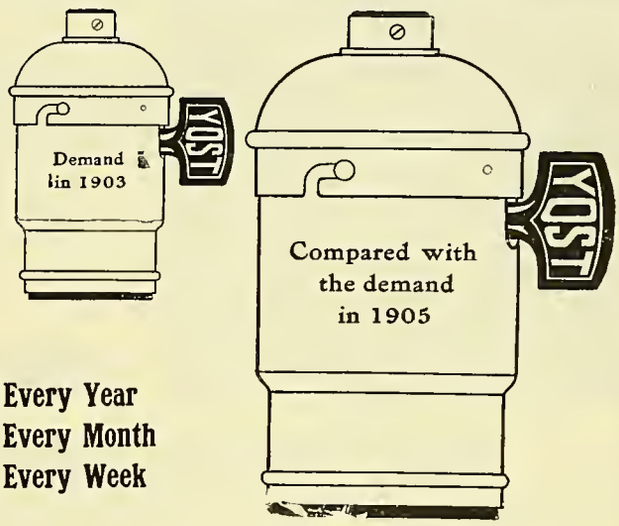
Insulated Wire of All Kinds

Bare Copper Wire

MAIN OFFICE AND WORKS **TRENTON, N. J.**

AGENCIES AND BRANCHES

New York, Chicago, Cleveland, San Francisco, Philadelphia, Atlanta



Every Year
Every Month
Every Week

shows a decided increase in the demand for

Yost Sockets

demonstrating they are of

MORE THAN ORDINARY MERIT

Is there **one good** reason why **you** do not use YOST SOCKETS?

The Yost Electric Mfg. Co.
TOLEDO, OHIO

Metropolitan Life Insurance Building
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INDIA RUBBER & GUTTA PERCHA INSULATING CO.

AUTHORIZED MANUFACTURERS

HABIRSHAW RED CORE

Used Throughout Metropolitan Life Insurance Building, New York City

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SALES DEPARTMENT
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FREE TO
Central Stations
50 FEET
"Oneida"
Galvanized Chain

EXPRESS PREPAID

Suspend an Arc Lamp with this chain and you will see the advantages obtained.

It excels either rope or cable, because it lasts longer!
It works freer! Is more reliable!
It has no splices or strands to give away!
A perfect chain for the purpose!

ONEIDA COMMUNITY, LTD.

"American" Pattern

Address all Inquiries to "Sales Dept." **ONEIDA, N. Y.**

Branch Factory, NIAGARA FALLS, ONTARIO, CANADA.

Continuous and judicious advertising is the magic wand which converts a little business into a big business.

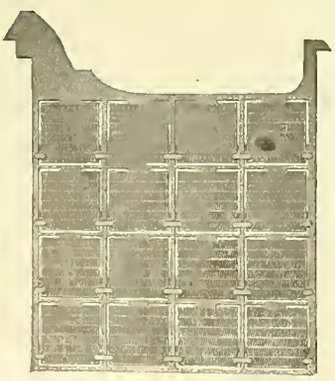
Crimshaw — Raven White Core — Raven Black Core

ALL OUR WIRES pass Inspection and carry the above **TRADE-MARKS** on our tags. We also manufacture **Crimshaw** and **Competition Tapes** and **Splicing Compounds.**

NEW YORK INSULATED WIRE COMPANY,

MAIN OFFICE: 114, 116 & 118 Liberty St., New York.

BRANCHES: CHICAGO: 192 Despiaines St. BOSTON: 7 Otis St. SAN FRANCISCO: 638 Mission St.



ABOVE ALL OTHER CONSIDERATIONS

Electric Storage Batteries of the "Unit Accumulator" Type are

RELIABLE

FOR STREET RAILWAYS, CENTRAL STATIONS, TELEPHONE SYSTEMS, ETC.

Descriptive Catalogue and Prices Furnished Upon Application.

Ask for Bulletin on "A WATER POWER SYSTEM."

National Battery Company

Branch Offices: NEW YORK, CHICAGO BUFFALO, N. Y.

SPECIAL PORCELAIN PIECES

GET OUR PRICES ON THIS LINE OF WORK.

COLONIAL SIGN AND INSULATOR CO., SOUTH AKRON, O.

"Diamond H" Switches

Trade H Mark

This Trade-Mark guarantees quality.

The Hart Mfg. Co., Hartford, Conn.

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PROTECT YOUR IDEAS. No patent, no fee.
Consultation free. Established 1864.
Milo B. Stevens & Co., 848 14th St., Washington.

As a Practical Book for Practical Men Spangenberg's Book Ranks First
All the engineering information you should have; all you really need is contained in this book in plain, practical and concise form.

Spangenberg's Steam and Electrical Engineering

Is a complete library covering the subject in all its various branches and contains 672 pages.

The only book ever published containing 1035 questions and answers. Written so you can understand it.

$3.50 is the price, and it is sold with the understanding that it may be returned if not satisfactory, and your money will be refunded immediately. Out of 10,000 books sold only two have been returned. This fact speaks for itself.

Bound in Silk Cloth.
Size 6x9. 672 pages. 648 Illustrations.

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GEO. A. ZELLER BOOK COMPANY
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I accept your offer to send me, express prepaid, one of Spangenberg's Steam and Electrical Engineering, price $3.50, and enclose $2 as first payment. The balance, $1.50, I agree to remit in 50 cent monthly installments, money or express order or Stamps.

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WORKS QUICK AND EASY. KEEPS ITS LUSTER. MOLDS OLD TRADE AND MAKES NEW. DOES NOT DETERIORATE. ESTABLISHED 10 YEARS. SOLD BY AGENTS AND DEALERS ALL OVER THE WORLD

U.S. METAL POLISH

3 OUNCE BOX 10 CENTS
SAMPLES SENT FREE
GEO. W. HOFFMAN

POLISHES ALL METALS. BRANCHES: NEW YORK, CHICAGO, SAN FRANCISCO. 295 E. WASHINGTON ST. INDIANAPOLIS, IND.
HIGHEST AWARD - CHICAGO WORLD'S FAIR, 1893. LOUISIANA PURCHASE EXPOSITION 1904.

The "REFLECTRIC"

is furnished FREE to customers by live Central Stations.
Write for booklet.

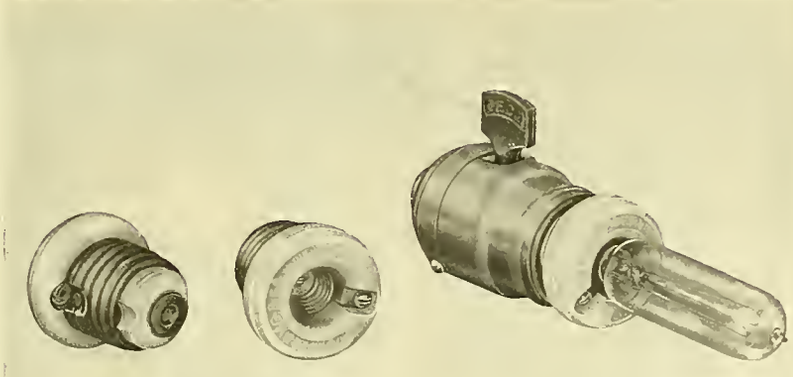
WESTERN DISPLAY COMPANY, SOLE MANUFACTURERS
ST. PAUL, - - MINN.

The more a man advertises, the greater his business. The greater his business, the more he advertises.

General Electric Company

CANDELABRA ADAPTER

This adapter makes the miniature lamp with its candelabra base immediately available for use on an ordinary lighting circuit.



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DURABLE

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Chicago Office: Monadnock Bldg.

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Sales offices in all large cities

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BACK of the facts about Packard Lamps are the reasons for the facts. The high efficiency and long life of Packard Lamps are due to a good glass bulb, perfect vacuum, and delicate, yet strong and tenuous filament. Bear down heavy on the filament. It's the pride, the mainstay of the lamp. But it takes the combination mentioned to make the perfect lamp, which is called the "Packard."

Sold at minimum prices. Special terms on contract.

ELECTRIC APPLIANCE COMPANY
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SET A STANDARD
OF
Brilliant and Efficient Lighting
By using
EDISON LAMPS

Used in larger quantities than all other American makes combined.

All types and varieties. Regular Multiple Lamps, Street Series Lamps, Miniature Lamps.

LOOK FOR THE LABEL IN THE STICK

GENERAL ELECTRIC COMPANY
Main Lamp Sales Office, HARRISON, N. J.
(476)

The insulation is the most important part of your machine—be sure you buy only the best. Cheap insulation cannot be good insulation.
IF IT'S MICABOND YOU CAN BE SURE YOU HAVE THE BEST—OUR GUARANTEE IS BEHIND IT
CHICAGO MICA CO. : : : Valparaiso, Ind.

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BIJUR
HIGH-DUTY
B. H. D.
STORAGE BATTERIES
General Storage Battery Company
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MICA Of all Qualities, In any Form at Lowest Prices
EUGENE MUNSELL AND CO.
NEW YORK and CHICAGO

INSULATION That Is.
Micanite, Linotape, M. I. C. Compound, Empire Cloth and Paper. For Years the Standard.
MICA INSULATOR CO., Originators
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USE
"SAFETY" RUBBER COVERED WIRE AND CABLE
FOR EVERY ELECTRICAL SERVICE.
M. B. AUSTIN & CO.,
CHICAGO REPRESENTATIVE.
THE SAFETY INSULATED WIRE & CABLE CO.,
WORKS: Bayonne, N. J. 114-116 LIBERTY STREET, N. Y.

EMPIRE MINIATURE LAMPS
Send for Circular
H. W. McCANOLESS & CO.
Licensed Manufacturers
67 & 69 Park Place
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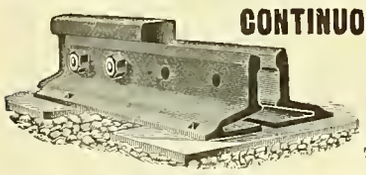
VOLT - AMMETERS
POCKET SIZE
For testing Batteries and Battery Circuits, Locating Faults, Grounds, etc.
RELIABLE. ACCURATE.
Send for Circular.
L. M. PIGNOLET
78-80 Cortlandt St., New York, N. Y.

HORNBERGER TRANSFORMERS
LAFAYETTE ELECTRICAL MFG. CO.
LAFAYETTE, IND.

WANTED
You Who are Troubled with Sparking and Cutting of Commutators to Use

The only article that will PREVENT SPARKING. Will keep the commutator in good condition and PREVENT CUTTING.
Absolutely Will Not Gum The Brushes . . .
It will put that high glass on the commutator you have so long sought after.
50 Cts. per Stick. $5.00 per Dozen
For Sale by all Supply Houses, or
FREE, Sample Stick.
K. McLENNAN & CO.,
Sole Manufacturers,
Room 411, Inter Ocean Bldg., 130 Dearborn St., CHICAGO, ILL.



CONTINUOUS RAIL JOINT CO. OF AM.
NEWARK, N. J.
OVER 20,000 MILES IN USE
The St. Louis Exposition, 1904, awarded us the only gold medal for rail joint products.

ALWAYS READY AND DOES THE WORK. WILL MAKE THE SOLDER FLOW WHERE YOU WANT IT, AND STAY WHERE YOU PUT IT. IN COLLAPSIBLE TUBES AND TIN BOXES.
"NEW IDEA" SOLDERING PASTE SAMPLE FREE
NEW IDEA SOLDERING PASTE CO., 214 Hibbard Ave., Detroit, Mich.

QUALITY IS THE CORNER STONE in the building of success. Mere cheapness never established a lasting reputation for a product.

In the making of "P & S" sockets, we have aimed at highest quality and we have won.

None but the best materials have been allowed to enter into the making; copper has been used instead of brass or copper plated material in our contact shells.

They are DOUBLE POLE; others are single. Ours eliminate the chance of grounding, others admit of the possibility.

You want quality—then order "P & S"—"THE ONE WITH THE DOUBLE POLE."

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Solvay, New York

1322 Havemeyer Bld. . . . . New York, N. Y.
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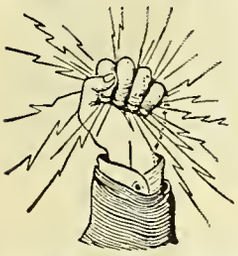
101

FRANK N. PHILLIPS, Pres. EUGENE R. PHILLIPS, V. P. C. H. WAGENSEIL, Treas. C. R. REMINGTON, Jr., Sec.

AMERICAN ELECTRICAL WORKS,

PROVIDENCE, R. I.



BARE AND INSULATED ELECTRIC WIRE,

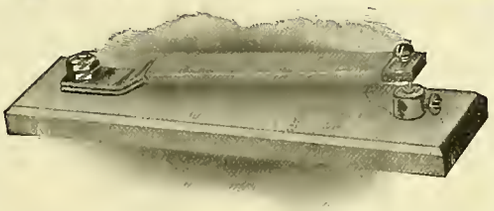
ELECTRIC LIGHT LINE WIRE,
INCANDESCENT AND FLEXIBLE CORDS,
Railway Feeder and Trolley Wire,
AMERICANITE, MAGNET, OFFICE AND
ANNUNCIATOR WIRES.
CABLES FOR AERIAL AND UNDERGROUND USE.

NEW YORK STORE, W. J. Watson, 26 Cortlandt St.
CHICAGO OFFICE, F. E. Donohoe, 135 Adams St.
MONTREAL BRANCH, Eugene F. Phillips' Electrical Works.
MAIN OFFICES AND FACTORIES, PHILLIPSDALE, R. I.

THE "FIREFLY" MOTORLESS FLASHER

Automatically operates three 16, six 8, twelve 4 c. p. lamps or less, on either direct or alternating current.

Nothing to get out of order and requires no attention. It has heavy Platioum contacts that will never wear out. It saves current and can be regulated. Enclosed in a metal box.



List Price $1.50 Each

Liberal discount to the trade.

C. O. SCHNEIDER & CO., Mfrs., 84 East Adams St., CHICAGO

AMERICAN ELECTRICAL SUPPLY CO

IS THERE ONE GOOD REASON why you should not see for yourself whether our claims of superiority are true or not? We believe you owe it to yourself to investigate. WE ARE SATISFYING thousands of others. WHY NOT YOU?

IF ELECTRICAL AND GOOD WE SELL IT

83-85-87 FIFTH AVE CHICAGO

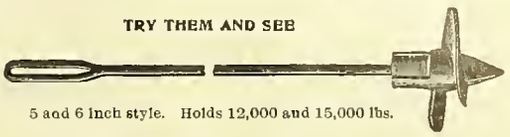
Anchors that hold

Stombaugh Guy Anchors

ARE HOLDING

Thousands of poles all ov he country
They are as good as any anchorage
Better than most anchorages and
Less expensive than any other anchorage

TRY THEM AND SEE



5 and 6 inch style. Holds 12,000 and 15,000 lbs.

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MANUFACTURERS
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NATIONAL CODE STANDARD

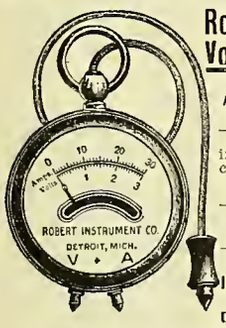
WEATHER-PROOF TRADE MARK "O.K." LINE AND HOUSE WIRES

"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Ideal Wire.

Prices and Samples on Application.

Phillips Insulated Wire Co.

Office and Factory: PAWTUCKET, R. I.



Robert Volt-Ammeter

Dead Beat
Accurate, Durable
Guaranteed

List Price, $6 00 including leather case.

Send for Catalogue

3 Volts
30 Amperes

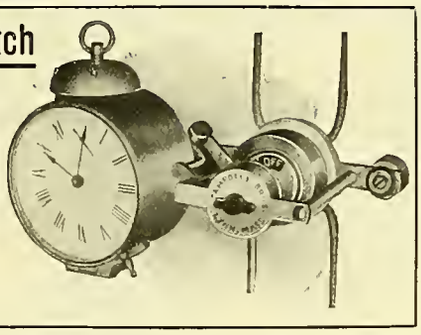
THE ROBERT INSTRUMENT CO.
26 Shelby Street
DETROIT, - MICH.

Campbell Time Switch

THE BEST

For operating
Window Lights, Contract Service, Time Exposures

And many other uses too numerous for mention here. Send now for sample and our low prices.

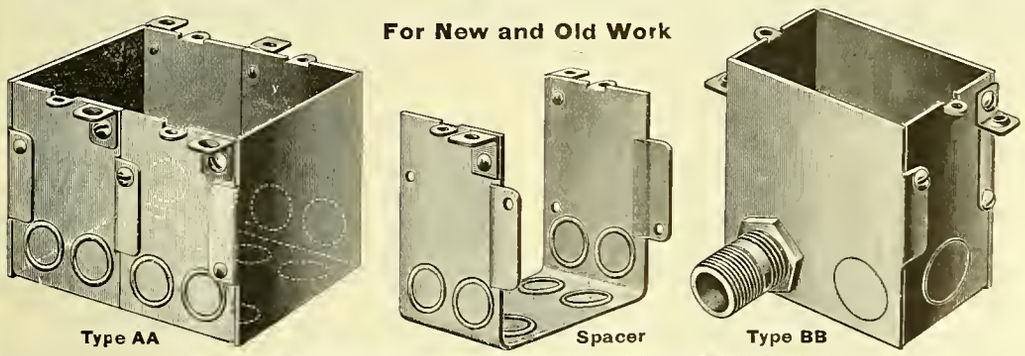


CAMPBELL BROS.
Mfrs. Electrical Apparatus
LYNN, MASS. U. S. A.

NEW NEW NEW

'UNION' OUTLET COMBINATION SWITCH BOX

For New and Old Work



Type AA Spacer Type BB

Approved by the Underwriters National Electrical Association. (Patents Pending.)
Takes all Standard Switches and Receptacles

Designed whereby a **2-gang** box can be converted into any number of gangs by releasing the clamping screws and inserting "Spacers." These gangs are easily assembled with the aid of a screw-driver, and fit together snugly, making a perfect and solid gang box for any required number of switches.

CHICAGO FUSE WIRE & MFG. CO.
120 E. Randolph St., CHICAGO 203 Fulton St., NEW YORK Mutual Life Bldg., BUFFALO

PREDOMINATES IN 27 States

"IT gives me great pleasure to state, that for 'Gitthereitiveness' your periodical certainly is a winner. As you perhaps are aware, the company I travel for, advertises in all the electrical papers, and it has been a question in my mind whether they reached every central station, as their advertising manager would have our company believe. So, for one year I have kept account of the electrical papers and peridieals subscribed for and received by the manager or superintendent of electric light companies in twenty-seven states, (which has been my territory), and in summing it up, I find that your periodieal predominates, three to one. I do not get in many telephone plants, but when I do, I invariably find the 'Western Electrician' staring me in the face."

The letter from which the above is taken, is dated May 8, 1905, and is on file in this office.

WANTED, FOR SALE *and similar* **WANT COLUMN** *advertisements (50 words or less), $1.50 an insertion; additional words 3c each* **POSITION WANTED** *advertisements (50 words or less), $1.00 an insertion; additional words 2c each.*

POSITION WANTED

Party with 12 years experience in shop work, wiring and running engines desires responsible position with some good firm. Address Box 531, care Western Electrician, 510 Marquette Building, Chicago.

POSITION WANTED

in the independent telephone field by a bell man of considerable executive ability, backed up with ten years' practical experience, partly spent as manager of some of their larger exchanges and partly as foreman of some of their heavy construction crews. Thoroughly familiar with all switchboard and cable work. Address Box 534, care Western Electrician, 510 Marquette Bldg., Chicago.

WANTED.

An experienced Electrical Engineer thoroughly familiar with the electrical and mechanical design of induction motors. Must be a technical graduate. Write fully, giving age, qualifications, experience and salary expected. Address Box 530, care of Western Electrician, 510 Marquette Building, Chicago.

WANTED

A young man with experience to act as selling engineer. A man with practical shop experience as well as ability as a salesman can make permanent arrangements. Give all particulars as to past experience, reference, etc. Address Room 809, No. 1265 Broadway, New York City.

WANTED.

At once, experienced incandescent lamp salesman. Good salary to first-class man. State experience and name of former employers, territory traveled, etc. Address Box 532, care Western Electrician, 510 Marquette Bldg., Chicago.

WANTED.

A competent electrician who is able to take every part of the work pertaining to an electric plant. Must be 35 years of age, and several years experience; must give several references as to character and ability as a foreman. Wages $900 per year, lights and phone furnished. House rent good at $12; city of four thousand. Address Box 538, care of Western Electrician, 510 Marquette building, Chicago.

WANTED.

Inside journeymen wiremen and chandelier hangers. The Sanborn-Marsh Electric Co., Indianapolis, Ind.

TELEPHONE ENGINEERS.

Engineers of experience with telephone manufacturers will gain information to their interest by writing to Box 1732 General Post Office, New York City, in regard to business openings. State nature of present work and name of employer as well as age, experience and salary expected.

FOR SALE

12, 10 light 15 amp. Weston Constant Current Arc Generators with pulleys and sliding bases in good condition.

1, 10 Circuit Arc Switchboard with plugs and 4 ammeters.

100 Weston Arc Lamps, 15 amps.

J. B. & J. M. CORNELL CO.
26th St. and 11th Ave., New York

FOR SALE

for immediate delivery by The Spring River Power Company, Joplin, Mo.

Two 80 K. W. 4 pole 125 V. Compound Triumph Generator complete with paper pulleys, 24x19½ inch, slide rails, rheostat ammeter and volt meter, speed 500 R.P.M.

One 50 K.W. 4 pole 125 V. Compound Wound Triumph Generator complete, with paper pulley, 30x12 inch, slide rails and rheostat, speed 575 R.P.M.

One 37½ K. W. 4 pole 110 V. Compound Wound Triumph Generator complete with starting rheostat, extended shaft and two wood pulleys, 10x13 inch, speed 550 R.P.M.

One 30 H.P. 4 pole 110 V. Compound Triumph Motor, complete with starting and speed controlling rheostat, extended shaft and two wood pulleys, 28x8 inch, speed 600 R.P.M.

One 30 H.P. 4 pole 110 V. Compound Wound Triumph Motor complete, with starting and speed controlling rheostat, wood pulley, 18x12 inch, speed 600 R.P.M.

SECOND-HAND MACHINERY

1 A. 70 T. H. 125 Cycle, 1100 Volt Alternator, 1070 R. P. M.
1 120 K. W. General Electric 125 Cycle, 1100 Volt, Type A. S. 1070 R. P. M. All complete with exciters—self-oiling bearings.
1 270 K. W. T. H. 550 Volt Railway Generator, 400 R. P. M.
1 A. 70 Armature newly rewound.
1 24x18 Ideal Automatic Engine.
2 66-inch x 20-ft. Return Tubular Boilers built for 130 lbs. working pressure.

The above is all in first-class operating condition and is offered subject to prior sale.

Springfield Light, Heat & Power Company
Springfield, Ill.

For Sale

1,500 Telephone Transmitters with Arms, at 35 cents.

15,000 lbs. Annunciator and Office Wire at 17½ cents per pound.

10,000 assorted Binding Posts from 2c up.

5,000 Cast Bronze Push Buttons from 5c up.

2,500 Inner Arc Globes, $1.00 per doz.

We job in all kinds of electric supplies and material. Send us your list of goods for sale or wanted.

Amber Electric Co.,
Monroe and Clinton Streets, Chicago

WANTED

ON COMMISSION
AGENTS and SALESMEN
FOR HIGH-GRADE
Refilled Incandescent Lamps
3.1 Watt Lamps a Specialty
EAGLE LAMP CO., Inc.
MIDDLETON, MASS.

We are Headquarters for
ELECTRICAL REPAIR WORK We operate the largest repair shops in America and have exceptional facilities for quick work. We repair **all kinds** of electrical apparatus and save our customers **weeks** in time in comparison with sending the work to the manufacturers direct. We have just reduced our prices and ask you to get our quotations on

Armatures Rewound, Commutators Refilled, Transformers Rewound, Etc.

Send for our monthly "**Bargain Sheet**," showing net prices on our stock of **second-hand** dynamos, motors, meters, transformers and supplies. Every article a bargain.

GREGORY ELECTRIC CO.
54-62 S. Clinton Street - CHICAGO

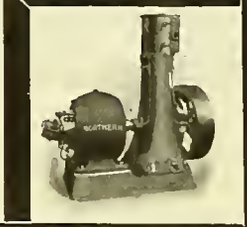
COMPACT ECONOMICAL ELECTRIC LIGHTING SETS

WE show a Northern Spherical Generator direct connected to an American Blower Co. "A" engine. The fraternity is familiar with the good qualities of generator and engine, and will accept our assurance that the outfit is

SUPERIOR

574

If sceptical, send for leaflet No. 25146. If interested get the leaflet and tell us your requirements for electrical apparatus.



NORTHERN ELECTRICAL MFG. CO.
Engineers, Manufacturers
MADISON, - WIS. U. S. A.
425 Monadnock Block, - Chicago, Ill.

M. KLEIN & SON.
Send 2c stamp for new catalogue No 6 of
KLEIN'S TOOLS
For Electrical Workers and Line Builders.
MATHIAS KLEIN & SONS.
81 W. Van Buren St., Chicago, Ill.

WATER-Tight Push Buttons for use in damp places We are prepared to supply anything electrical.

Catalogue No. 21 is a 700 page encyclopaedia of "Something Electrical for Everybody"

Manhattan Electrical Supply Co.

32 Cortlandt Street NEW YORK — 188 Fifth Avenue CHICAGO

A LIBRARY OF WELL SELECTED ELECTRICAL BOOKS

is of inestimable value to electricians. Such a library is best formed by occasional and carefully chosen purchases. ELECTRICIAN PUB. CO., 510 Marquette Building, Chicago.

As Sure As The Sun

Edison Primary Batteries

Formerly Edison-Lalande

One of their distinctive features is the sure and constant current delivery. They are so constructed that internal resistance grows less with use, polarization is completely obviated, and they work at full strength until all the energy of every element is exhausted. It will pay you to investigate their other points of superiority. Write for booklet No. 7.

EDISON MFG. CO. Factory: Orange, N. J.
New York: 31 Union Sq. Chicago: 304 Wabash Ave.

CHICAGO EDISON COMPANY REPAIR SHOPS

High-Grade Machine Work of All Kinds Correspondence Solicited.

76 MARKET STREET, CHICAGO. TELEPHONE MAIN 1280

FIRST CLASS EQUIPMENT THROUCHOUT

Dynamos, Armatures, Motors, Arc Lamps, Fans, Instruments.

ELECTRICAL REPAIRING

We Guarantee All Work

DYNAMOS, ARMATURES, MOTORS, ARC LAMPS, INSTRUMENTS, GENERAL REPAIRING. Correspondence Solicited.
NEW AND SECOND-HAND MACHINERY FOR SALE

SOUTHWESTERN ELECTRIC CO., ST. LOUIS.

On receipt of
10 CENTS
we will send you a
Western Electrician
Moonlight Schedule
for 1905.
Every lighting man
should have one.

Electrician Publishing Company.
510 Marquette Bldg., Chicago.

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The Business Man's Magazine and The Bookkeeper

is the oldest, largest and best of all business magazines. It not only tells you what is being done in business, but how it is done. All of the latest methods for conducting every department of any business are described, and every detail is fully illustrated.

Subscription Price, $1.00

Business Short Cuts

is a book of 160 pages (5x7 in.) of the concentrated business experience of a hundred successful business men. Read it and it will save you ten dollars' worth of time, for it contains scores of short methods and easy ways of doing the things you are spending most of your time upon every day. The men who originated these short cuts get $25.00 to $50.00 a day—their experience here cost you nothing—not a penny. More than 16,000 business men have bought Short Cuts at $1.00 a copy.

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The Western Electrician

you already know its value to you. We have made arrangements with the publisher of this excellent journal which enable us to offer you a years' subscription (regular price $3.00) in connection with The Business Man's Magazine and The Book-Keeper.

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Town and State .....

Business .....

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Expert Electrical Subway Contractor,
NO. 1122 UNION TRUST BLDG. CINCINNATI, OHIO.
NEW YORK. BOSTON.

We are experts in Underground Conduit Construction.
WRITE FOR INFORMATION.

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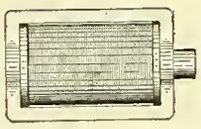

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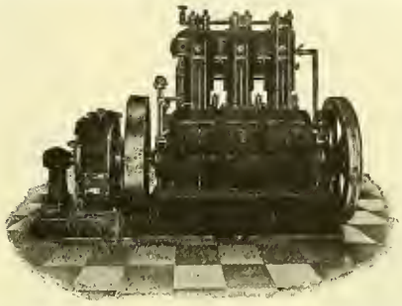

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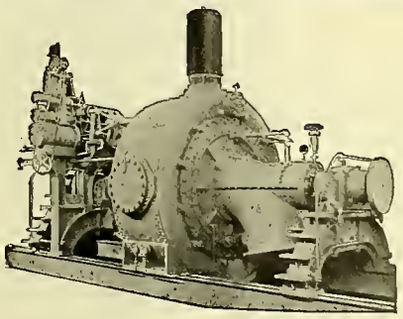

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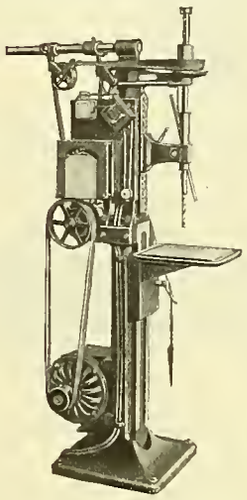

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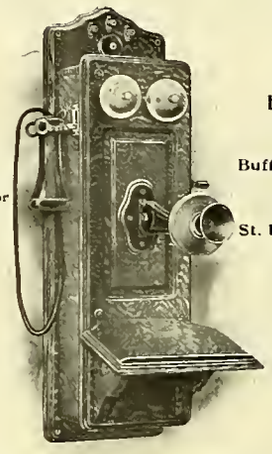

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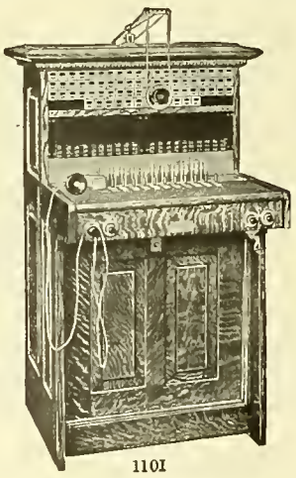

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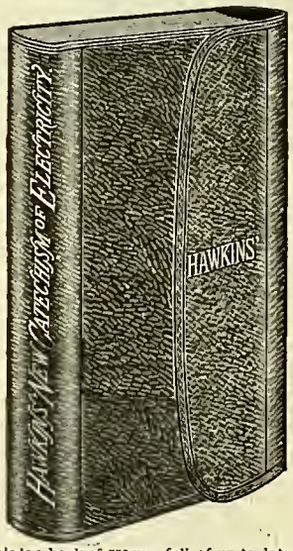

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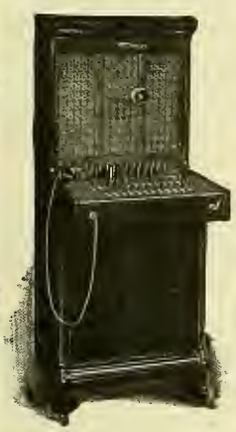

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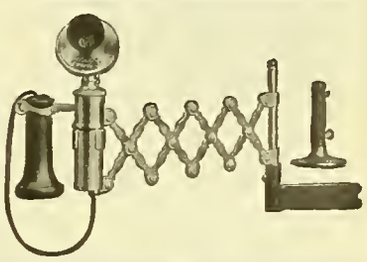

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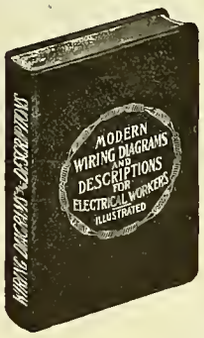

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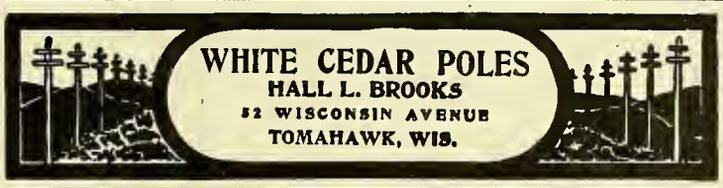

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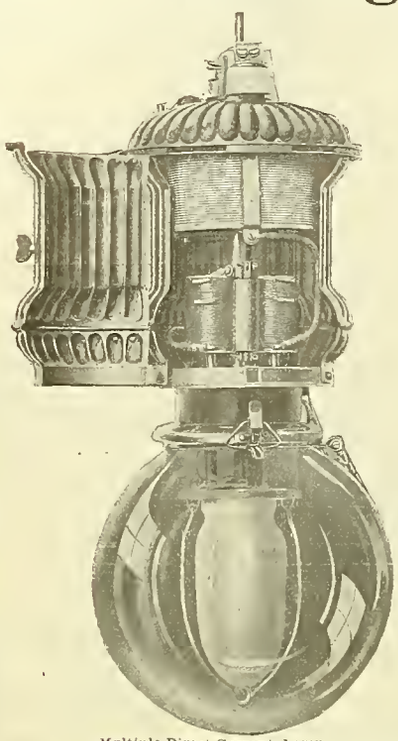

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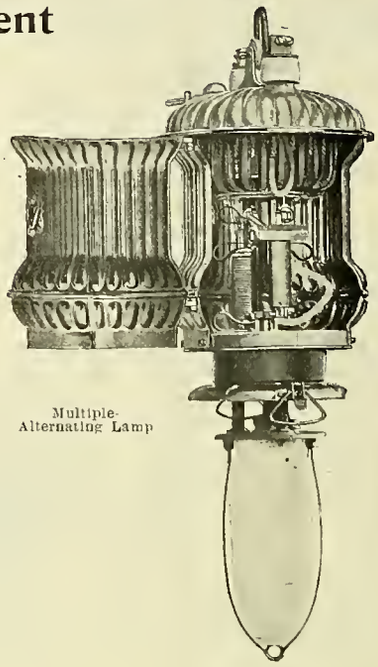

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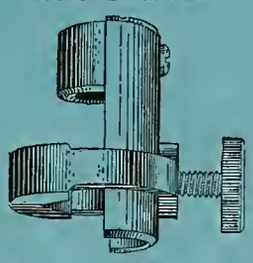

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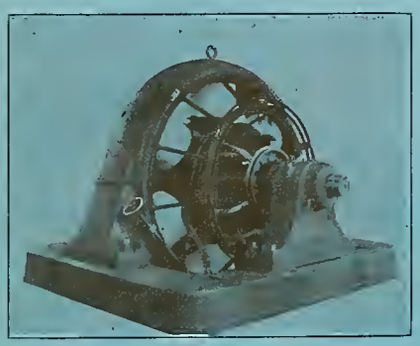

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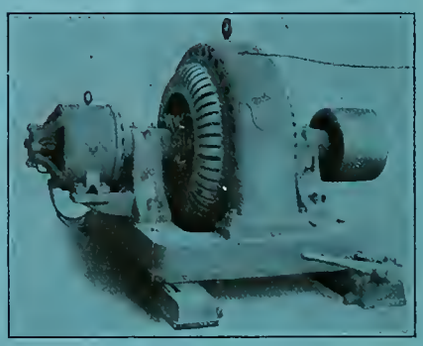

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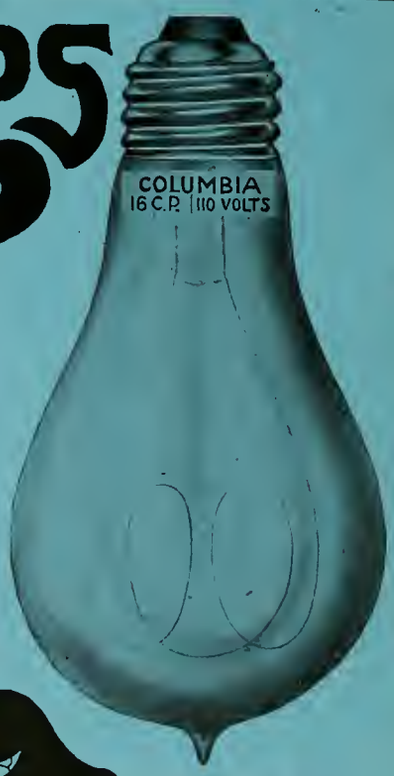

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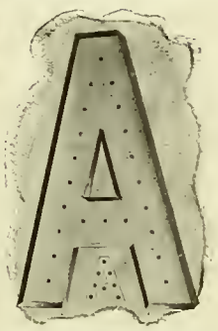

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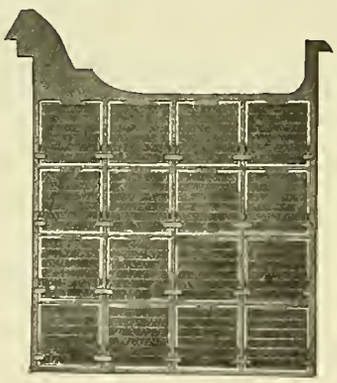

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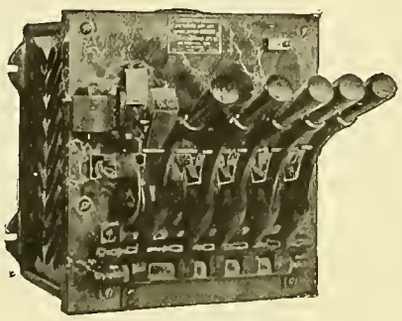

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Mueller Company, William.
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Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Co.

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Chicago Edison Co.
Electric Appliance Co.
Manhattan Elect'l Supply Co
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Western Electric Co.

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American El. Telephone Co
Automatic Electric Co.
Bissell Co., The F.
Central Electric Co.
Electric Appliance Co.
International Tel. Mfg. Co.
Kellogg Switchb. & Sup. Co.
Manhattan Elec. Supply Co.
Stromberg-Carlson Tel. M.Co.
Wesco Supply Co.
Western Electric Co.

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Crocker-Wheeler Co.
Electric Appliance Co.
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General Electric Co.
Kuhlman Electric Co.
La Fayette Elect'l. Mfg. Co.
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Westinghouse Machine Co.

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Vulcanized Fibre Co.

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Belden Mfg. Co.
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Western Electric Company.

Woodwork, Telephonic.
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St. Marys Incandescent Lamp Co.

ST. MARYS, PA.

ANNOUNCEMENT

TO ALL INCANDESCENT LAMP BUYERS:

For 15 years I have been active in the sale of incandescent lamps, having been indentified with several of the leading companies.

On July 1, 1905, I organized the Eureka Electric Lamp Company, which company had the purpose of yielding to the conditions and selling restrictions of the association of Licensed Manufacturers of Electric Incandescent Lamps, provided a license was immediately extended.

The Association was given full opportunity to issue this license to the Eureka Electric Lamp Company, but, having no reply before the time limit given had expired, except an intimation through one of the Association's members that a deposit of $2,000 was necessary as a guarantee that the company should not cut prices, I decided to free myself from all "Associations" entanglements. My purpose in refusing to accede to this deposit proposition was because of the fact that my sales in the past had always been at higher figures than quoted by many of the Licensed Companies and because of my intimate knowledge of the lamp situation, especially as to the emptiness of these patents, except for their questionable value in cajoling the public. Moreover, we were under obligations to fill certain contracts on hand and further delay was impossible.

It later developed that moves had been made to prevent any licensed company from furnishing lamps to the Eureka Electric Lamp Comany at a figure such as would enable The Eureka Company to do business.

Because of this threatened procedure, I am now able to announce the mergement of The Eureka Electric Lamp Company into the St. Marys Incandescent Lamp Company, St. Marys, Pa., with a capital stock of $100,000.

The St. Marys Incandescent Lamp Company will have a factory in operation with the finest mechanical equipment that money can buy, within 60 days, and the best skilled men in the manufacturing department. It will have a capacity of 6,000 lamps per day with space for rapid increase of output. It will have a well-organized up-to-date sales department.

The following is a list of the stockholders of the St. Marys Incandescent Lamp Company:

Senator J. K. P. Hall, of the firm of Hall & Kaul, St. Marys, Pa, and the firm of Kaul & Hall, St. Marys, Pa.; President of the St. Marys National Bank. St. Marys, Pa.; President of the St. Marys Trust Company, St. Marys, Pa.; President of the Kaul & Hall Lumber Company, St. Marys, Pa., President of the Portland Lumber Company, St. Marys, Pa.

Louis Streuber, Erie, Pa.; Vice-President of the St. Marys Sewer Pipe Company, St. Marys, Pa.; President of the Erie Oil Company, Erie, Pa.

Frank Oberkirch, President of the St. Marys Sewer Pipe Company, St. Marys, Pa.

John Kaul, Vice-President of the Kaul & Hall Lumber Company, St. Marys, Pa.

William Kaul, President of the St. Marys Brewing Company, St. Marys, Pa.

D. B. Anderson, General Manager of the St. Marys Sewer Pipe Company, St. Marys, Pa.

Wm. M. Rothschild, President of the Eureka Electric Lamp Company, Cleveland, O.

G. C. Simons, Vice-President, The St. Marys National Bank, St. Marys, Pa.

The Officers and Board will be announced in a later issue.

WM. M. ROTHSCHILD
President, The Eureka Electric Lamp Co.
(St. Marys, Pa.)

St. Marys Incandescent Lamp Co.

ST. MARYS, PA.

FREE TO
Central Stations
50 FEET
"Oneida"
Galvanized Chain

EXPRESS PREPAID

Suspend an Arc Lamp with this chain and you will see the advantages obtained.

It excels either rope or cable, because it lasts longer!
It works freer! Is more reliable!
It has no splices or strands to give away!
A perfect chain for the purpose!

ONEIDA COMMUNITY, LTD.

"American" Pattern

Address all inquiries to "Sales Dept." **ONEIDA, N. Y.**

Branch Factory, NIAGARA FALLS, ONTARIO, CANADA.

The more a man advertises, the greater his business. The greater his business, the more he advertises.

Crimshaw

Raven White Core

Raven Black Core

ALL OUR WIRES pass Inspection and carry the above **TRADE-MARKS** on our tags. We also manufacture **Crimshaw** and **Competition Tapes** and **Splicing Compounds.**

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TYPE F

For Direct or Alternating Current

Dust and Bug Proof :: Improved Construction

Moving parts are extremely light, insuring a highly sensitive and accurate meter.

Write for Prices and Descriptive Literature

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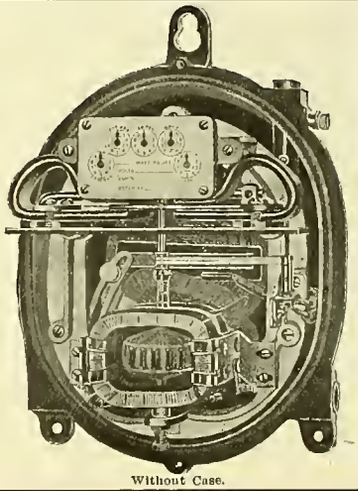
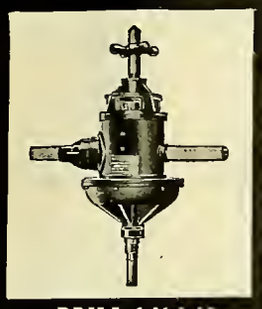


Without Case.



DRILL 1-M-1-10

SEATTLE
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THE DUNTLEY
AIR-COOLED ELECTRIC DRILLS

Are manufactured in sizes to correspond with our Air Drills. They are invaluable in any machine or repair shop where electric current can be obtained; also office buildings, hotels, steamships, etc., can use them advantageously. Wound for 110 and 220 volts direct current.

OVER 4000 SOLD DURING THE PAST 90 DAYS

FULL PARTICULARS, ETC., ON REQUEST.

MANUFACTURED BY

CHICAGO PNEUMATIC TOOL CO.

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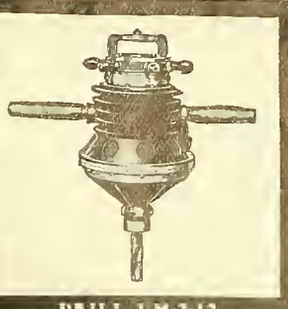

DRILL 1-M-2-12

TORONTO
BOSTON
PITTSBURG
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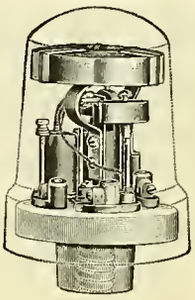
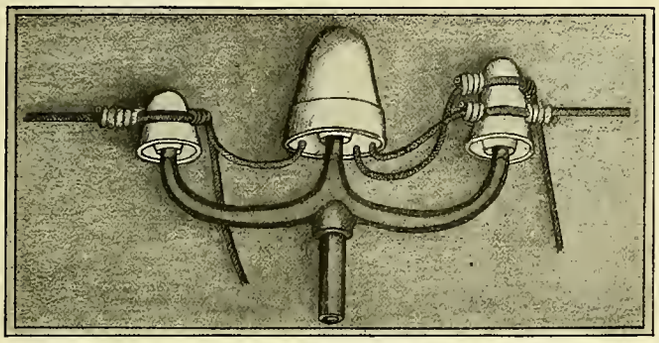
NORFOLK

PROTECTIVE FEATURES

OF THE

Hamacek Automatic Series Cut-Out





No. 1. Series Automatic Cut-Out with Porcelain Housing

Will protect against lightning and disruptive discharge of current.
Will protect shunt coils.
Will cut-out ground lamps and broken lamp loops.
Will insure continuous lighting service and thereby save many times its cost in rebate bills.
Will locate a break immediately.
Let us send sample on approval—its work will be a pleasant surprise.

A. F. HAMACEK

2014 Kenmore Avenue CHICAGO

General Electric Company

Thomson High Torque Induction Meter

Thomson High Torque Induction Meter
(With Cover)

High Torque

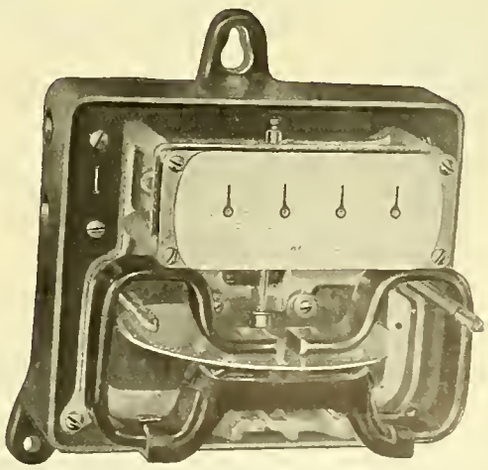
Light Moving Element

High Ratio of Torque to Weight

Small, Compact

Simple Adjustment

Reads Direct in Kilowatt-Hours



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(With Cover Removed)

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(721)

Sangamo D. C. Watt-Meters
MERCURY FLOTATION

For All Voltages

No jewel sustaining weight of moving parts and receiving "kicks" from short-circuits.

No commutator and brushes.

Result:—Long Life and Accuracy

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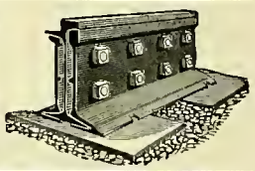

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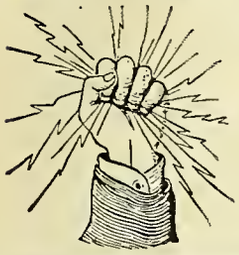

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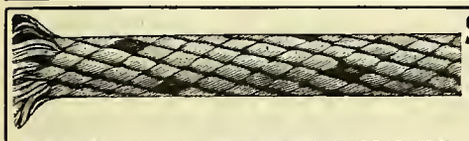

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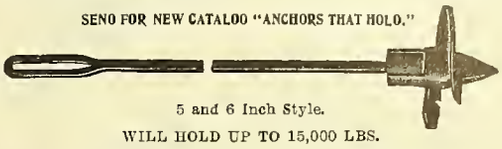

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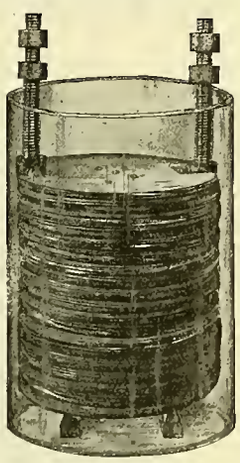

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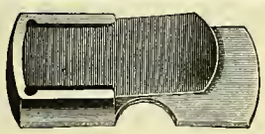

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27 States

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The letter from which the above is taken, is dated May 8, 1905, and is on file in this office.

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By a single middle-aged man of strictly good habits having a general knowledge of electrical machinery and appliances. Would take agency or act as collector and adjustor—no objection to traveling; salary not so much an object as steady position where limited but faithful services would be appreciated. Can furnish best of reference and bond if required. "Principals only." Address Box 539, care of Western Electrician, 150 Nassau Street, New York, N. Y.

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A young man with experience to act as selling engineer. A man with practical shop experience as well as ability as a salesman can make permanent arrangements. Give all particulars as to past experience, reference, etc. Address Room 809, No. 1265 Broadway, New York City.

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A competent electrician who is able to take every part of the work pertaining to an electric plant. Must be 35 years of age, and several years experience; must give several references as to character and ability as a foreman. Wages $900 per year, lights and phone furnished. House rent good at $12; city of four thousand. Address Box 538, care of Western Electrician, 510 Marquette building, Chicago.

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Engineers of experience with telephone manufacturers will gain information to their interest by writing to Box 1732 General Post Office, New York City, in regard to business openings. State nature of present work and name of employer as well as age, experience and salary expected.

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1 150 K. W. 2 phase, compensated revolving field, 2200 volt, G. E. belted alternator, type A. Q. B.
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1 24x18 Ideal Automatic Engine.
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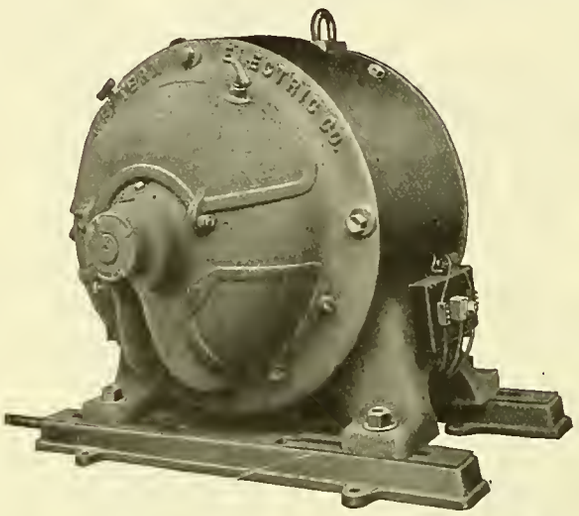

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One 30 H P. 4 pole 110 V. Compound Triumph Motor, complete with starting and speed controlling rheostat, extended shaft and two wood pulleys, 28x8 inch, speed 600 R.P.M.

One 30 H.P. 4 pole 110 V. Compound Wound Triumph Motor complete, with starting and speed controlling rheostat, wood pulley, 18x12 inch, speed 600 R.P.M.

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	List Price	Sale Price
The Corliss Engine, by John T. Henthorn and Charles D. Thurber, New York, 1894	$1.00	$ .40
Mechanical Manual, by E. L. Hobson, Philadelphia, Pa.	.50	.20
Theoretical Elements of Electro Dynamic Machinery, by A. E. Kennelly, F. R. A. S., London, 1893	1.50	.75
Secret Letter and Telegraph Code, by Charles Larrabee, New York, 1884	.60	.20
Electricity, Magnetism and Electric Telegraphy, by Thomas D. Lockwood, New York, 1890	2.50	1.00
Handbook of Patent Law, by Charles B. Mann, Baltimore, 1884	.50	.20
A Treatise on Electro Metallurgy, by Walter G. McMillan, F. C. S., London, 1890	3.50	1.75
Laboratory Manual of Physics and Applied Electricity, Vols. 1 and 2, by Edward L. Nichols, New York, 1894	6.25	2.50
Condensers, by "Power," New York, 1900	.50	.20
Aluminum, Its History and Occurrence, Properties, Metallurgy and Applications, by Joseph W. Richards, M. A., Philadelphia, 1890	6.00	2.75
Electric Light Installations, Vol. 3. Application by Sir David Salomons, M. A., New York, 1890	1.50	.75
Electricity in Town and Country Houses, by Percy E. Scrutton, London, 1898	1.00	.50
Press Working of Metals, by Oberlin Smith, New York, 1896	3.00	1.75
Outlines of Industrial Chemistry, by F. H. Thorp, Ph. D., New York, 1898	3.50	1.75
Evolution of the Electric Incandescent Lamp, by Franklin Leonard Pope, Elizabeth, N. J., 1889	1.00	.50
Power Catechism, New York, 1889	2.00	.75
Electric Light Installations, Vol. 2, Apparatus, by Sir David Salomons, M. A., London, 1894	2.25	1.25
Electricity Simplified, by T. O'Connor Sloane, Ph. D., New York, 1897	1.00	.50
How to Become a Successful Electrician, New York, 1899	1.00	.50
Dynamo Electric Machinery, by Silvanus P. Thompson, D. Sc., American edition, New York, 1902	5.00	2.75
Polyphase Electric Currents and Alternating Current Motors, by Silvanus P. Thompson, New York, 1898	3.50	1.75
How to Run Engines and Boilers, by E. P. Watson, New York, 1901	1.50	.75
Drum Armatures and Commutators, by F. Marteo Weymouth, London, 1893	3.00	1.50
Handbook for Street Railway Engineers, by H. B. Andrews, C. E., New York, 1902	1.25	.60
Electric Transformation of Power, by Phillip Atkinson, Ph. D., New York, 1893	2.00	1.00
Electric Sparks, Electricity in All Its Branches and Applications, Prof. James A. Beaton, A. M., Chicago, 1901.	.50	.20
Mechanical Engineers' Pocket Book, by D. Kinnear Clark, M. I. C. E., New York, 1893	3.00	1.25
Mechanics' Complete Library of Modern Rules, Facts, Processes, Etc., Chicago, 1900	1.00	.50
The Electrical Transmission of Energy, by Arthur Vaughan Abbott, C. E., New York, 1900	4.50	2.00
Telephone Systems of the Continent of Europe, by A. R. Bennett, London, 1895	4.50	2.00
Motor Power and Gearing for Electrical Machinery, by E. T. Carter, C. E., London, 1896	5.00	2.25
Textbook on Gas, Oil and Air Engines, by Bryan Donkin, London, 1896	7.00	3.25
Practical Application of the Indicator, by Lewis M. Ellison, Chicago, 1897	2.50	1.00
Alternating and Interrupted Electric Currents, by Prof. G. Forbes, M. A., London, 1895	1.00	.50
Central Station Management and Finance, by H. A. Foster, New York, 1899	1.50	.75
American Telephone Practice, by Kempster B. Miller, New York, 1903	3.00	2.00
Practical Electricity and Magnetism, by John Heoderson, B. Sc., London, 1898	2.00	1.00
Original Papers on Dynamo Machinery, by John Hopkinson, M. A., New York, 1893	1.00	.50
Practical Notes for Electrical Students, Vol. I, Laws, Units and Simple Measuring Instruments, by A. E. Kennelly and H. D. Wilkinson, M. I. E. E., London, 1890	2.50	1.25
Patented Telephony, Chicago, 1897	1.50	.60
Turbine Wheels, by Prof. W. P. Trowbridge, New York, 1890	.50	.20
History of the Transformer, by F. Uppenborn, paper, London, 1889	.75	.30
Electro Motors, by J. W. Urquhart, London, 1882	3.00	1.00
Practical Guide for Firemen, W. H. Wakeman, Bridgeport, Conn., 1896	.50	.20
Researches or Fresh Light on the Dynamic Action and Ponderosity of Matter, by "Waterdale," London, 1892	2.00	.60
Practical Wiring of Buildings, by E. D. Weber, New York, 1896	1.00	.40
Deviations of Practical Electrical Units, by Lieut. F. B. Badt and Prof. H. T. Carhart, Chicago, 1890	.75	.35
Electricity as a Motive Power, by Count Th. du Moncel, London, 1883	3.00	1.25
Decorative Electricity, by Mrs. J. E. H. Gordon, London, 1891	2.50	1.00
Electrical Appliances of the Present Day, by Major D. P. Heap, U. S. A., being a report of the Paris Electrical Exhibition of 1881	2.00	.75
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Steam Heating Data, by William J. Baldwin, N. Y., 1897.	.50	.20
The Telegraphist's Guide: The New Examinations of Technical Telegraphy, by James Bell, A. I. E. E., London, 1895	.50	.20
The Mechanical Arts Simplified, by D. B. Dixon, Chicago, 1897	2.50	1.25
Electric Lighting, translated from the French of Count du Moncel, by Robert Routledge, B. S. C., London, 1883	1.25	.60
The Arithmetic of the Steam Engine, by E. Sherman Gould, New York, 1897	1.00	.40
Mechanical Graphics, by George Halliday, London, 1889.	2.00	.75
Physical Units, by Magnus Maclean, D. Sc.	1.00	.40
The Indicator and Dynamometer, by Thomas J. Main, M. A., Philadelphia, 1883	1.50	.70
The Indicator Handbook, by Charles N. Pickworth	.75	.25
The History and Process of the Electric Telegraph, by Robert Sabine, C. E., London, 1869, cloth	1.25	.50
Paper	.75	.25
Bearings and Lubrication, by A. J. Wallis-Taylor, C. E.	1.50	.75
Electricity in Our Homes and Workshops, by Sidney F. Walker, London, 1889	1.50	.75
Electricity in the Service of Man, by R. Wormell, D. Sc., M. A., New York, 1886	3.00	1.25
The Mathematical Theory of Electricity and Magnetism, by Watson & Burbury, London, 1885. Vol. I, Electrostatics	2.75	1.25
Vol. II, Magnetism and Electrodynamics	2.60	1.25
Chapters on Electricity, by Samuel Sheldon, Ph. D.	1.10	.50
Electricity, Its Theory, Sources and Application, by John T. Sprague, London, 1892	6.00	1.80
Electricity Up to Date, by John B. Verity, M. I. E. E., London, 1896	1.00	.40
Telegraphy, by W. H. Preece and J. Sivewright, London, 1888	2.00	1.00
Electricity and the Electric Telegraph, in two volumes, by George B. Prescott, New York, 1888	7.00	3.25
Useful Rules and Tables, Relating to Measuration, Engineering, Structures and Machines, by William John Macquorn Rankine, London, 1889	4.00	1.60
Electricity and Magnetism, by Francis Nipher, A. M., St. Louis, 1895	3.25	1.50
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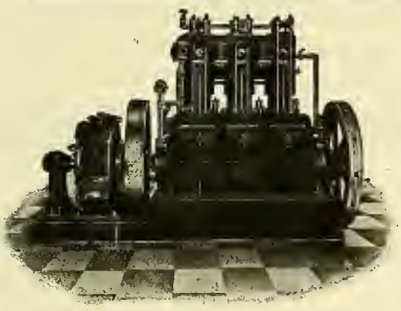

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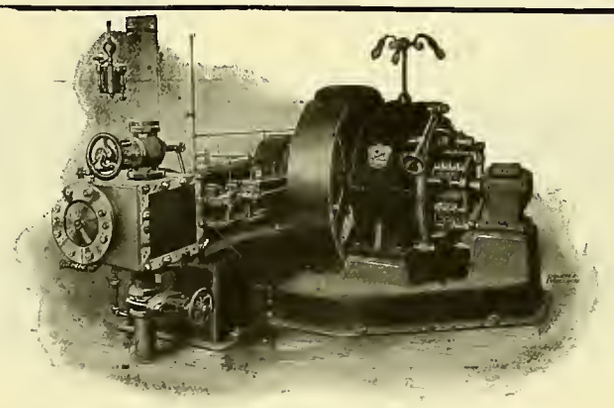

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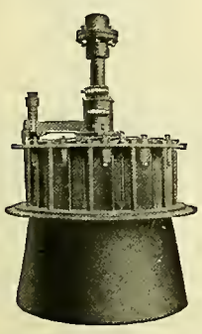

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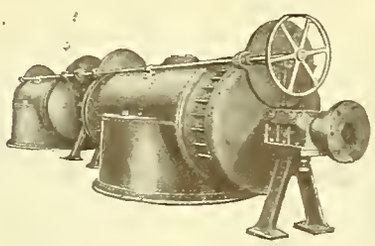

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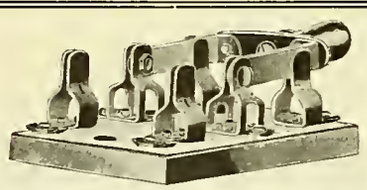

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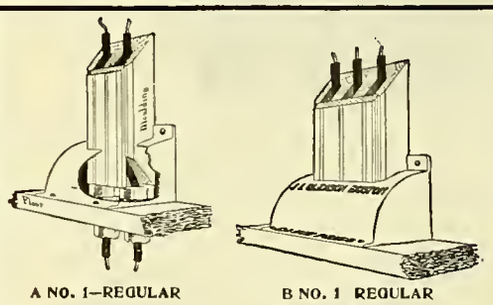

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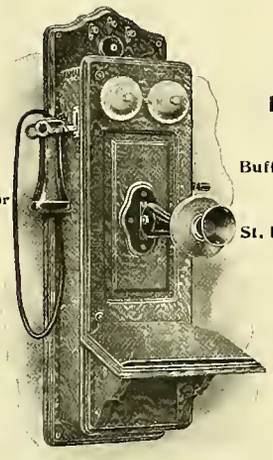

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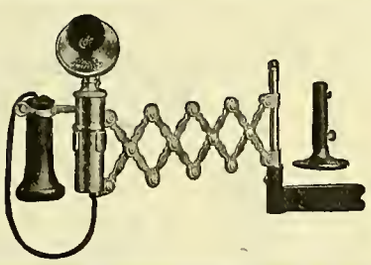

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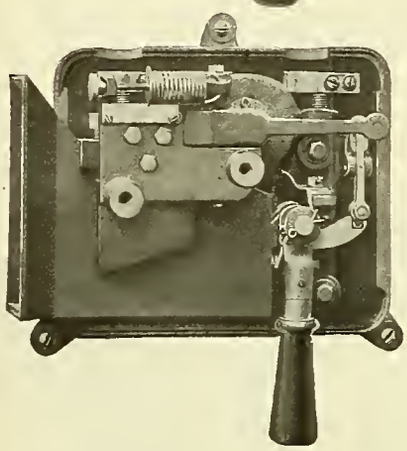

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The cool circulating oil carries the heat away from core, secondary coils and primary coils alike.

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Shorter lengths of copper are used with this type. Hence smaller copper losses and better regulation.

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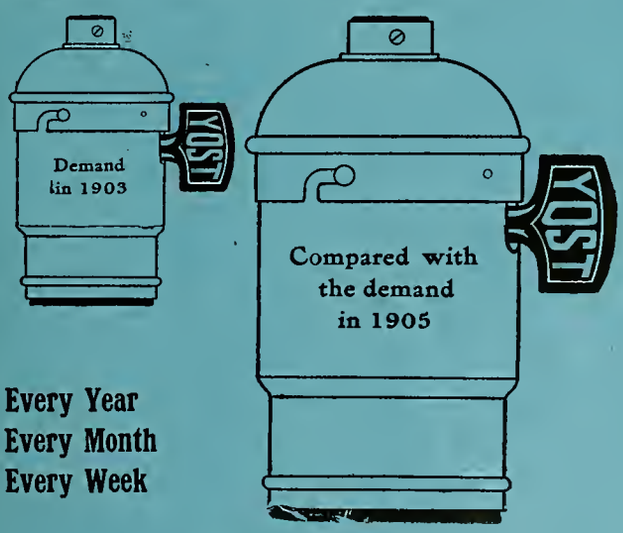

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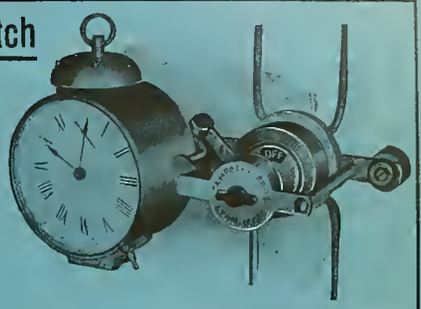

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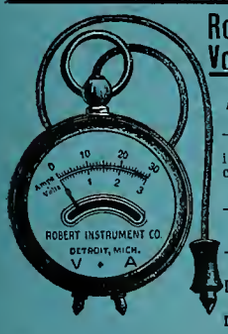

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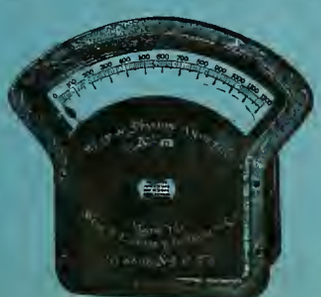

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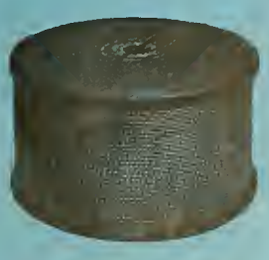

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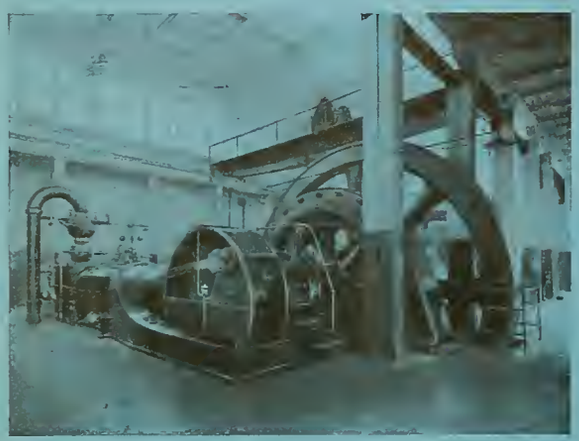

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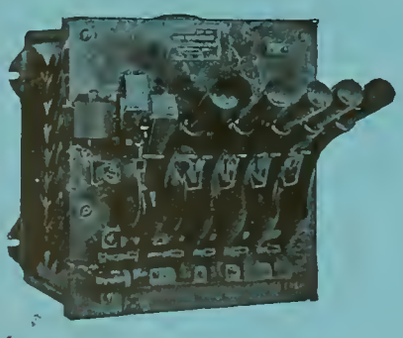

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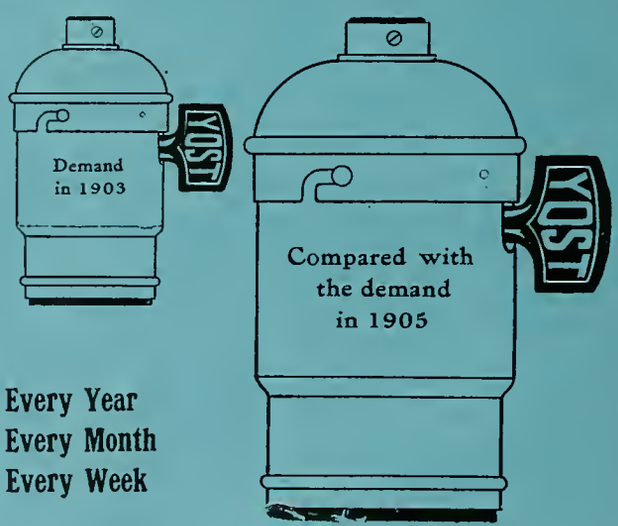

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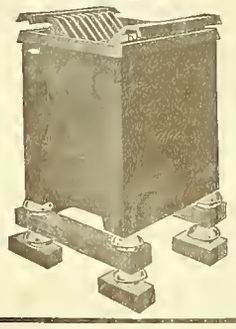

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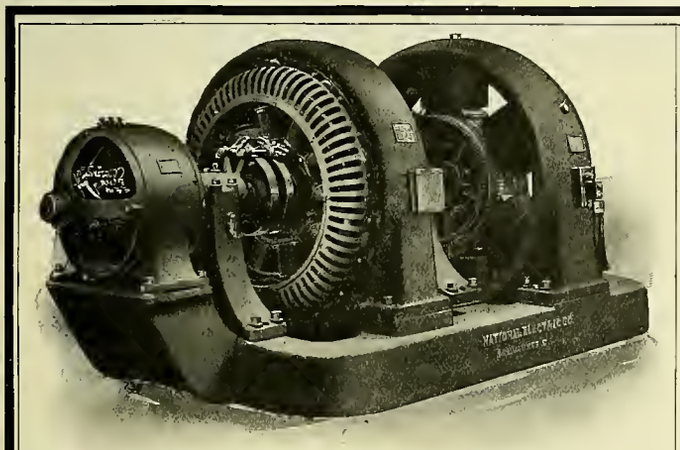

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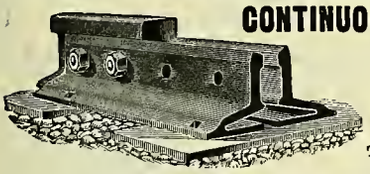

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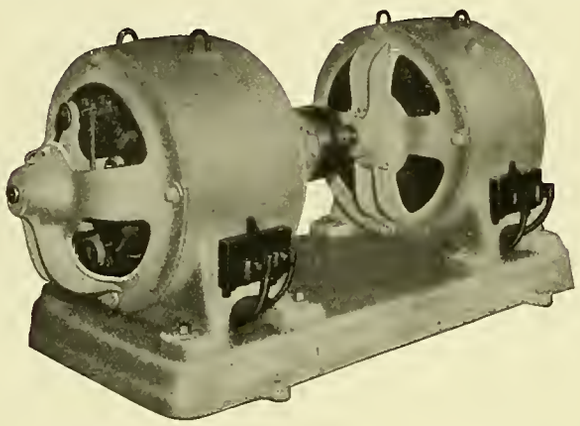

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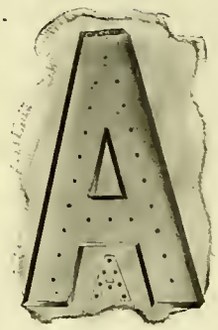

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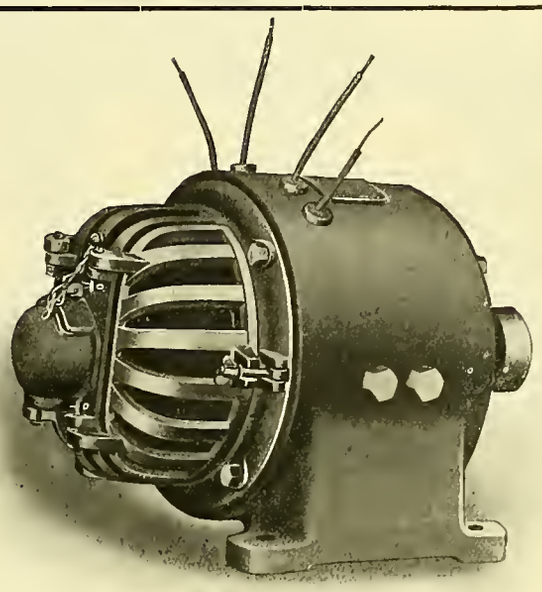

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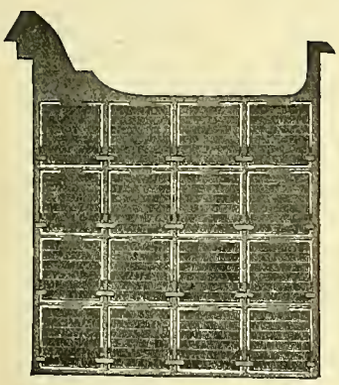

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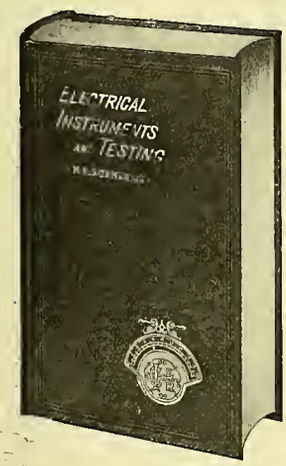

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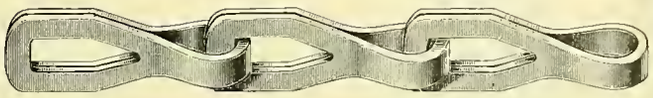

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Mechanical Manual, by E. L. Hobson, Philadelphia, Pa.	.50	.20
Secret Letter and Telegraph Code, by Charles Larrabee, New York, 1884	.60	.20
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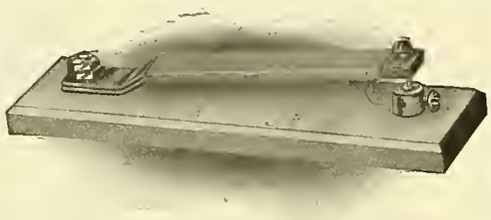

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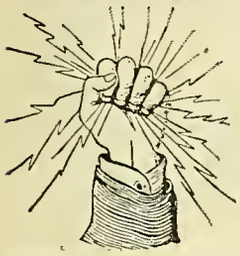

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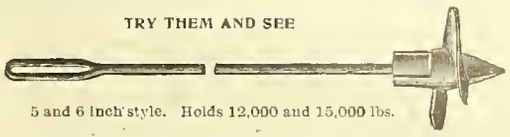

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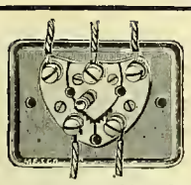

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The letter from which the above is taken, is dated May 8, 1905, and is on file in this office.

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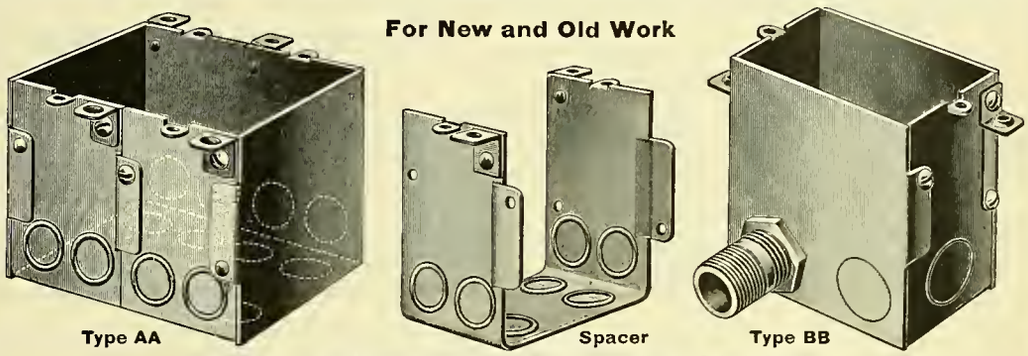

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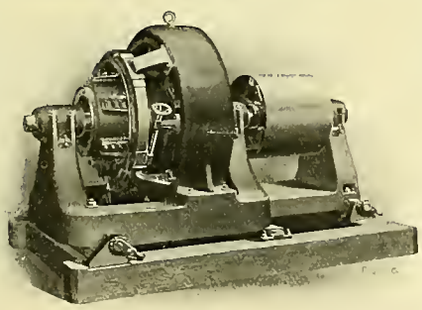

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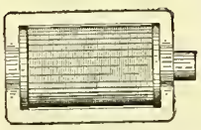

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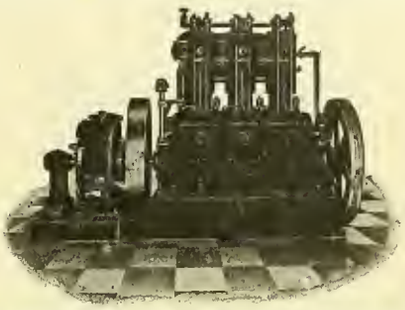

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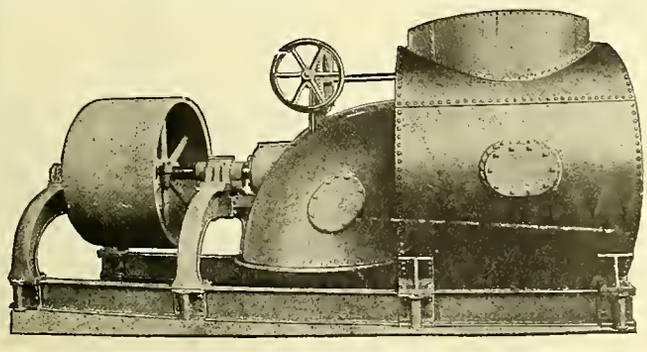

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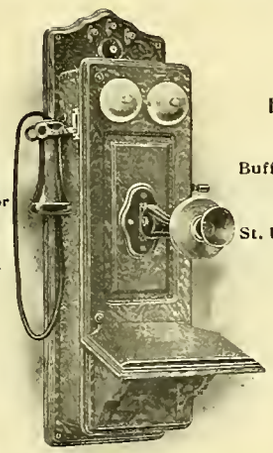

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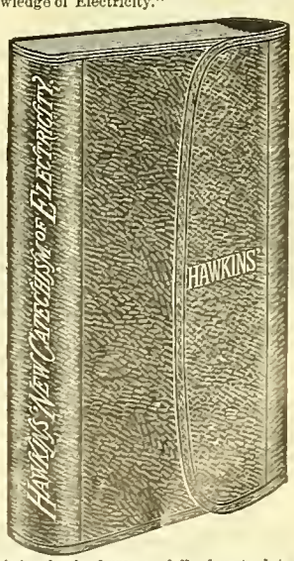

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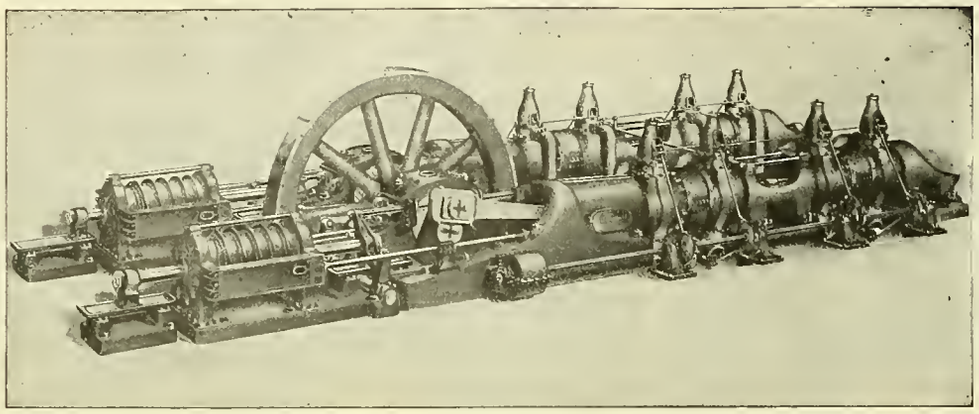

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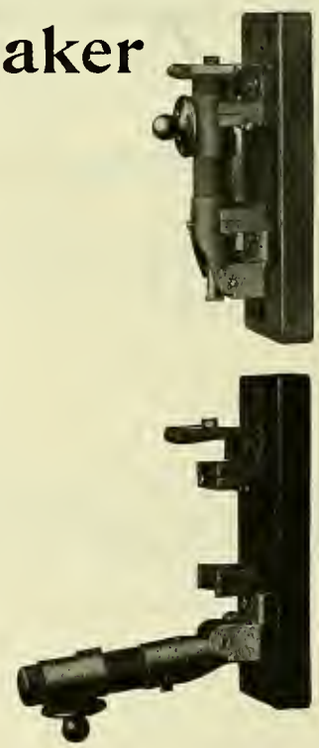

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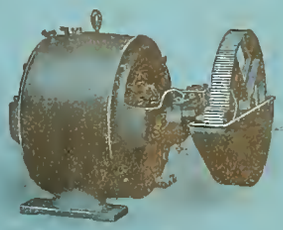

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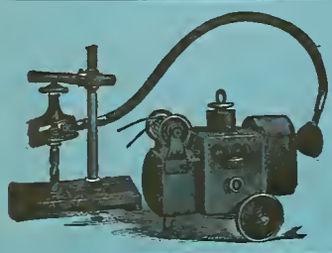

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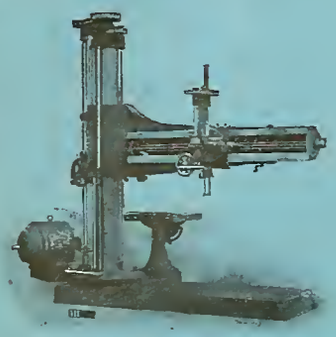

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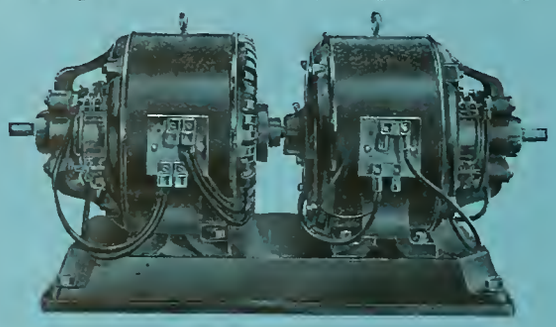

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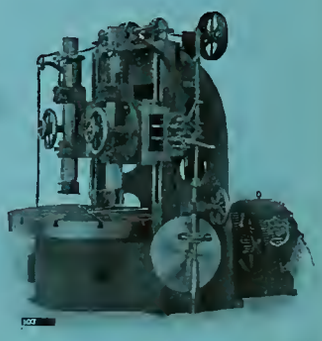

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CUT THIS OUT. Send to your Supply House
Good until December 15, 1905

To the Jobber
Kindly return at once to the Vought-Berger Company, La Crosse, Wisconsin.

With the following order for at least 12 Two Balls Adjusters include one Adjuster.....finish free. We hereby agree to install this complimentary set in a conspicuous position in our place of business, and to display it for at least one year.

Ship to us via.....the following TWO BALLS ADJUSTERS

.....Style A, Gold Bronze.....Aluminum.....Black.....

.....Style B, Plain Brass.....Fancy Brass.....Nickel Plated .....

Insert number and finish desired.
You know our prices. If not, write for them. Quoted in all supply house lists.

Sign Name and Address

Complimentary Set to be same style as majority of order.

If you have an opportunity of figuring on a large contract we will gladly help you land the order, urging your customer to order from you.

SOLE MAKERS

THE VOUGHT-BERGER CO.

LA CROSSE, WIS.

Two Balls Adjusters are as staple as a socket. You can't overstock. Get your share of the season's business.

Get our Literature

A LAMP

LOOK FOR THE LICENSE LABEL IN THE STEM

THAT WILL GIVE YOU THE FULL VALUE OF YOUR MONEY IN CANDLE-POWER EFFICIENCY AND LIFE.

THE COLUMBIA

Columbia Lamps are manufactured under license to use the Chemical Exhaust Process of exhausting lamps. This process is vitally necessary in the production of the highest quality of lamp.

OKONITE IT NEVER DISAPPOINTS

Central Electric Company,

GENERAL SALES AGENTS

207-209-211 EAST JACKSON BOULEVARD, CHICAGO

OKONITE IT NEVER DISAPPOINTS

Just What the World Has Been Waiting For.

NEW "MORRISON" STORAGE BATTERY

THE CELL

This plate is so strong electrically and mechanically that no amount of electrical abuse or of vibration in traction service can dislodge even the slightest particle of its active material.

Lowest internal resistance of any storage battery in the world.

The weight efficiency is conservatively 14 watts per pound total weight, and electrical efficiency unsurpassed . . . .

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UNIVERSAL ELECTRIC STORAGE BATTERY CO.

INCORPORATED

OFFICE: 1355 RAILWAY EXCHANGE BUILDING FACTORY: 36-38 UNION PARK PLACE

CHICAGO, ILLINOIS

Gould Storage Battery Co.

Complete Storage Battery Plants

Railway Line and Regulating
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WORKS: DEPEW, N. Y.

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Automatic Electric Co.
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ELECTRA CARBONS

"TRADE MARK"

HIGHEST GRADE NUERNBERG

They give more light, whiter light and less dust than any other carbon. Their quality is uniform and always of the highest grade. Diameter and straightness perfect. Grand prize St. Louis World's Fair, 1904

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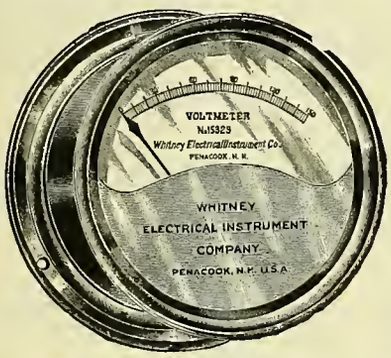

Diam. of body, 6 in., of base flange 7½ in.

THE **"I. P."** (ISOLATED PLANT) **TYPE DIRECT-CURRENT INSTRUMENTS**

Are winners. Scales are equally divided, indications are dead beat, high range ammeters have separate shunts and the cases are of heavy polished brass.

Prices are right, the list figure for the meter illustrated, for instance, being $16.50.

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MACHADO & ROLLER,

203 BROADWAY, NEW YORK CITY, N. Y., Or Your Nearest Supply House.

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FOR MANY STYLES OF ARC LAMPS

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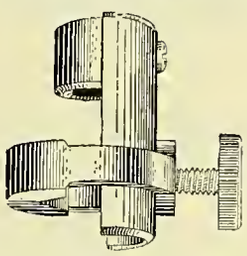

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THE TURNER BRASS WORKS

..MANUFACTURERS..

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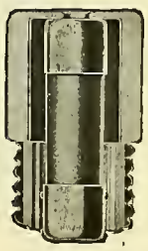

MAN

Wants but little here below, but when he wants a fuse plug he wants a GOOD ONE. That means a

"NOARK"

NATIONAL STANDARD

TRADE MARK

When the fuse is blown—give it a push from the top, through the opening provided, and out it comes.

Durability and Efficiency

are synonymous with

"Noark" National Standard Devices

And you might also add

Economy

For a standard fuse may be used with this or any other form of **"Noark" National Standard Devices.**

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Manufacturers of Asbestos and Magnesia Pipe and Boiler Coverings, Asbestos Packings, Roofing, Etc.

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We are the originators and builders of the ONLY underground system of live and exhaust steam heating. Our system is used for the utilization and distribution of exhaust steam from electric-light and power plants, for heating residences, stores, public buildings, etc. 250 plants in successful financial and mechanical operation. We have the only practical Steam Meter. Also manufacturers of Wooden Water Pipe, Steam Pipe Casing, Steam Traps, Condensation Meters, Valves, Economizing Coils, Separators, and a full line of Steamfitters' Supplies.

Write for the STORY of DISTRICT STEAM HEATING

AMERICAN DISTRICT STEAM COMPANY

MAIN OFFICES LOCKPORT, N.Y.

WESTERN OFFICES: MONADNOCK BLDG. CHICAGO, ILL.

FREE
TO
CENTRAL STATIONS
50 FEET
"Oneida" Galvanized Chain
EXPRESS PREPAID

Our flexible steel chain (American pattern) herewith illustrated will outwear cord, cable or rope many times over.

Give it a trial for raising and lowering Arc Lamps suspended from Mast Arms.

You will use no other attachment after making this test as "Oneida" Galvanized Chain is absolutely uniform in strength.

HEAVILY GALVANIZED!
RUST PROOF!

You need have no fear of your lamps falling to the street as happens so unexpectedly when strands of cable give way or a rope has rotted out.

MANUFACTURED BY
ONEIDA COMMUNITY, Ltd.
ONEIDA, NEW YORK.
Branch Factory, Niagara Falls, Ont. Can.

Address all inquiries to Sales Dept.

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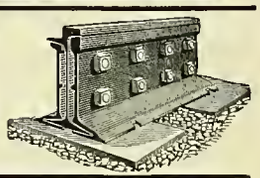
MECHANICAL, ELECTRICAL, STEAM, CIVIL.

Complete and short courses. Thoroughly equipped engineering shops. **Shop work from the beginning.** Short courses in Steam and Electrical Engineering. Expenses low. Accommodations the best. School all year. Students may enter any time. Correspondence steam and electrical courses. Send for catalogue. Mention course in which interested.
HIGHLAND PARK COLLEGE, DES MOINES, IOWA

CENTURY ELECTRIC CO.
MANUFACTURERS OF
SINGLE-PHASE SELF-STARTING
MOTORS AND CEILING FANS
ST. LOUIS, MO.

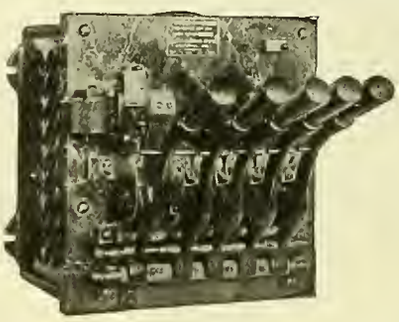
BOSSERT'S BOXES
Drawn steel. One blow of a hammer gives clean round hole. No filing.
SAVE TIME, BOXES AND MONEY
Be up to date. Use them. Write for bulletin giving full particulars.
Bossert Electric Construction Co., UTICA N.Y.

CONTINUOUS RAIL JOINT CO. OF AM.
NEWARK, N. J.
OVER 20,000 MILES IN USE
Highest Award at Paris Exposition, 1900, Buffalo, 1901, and St. Louis, 1904.



The more money you spend in advertising the more money you have.
The less money you spend in advertising the less money you have.

Multiple Switch Type Starter



This is the best type of starter to use on motors from 50 H. P. up because it is much more compact than the sliding type of starter, and in addition does not spark.

By an interlocking arrangement the switches cannot be thrown in except in their proper order, and in case of no voltage the same arrangement causes them to drop consecutively out of contact.

Send for Bulletin 10½ for Description

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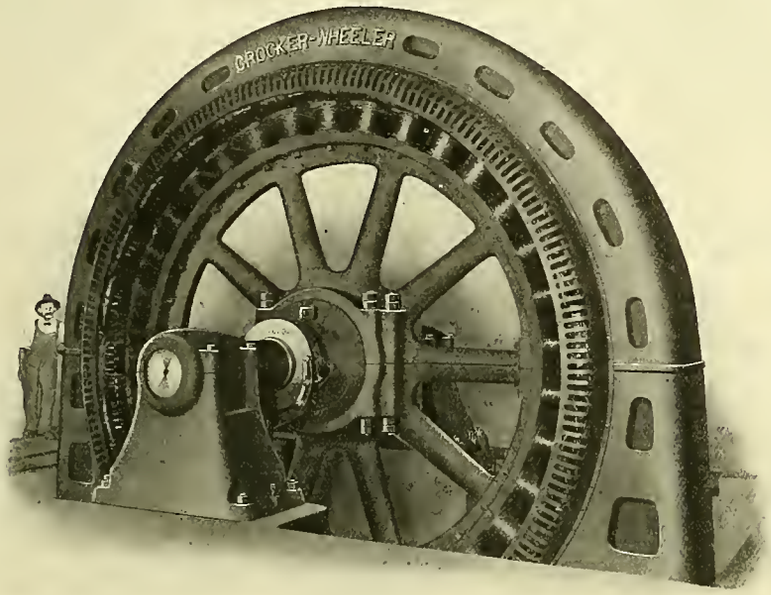

This is one of the three 4,000 KVA A. C. generators driven by Snow gas engines, which will supply current for all the trolley lines in San Francisco and vicinity.

Crocker-Wheeler alternators, as has been proved in actual service, will run in parallel without the usual close attention. These 4,000 KVA machines are to run in parallel with waterwheel driven generators 100 miles distant.

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Manufacturers and Electrical Engineers

COMPANY : Ampere, N. J.

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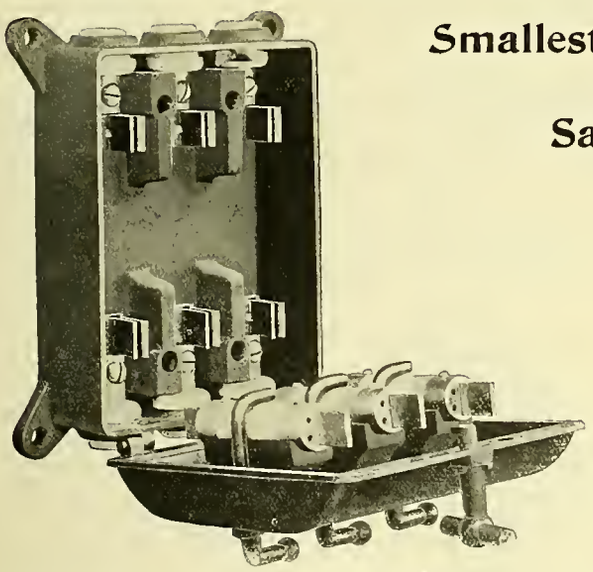

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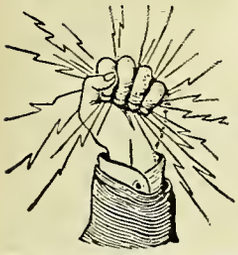

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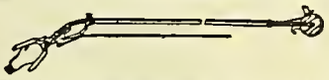

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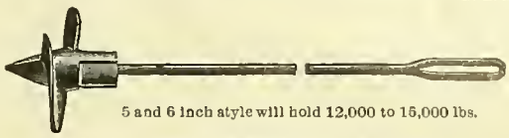

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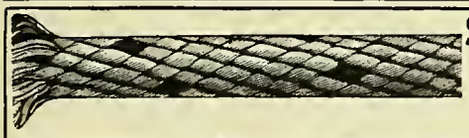

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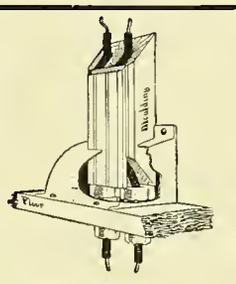

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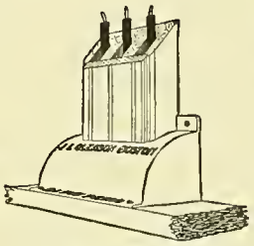

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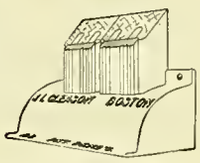

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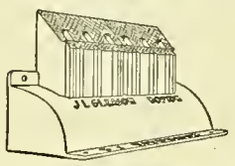

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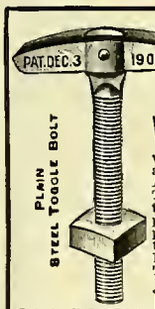

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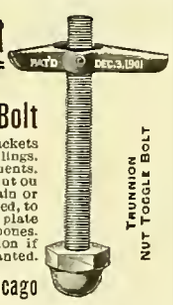

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The letter from which the above is taken, is dated May 8, 1905, and is on file in this office.

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One Sioux City Corliss 350 horse power (24x48) 75 revolutions.

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40	Milwaukee M. P.	1,900	40.00
60	Western Electric, Type G	1,350	50.00
65	Browning M. P. Compound	1,000	75.00
70	Bullock M. P. Compound	1,800	75.00
100	Hobart M. P. Compound	1,500	85.00
75	Phoenix Compound, direct connected to No. 4 Case Engine	650	300.00
150	Western Electric M. P., Type N. T.	1,100	100.00
250	Western Electric M. P. Compound	750	150.00
350	Edison, 20 K. W.	1,400	165.00

220 TO 250 VOLTS.

K. W.		Speed.	Price.
12	Westinghouse M. P. Compound	1,250	$175.00
20	Western Electric M. P. Compound	700	200.00
35	Bernard M. P. Compound	575	300.00
50	General Electric, direct connected to Ball & Wood 13x11 Engine, new	450	500.00

500 TO 550 VOLTS.

K. W.		Speed.	Price.
45	Edison Compound, new	1,000	$300.00
110	General Electric M. P. 6-Pole, Compound	600	800.00

Generators—Alternating current, 125 to 133 cycles.

Lights.		Speed.	Price.
1,200	Westinghouse, 60-K. W., Toothed Armature, with Exciter, Compound, 1,100 Volts. Brand new	1,650	$335.00

60 CYCLES.

Lights.		Speed.	Price.
900	Westinghouse, 45-K. W., Toothed Armature, Compound, Single Phase, 1,100 Volts, with Exciter	900	$500.00
Same as above, 2,200 Volts		900	525.00

Arc Dynamos.

Lights. C. P.		Speed.	Price.
35	2,000 T. H., L. D., 2, Self Oiler, ring armature. Brand new	$20	$300.00

Motors—Direct current, 110 to 125 Volts.

H. P.		Speed.	Price.
⅓	Akron M. P., back geared with magnetic clutch. Motor speed, 1,300; speed of shaft, 170. Brand new	.....	$40.00
½	General Electric, Type C. A., new. Shunt wound, 2 poles	1,180	$ 40.00
1	Browning, new	2,100	30.00
4	Browning M. P., new	900	55.00
7½	Akron M. P.	1,450	70.00
12	Western Electric M. P.	800	100.00
15	Triumph M. P.	1,000	145.00
35	Western Electric	550	195.00

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H. P.		Speed.	Price.
½	Lundell, for Linotype Typesetting Machines with gear. Never used	645	$ 25.00
½	Browning. Almost new	485	35.00
2	Bernard M. P.	350	70.00
5	Crocker-Wheeler special printing press motors. For direct connection	318	100.00

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H. P.		Speed.	Price.
½	General Electric, Type C. A.	1,700	$ 30.00
½	Browning. New	2,550	20.00
3	Westinghouse M. P.	1,700	50.00
7½	Eddy M. P.	1,100	75.00
15	Eddy, Type C. Self oiler	1,725	100.00

Motors—Alternating current, Single Phase, 125 to 133 Cycles.

H. P.		Speed.	Price.
½	Stanley, 100-110 volts. New	2,400	$10.00

SINGLE-PHASE, 60-CYCLE.

H. P.		Speed.	Price.
½	Wagner, 104 volts, auto	1,800	$ 60.00
2	Century, 104 or 208 volts, auto	1,750	100.00

THREE-PHASE, 60-CYCLE.

H. P.		Speed.	Price.
1	General Electric, 110 volts	1,800	$35.00
3	General Electric, 110 volts, Type T. I.	1,800	45.00

Motor Generators.

H. P.		Speed.	Price.
2	Crocker-Wheeler, 8.9 amps., 110 volts to 35 amp., 18 volts	1,800	$50.00

The usual fittings accompany each machine at the price named. All are guaranteed to be in perfect working order. I have also a large stock of new and second-hand Engines, Meters, Extra Armatures, Extra Commutators, Transformers, Arc Lamps, Lightning Arresters, Circuit Breakers, Etc., all at ridiculous prices.

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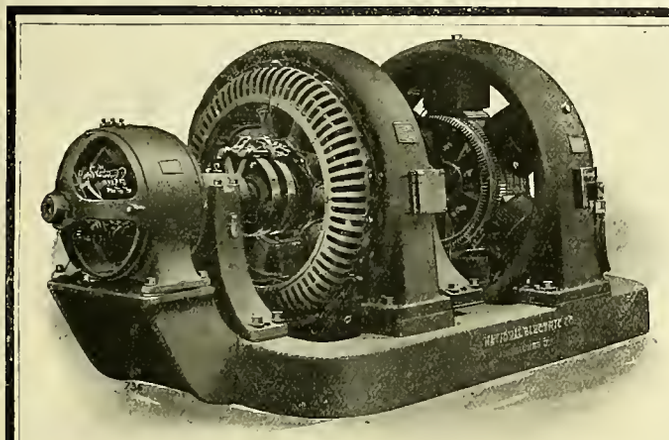

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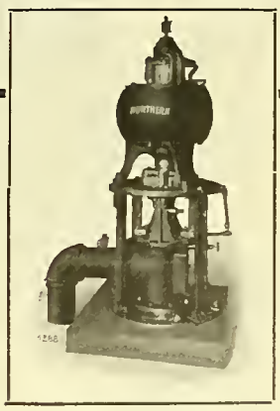

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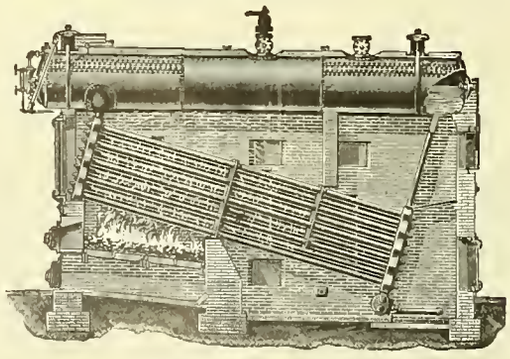

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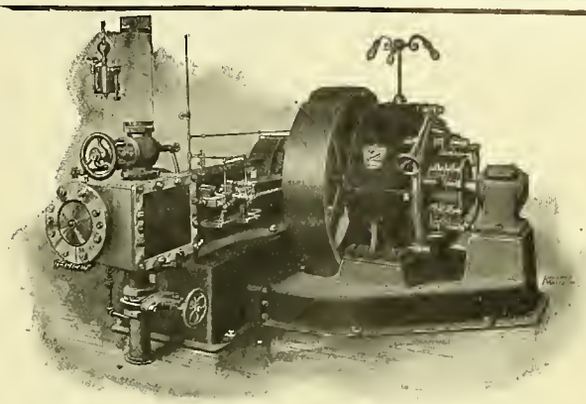

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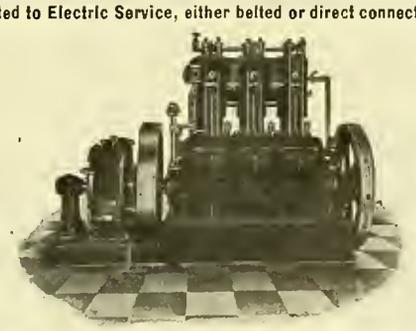

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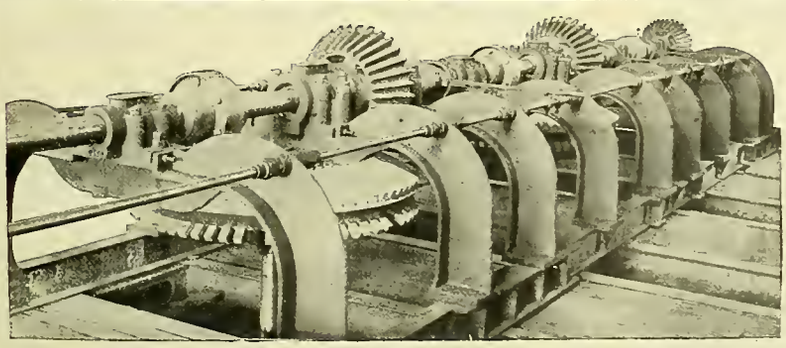

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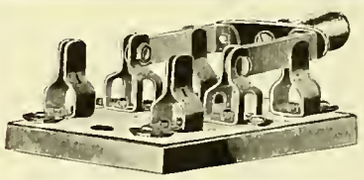

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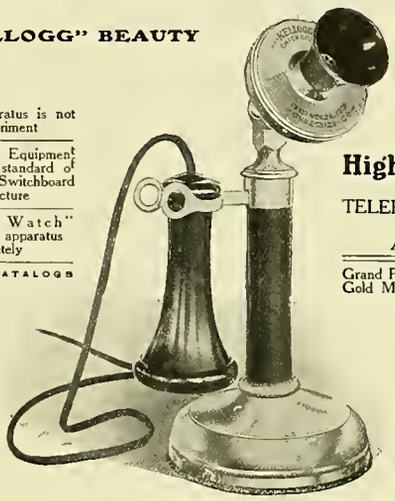

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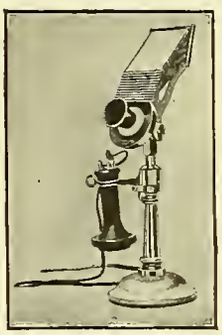

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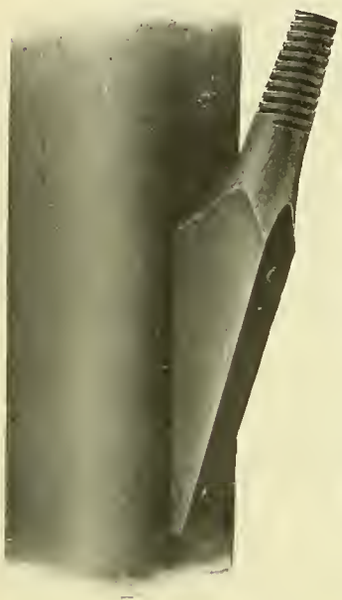

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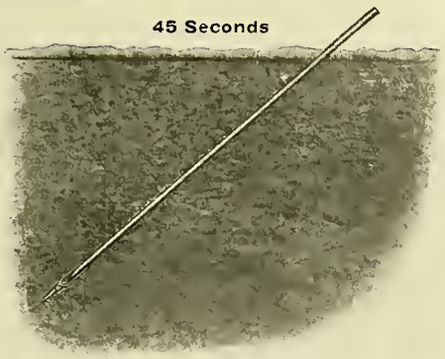

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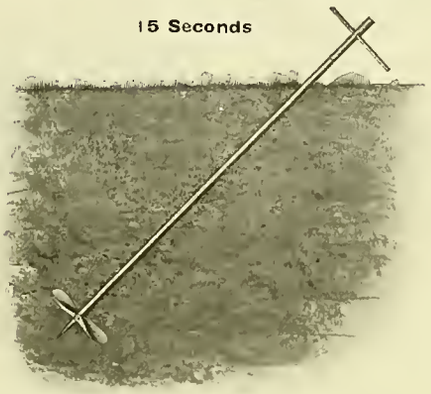

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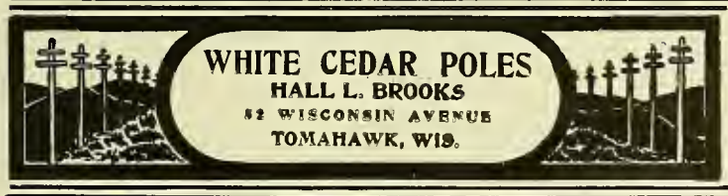

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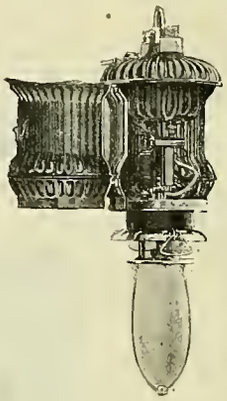

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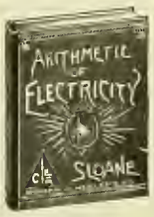

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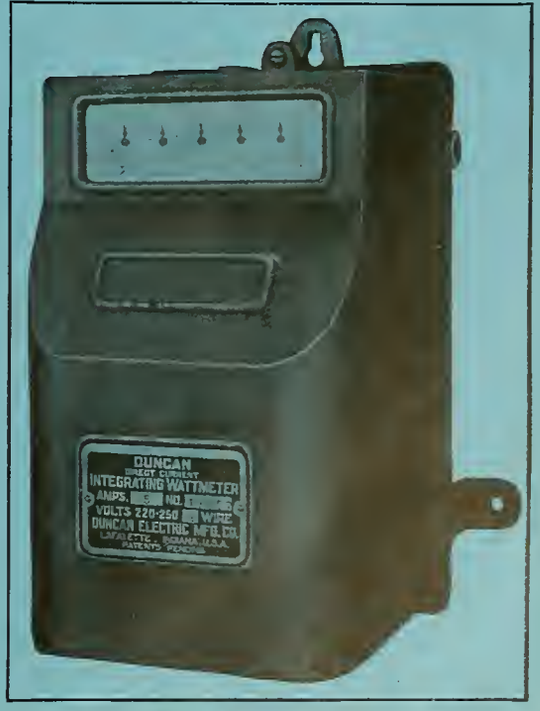

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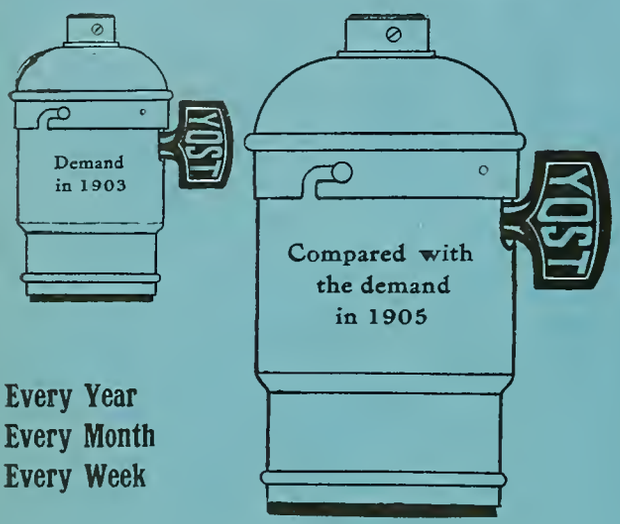

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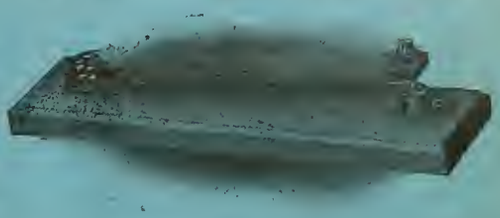

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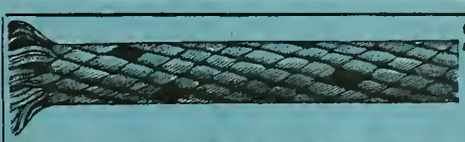

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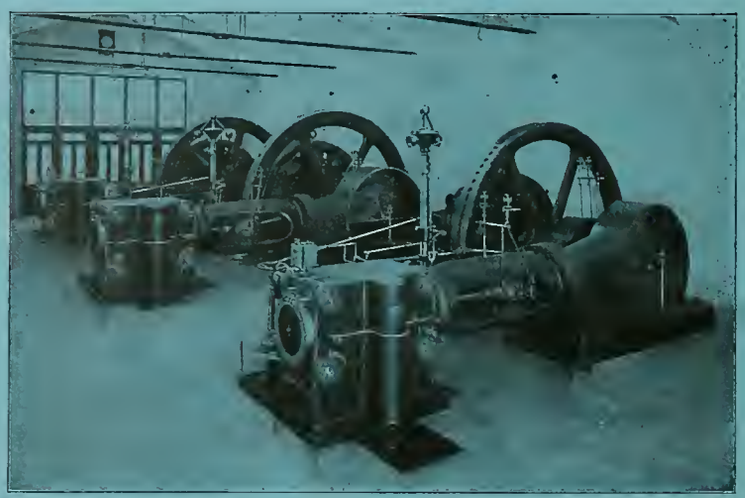

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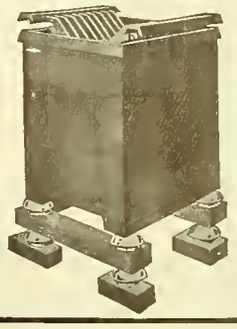

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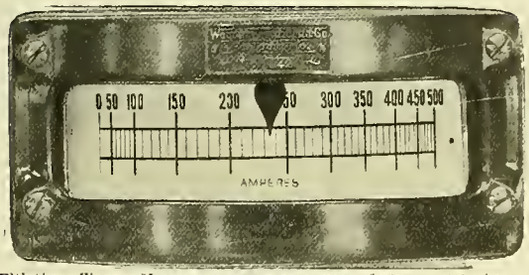

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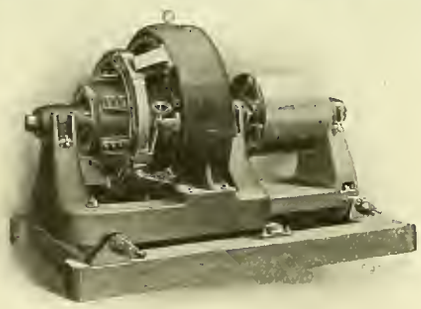

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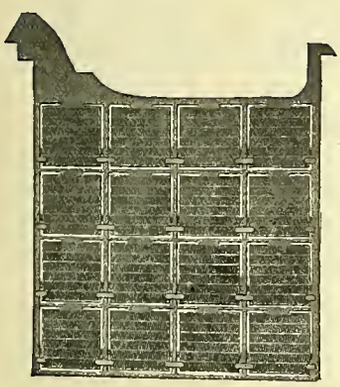

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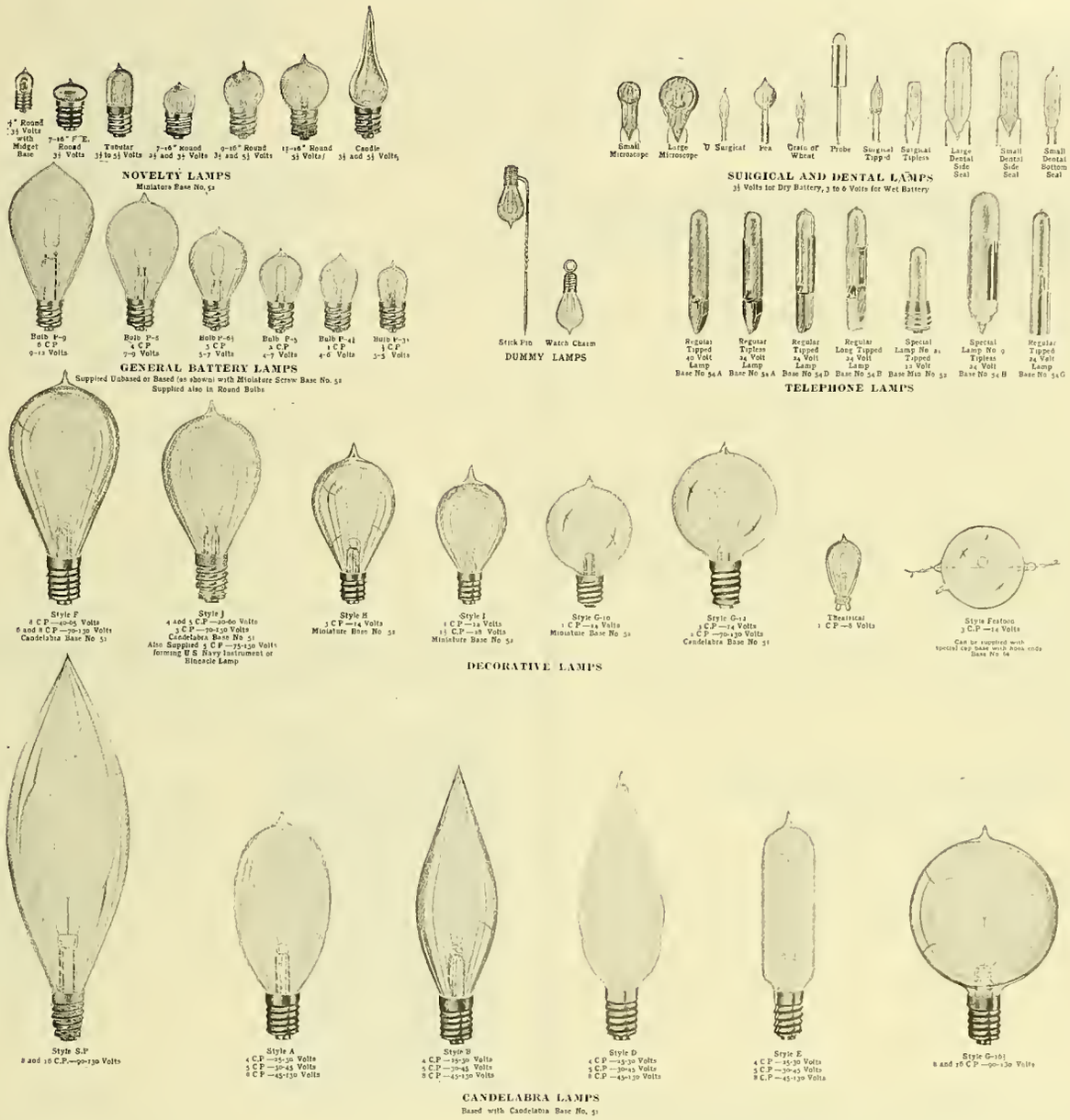

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Patent 537,693, April 16, '95
Patent 726,203, April 28, '03

Patent 444,580, Jan. 13, '91
Patent 532,760, Jan. 22, '95

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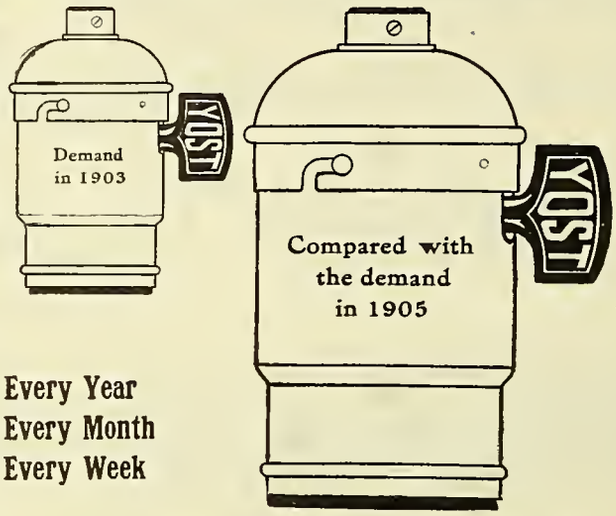

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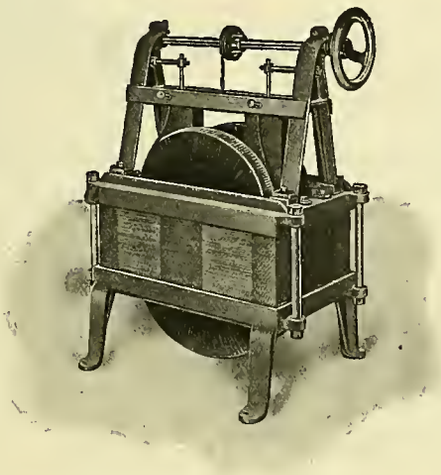

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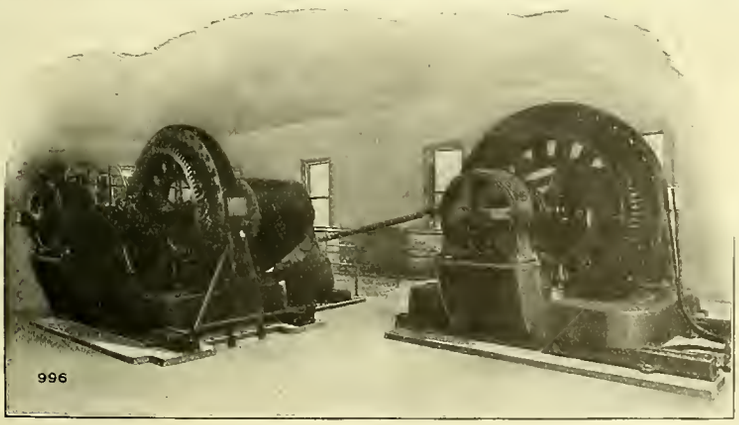

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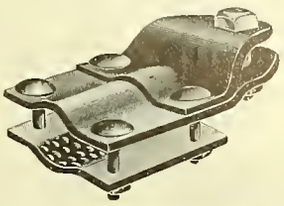

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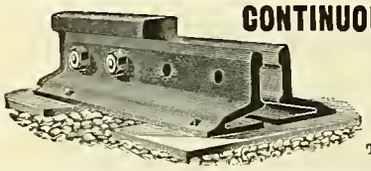

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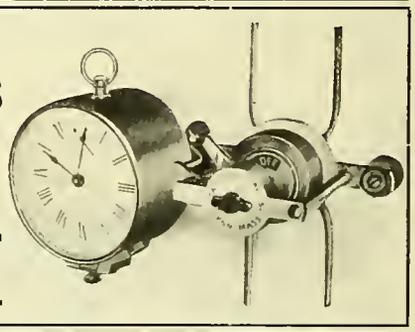

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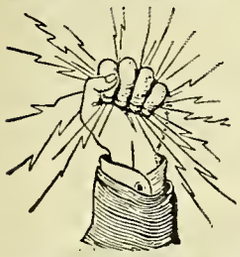

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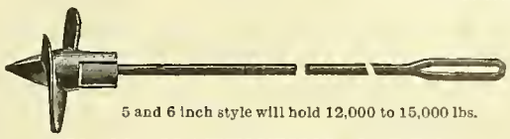

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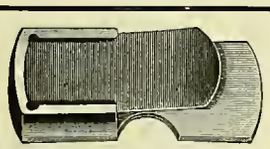

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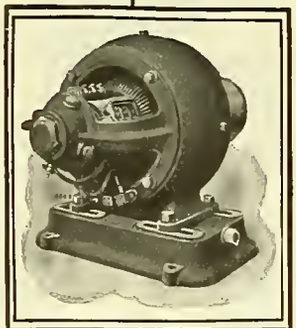

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Motor Bulletin No. 2535

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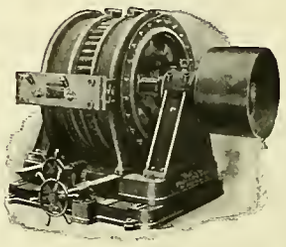

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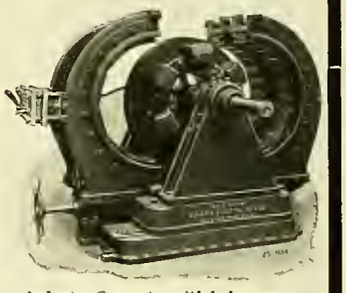

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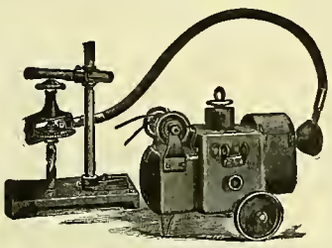

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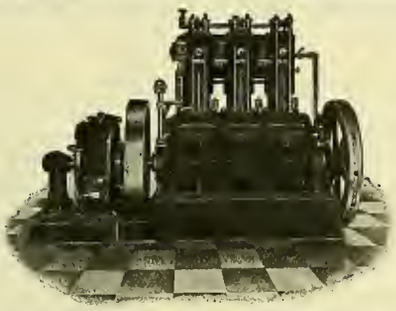

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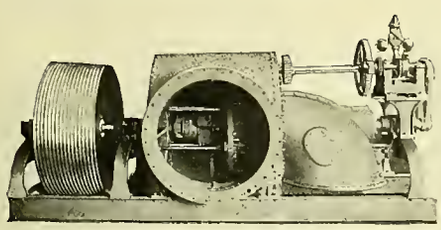

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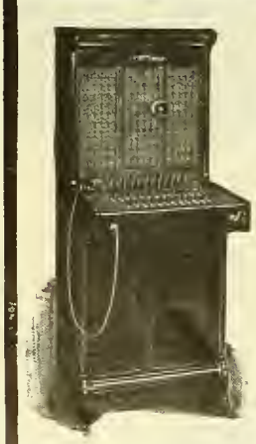

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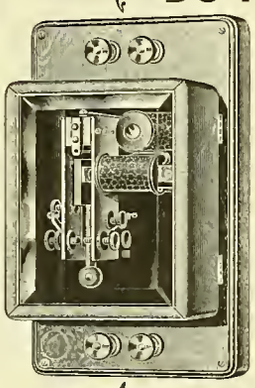

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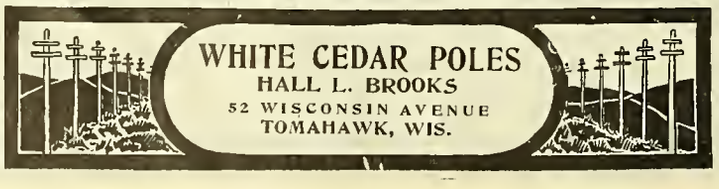

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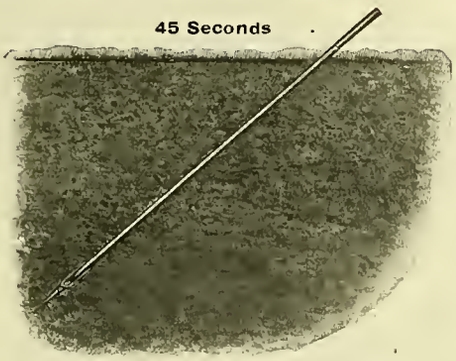

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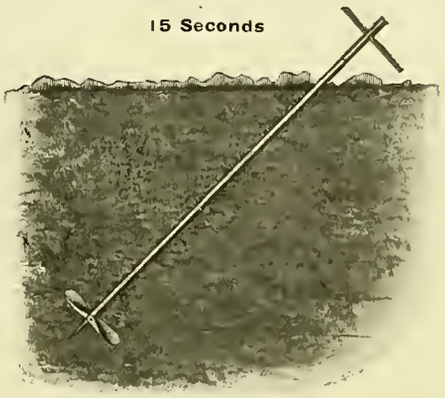

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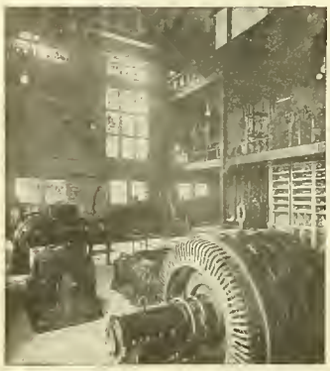

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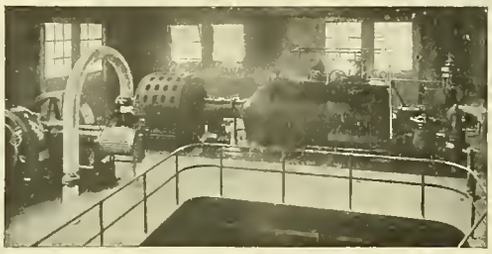

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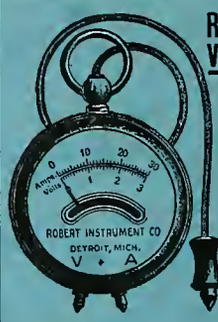

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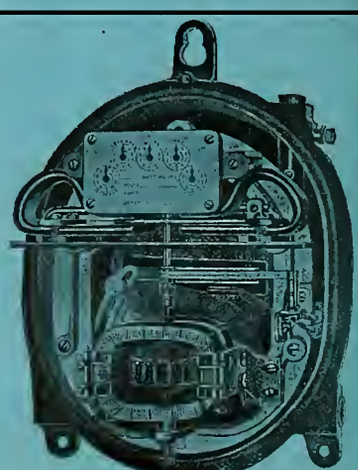

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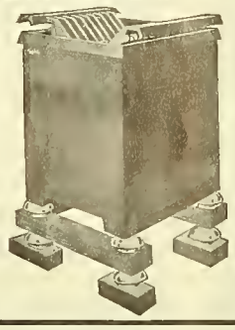

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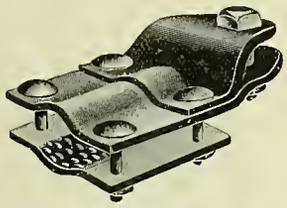

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Arc Lamps,
Circuit Breakers, Etc., Etc.

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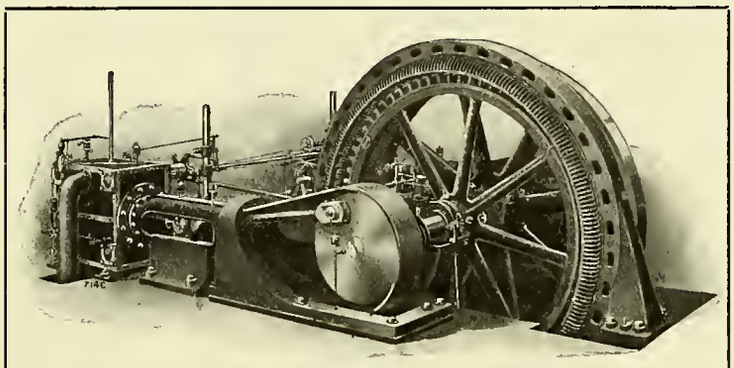

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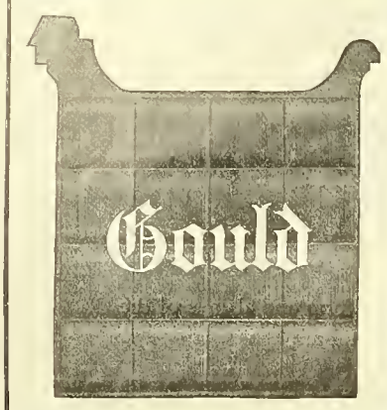

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Bulletins.

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Leather Preserver Mfg. Corp

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American Conduit Company
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Electric Appliance Co.
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Osburn Flexible Conduit Co.
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McRoy Clay Works.

Conduit Rods.
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General Electric Co.
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Vulcanized Fibre Co.

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Chicago Fuse Wire & Mfg. Co.
D. & W. Fuse Company.
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Addison Glass Co.

Globes, Reflectors and Shades.
Addison Glass Co.
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Replogle Governor Works.

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Southwestern Elec. Co.
Matthews & Bro., W. N.

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Pass & Seymour.
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Yost Elec. Mfg. Co.

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Chicago Solder Co.
Crolius & Son, E. R.
New Idea Soldering Paste Co.
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Underhill, Chas. R.

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Electric Appliance Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Co.

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Pass & Seymour, Inc.

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National Battery Co.
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Century Electric Co.
Chicago Edison Co.
Electric Appliance Co.
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Western Electric Co.

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Automatic Electric Co.
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International Tel. Mfg. Co.
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Manhattan Elec. Supply Co.
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Western Electric Co.

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Western Electric Co.
Westinghouse El. & Mfg. Co.

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General Electric Co.
Westinghouse Machine Co.

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Vulcanized Fibre Co.

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Safety Ins. Wire & Cable Co.
Simplex Electrical Co.
Standard Underground Cable Co,
Wesco Supply Co.
Western Electric Company.

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Telephone Woodworking Co.

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Inner Globe Wisdom

Longfellow could take a worthless sheet of paper, write a poem on it, and make it worth sixty thousand dollars, —"THAT IS GENIUS."

Rockefeller can sign his name to a piece of paper and make it worth millions,—"THAT IS CAPITAL."

Uncle Sam can take an ounce of gold, stamp an eagle upon it, and make it worth $20.00,—"THAT IS MONEY."

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Merchants buy articles for eighty-seven cents and sell them for a dollar,—"THAT IS BUSINESS."

A woman can purchase a sixty-nine-cent hat, but prefers one that costs $27.00; her husband says,—"THAT IS FOOLISHNESS."

SOME INNER GLOBE MANUFACTURERS take the poorest quality of glass, make it into a globe and try to sell it at a high price,—"THAT IS IMPUDENCE."

Other manufacturers sell you a globe full of water spots, unevenly ground, imperfectly tempered, and other defects that cause the globe to crack, get soft or blacken when put into service, — "THAT IS FRAUD."

Those who have had experience with various makes of INNER GLOBES fall back on the old reliable "PHŒNIX," the globe of quality, — "THAT IS GOOD JUDGMENT."

Phœnix Globes are heat-resisting, non-blackening, non-cracking. They have all the good qualities, nothing is lacking.

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THE PHŒNIX GLASS COMPANY
New York - Pittsburgh - Chicago

WILLARD STORAGE BATTERIES

FOR ALL PURPOSES
Manufactured by
THE WILLARD STORAGE BATTERY CO.
CLEVELAND, OHIO

CENTURY ELECTRIC CO.
MANUFACTURERS OF
SINGLE-PHASE SELF-STARTING
MOTORS AND CEILING FANS
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G. F. SAUTER CO., ELECTRICAL CONTRACTORS
Segel Bldg., Cor. State and Lafayette Sts.
SCHENECTADY N. Y.

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Raven White Core

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ALL OUR WIRES pass inspection and carry the above TRADE-MARKS on our tags. We also manufacture Crimshaw and Competition Tapes and Splicing Compounds.

NEW YORK INSULATED WIRE COMPANY,

MAIN OFFICE: 114, 116 & 118 Liberty St., New York.
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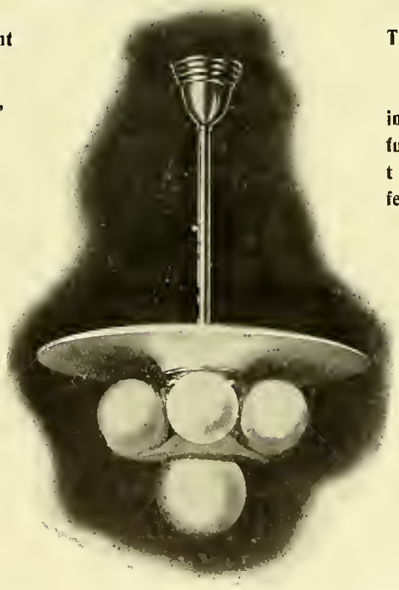
ARC-BURST

Just the Light for Stores, Hotels, Restaurants, Factories, Cotton Mills, Etc.

Many Central Stations Are Furnishing the Arc-Burst Instead of Arc Lamps. If Interested, Write Us.



The Arc Lamp Displacer. Thousands in use. Can be furnished with turn down feature.

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Weather-proof Form
Suspension Form

Cut Down Your Light Bill

Write for new 64-page catalogue.

Benjamin Electric Mfg. Co.
New York Chicago San Francisco

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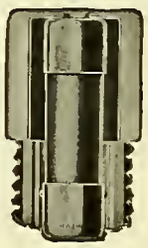

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NATIONAL
NOARK STANDARD FUSE PLUGS

When the fuse is blown—give it a push from the top, through the opening provided, and out it comes.

Reliability and Efficiency
are synonymous with
"Noark" National Standard Devices
And you might also add
Economy
For a standard fuse may be used with this or any other form of **"Noark" National Standard Devices.**

NEW YORK MILWAUKEE CHICAGO BOSTON PHILADELPHIA ST. LOUIS PITTSBURG CLEVELAND SAN FRANCISCO

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Manufacturers of Asbestos and Magnesia Pipe and Boiler Coverings, Asbestos Packings, Roofing, Etc.
100 WILLIAM STREET, NEW YORK

LOS ANGELES SEATTLE KANSAS CITY MINNEAPOLIS LITTLE ROCK NEW ORLEANS LONDON PARIS BRUSSELS

USED IN OVER 90% OF THE CENTRAL STATIONS IN THE UNITED STATES

COLUMBIA CARBONS

NATIONAL CARBON CO. CLEVELAND, O.

General Electric Company

Edison Ready-to-Use Electric Decorative Lighting Outfits Are Sure Sellers

Because no other method decorates the Christmas tree so quickly, neatly and beautifully. They are in demand at all seasons for the adornment of the home or for use on a larger scale at public entertainments.

The Edison outfit provides the safest means for the illumination of all kinds of decorations. It is durable because made in a substantial manner from the best materials.

The outfits are made in the following sizes:

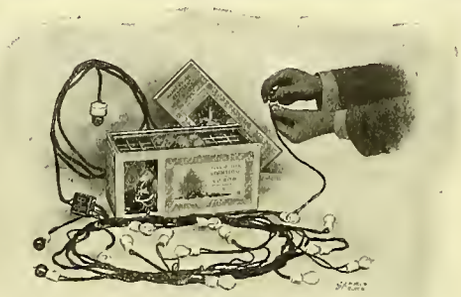
No. 1.—8-light outfit, including two extra lamps.

No. 2—16-light outfit, including three extra lamps.

No. 3.—24-light outfit, including four extra lamps.

No. 4.—32-light outfit, including four extra lamps.

Clear, green and red lamps are supplied.



For fuller details, write our nearest district office, or

GENERAL ELECTRIC COMPANY

OFFICES IN ALL THE PRINCIPAL CITIES

Main Lamp Sales Offices:
HARRISON, N. J.

741

A. C. MOTOR CONTROLLERS

We are prepared to furnish A. C. controlling apparatus for any purpose for which the A. C. motor is used.

We have developed a large number of types for different purposes and will be pleased to furnish you with information and quotations on receipt of your requirements.

THE

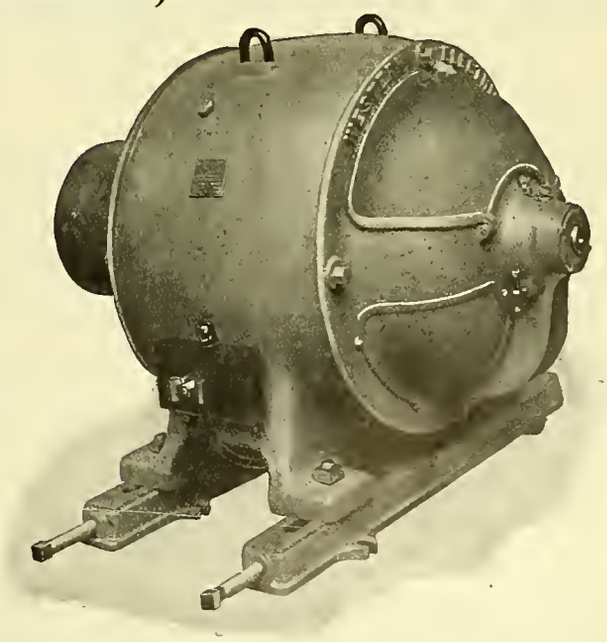
Cutler-Hammer Mfg. Co.

Milwaukee

New York Boston Chicago Pittsburg

CAN BE ATTACHED TO

FLOOR, WALL OR CEILING



Write For Bulletins

WESTERN ELECTRIC CO.

CHICAGO NEW YORK

OTHER LARGE CITIES

Get your orders to us for Porcelain before the tide turns.

Greatest opportunity in years to stock up at low prices.

WRITE US AT ONCE

Electric Appliance Company

CHICAGO AND SAN FRANCISCO

MICABOND will save you money in your repair work as well as in your new machines. It is good insulation—made out of the best materials and is sold at reasonable prices.

CHICAGO MICA CO. VALPARAISO, IND.

BIJUR "HIGH-DUTY"

Works:
BOONTON, N. J.

GENERAL STORAGE BATTERY CO.

General Offices:
42 BROADWAY, N. Y.

BOSSERT'S BOXES

Drawn steel. One blow of a hammer gives clean round hole. No filing.

SAVE TIME, BOXES AND MONEY

Be up to date. Use them. Write for bulletin giving full particulars.

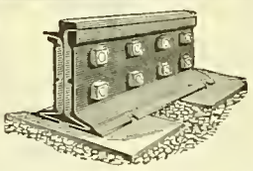
Bossert Electric Construction Co., UTICA N.Y.

CONTINUOUS RAIL JOINT CO. OF AM.

NEWARK, N. J.

OVER 20,000 MILES IN USE

Highest Award at Paris Exposition, 1900, Buffalo, 1901, and St. Louis, 1904.



EDISON READY-TO-USE

Electric Decorative Lighting Outfits

Excellent sellers during the holiday season because they afford such a convenient and beautiful method of decorating the Christmas tree. Useful on any occasion when decorative effects are desired for home or public entertainments.

It is durable because made in a substantial manner from the best materials

For fuller details write our nearest district office or

GENERAL ELECTRIC COMPANY

MAIN LAMP SALES OFFICES: HARRISON, N. J.

Offices in all the Principal Cities. 742

PEERLESS LAMPS LEAD

LOOK FOR THE LICENSE LABEL IN THE STEM

all others in EFFICIENCY, LENGTH OF LIFE, CURRENT CONSUMPTION and SUSTAINED CANDLE POWER.

A practical test and our contract prices will show you how you can save money.

WESCO

The Wesco Supply Co.

Fort Worth St. Louis

Engineering MECHANICAL, ELECTRICAL, STEAM, CIVIL.

Complete and short courses. Thoroughly equipped engineering shops. **Shop work from the beginning.** Short courses in Steam and Electrical Engineering. Expenses low. Accommodations the best. School all year. Students may enter any time. Correspondence steam and electrical courses. Send for catalogue. Mention course in which interested.

HIGHLAND PARK COLLEGE, DES MOINES, IOWA

VOLT - AMMETERS

POCKET SIZE

For testing Batteries and Battery Circuits, Locating Faults, Grounds, etc.

RELIABLE. - ACCURATE.

Send for Circular.

L. M. PIGNOLET

78-80 Cortlandt St., NEW YORK, N. Y.

YOU NEED IT!

GALE'S COMMUTATOR COMPOUND. DIRECTIONS FOR USE

Gale's Commutator Compound.

The Only Article That Will Prevent Sparking.

Will keep the Commutator in good condition and prevent cutting. Absolutely will not gum the brushes.

50c. per stick. $5.00 per dozen. Send 50c. for trial stick.

FOR SALE BY ALL SUPPLY HOUSES OR

K. McLENNAN & CO., Sole Manufacturers, Room 411, Inter Ocean Bldg., 130 Dearborn St., CHICAGO.

"PERU" Tie Button

FOR CONCEALED WORK

Saves time in wiring. Makes a neat and satisfactory job.

One of the

National Code Standard

Specialties illustrated in our bulletins. Write us for bulletins No. 2 and No. 3 on this material.

Made Also for Cleat and Moulding Work

No. 465

PERU ELECTRIC MFG. CO. PERU, IND.

MICA Of all Qualities, in any Form at Lowest Prices

EUGENE MUNSELL AND CO.
NEW YORK and CHICAGO

INSULATION That Is.

Micanite, Linotape, M. I. C. Compound, Empire Cloth and Paper. For Years the Standard.

MICA INSULATOR CO., Originators
NEW YORK and CHICAGO

ELECTRICAL REPAIRING

We Guarantee All Work

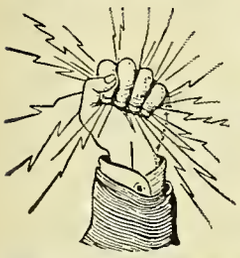
DYNAMOS, ARMATURES, MOTORS, ARC LAMPS, INSTRUMENTS, GENERAL REPAIRING. Correspondence Solicited.

NEW AND SECOND-HAND MACHINERY FOR SALE

SOUTHWESTERN ELECTRIC CO., ST. LOUIS.

FRANK N. PHILLIPS, Pres. EUGENE R. PHILLIPS, V. P. C. H. WAOENSEIL, Treas. C. R. REMINGTON, Jr., Sec.

AMERICAN ELECTRICAL WORKS,

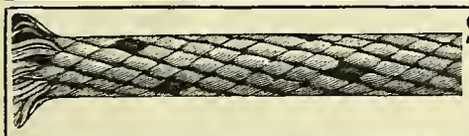


PROVIDENCE, R. I.

BARE AND INSULATED ELECTRIC WIRE,

ELECTRIC LIGHT LINE WIRE,
INCANDESCENT AND FLEXIBLE CORDS,
Railway Feeder and Trolley Wire,
AMERICANITE, MAGNET, OFFICE AND
ANNUNCIATOR WIRES.
CABLES FOR AERIAL AND UNDERGROUND USE.

NEW YORK STORE, W. J. Watson, 26 Cortlandt St.
CHICAGO OFFICE, F. E. Donohoe, 135 Adams St.
MONTREAL BRANCH, Eugene F. Phillips' Electrical Works.
MAIN OFFICES AND FACTORIES, PHILLIPSDALE, R. I.



Samson Spot Cord
For
ARC LAMP and
TROLLEY CORD
Send for Samples and Prices

SAMSON CORDAGE WORKS, - Boston, Mass.

FROSTS, SLEETS, THAWS AND FREEZINGS ARE COMING!
Go Over Your Lines and Anchor the Weak Places With

STOMBAUGH GUY ANCHORS

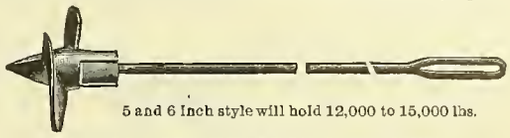
We give herewith the experience of one company

OFFICE OF NORTHFIELD TELEPHONE COMPANY,
NORTHFIELD, VT., Dec. 5, 1904

Gentlemen:—Yours of Nov. 30th received and contents noted. We have used your Anchors and have no doubt that they will prove satisfactory.

On the night of Nov. 20th this section was visited by the most severe storm we have had for years. On our lines running East and West there was from one to two inches of ice. Those poles guyed by the Stombaugh Guy Anchor are still standing, and we think that this is as good a test of their worth as we could have had.

Very truly yours,
NORTHFIELD TELEPHONE COMPANY,
H. D. Chamberlain, Superintendent.



5 and 6 Inch style will hold 12,000 to 15,000 lbs.

W. N. MATTHEWS & BRO.
203 N. 2nd St. MANUFACTURERS ST. LOUIS

SELF FLUXING **SOLDER**

FOR ALL PURPOSES

IN
18-INCH STICKS
OR
ON REELS

Kester Solder Can't Leak Flux.

CHICAGO SOLDER CO.

R. C. MILLER
St. Louis, Mo.
Gen. Western Agt.

46 N. Union Street, CHICAGO

ARC LAMP PARTS

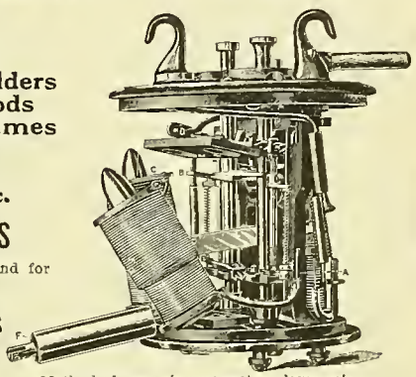
ORIGINATORS and
MANUFACTURERS of

Improved Carbon Holders
Improved Carbon Rods
Improved Rocker Frames
Improved Bushings
Improved Clutch
Improved Swing, etc.

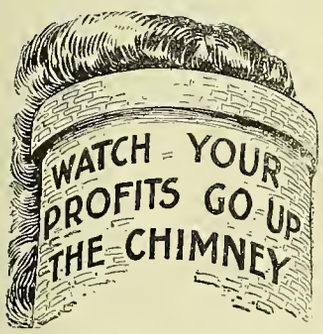
For T. H. ARC LAMPS

Complete Stock of all Parts. Send for Catalog 2312

The Turner Brass Works
23 N. Franklin Street
CHICAGO



Method of removing magnets in lamp using Turner Improved Rocker Frame.

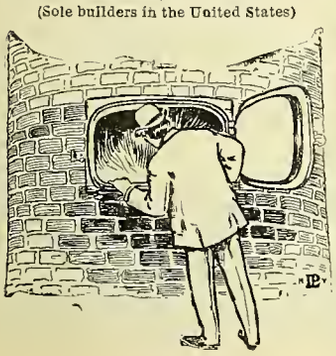


20 to 40 per cent of the heat of the fuel escapes in the flue gases if your boiler plant is not equipped with a

Green Fuel Economizer

Place a thermometer in the flue leading from the boiler and you will find a temperature of 500° to 600° F., according to the conditions of your plant. About half of this heat could be saved by an Economizer, which at the same time would largely increase the capacity of the boiler plant, take care of load fluctuations, decrease the amount of black smoke and prevent most of the impurities of the feed water from entering the boiler. Write for our BOOK "WB" on boiler economy, and ask also for our Catalog of Fans for Mechanical Draft and other purposes.

THE GREEN FUEL ECONOMIZER CO.
Matteawan, New York
(Sole builders in the United States)



NATIONAL CODE STANDARD

WEATHER-PROOF TRADE MARK "O.K." LINE AND HOUSE WIRES

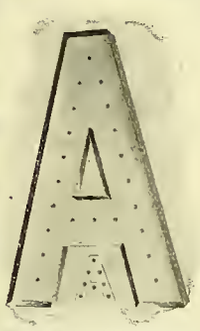
"O. K." Weatherproof Wire.
Slow-Burning Weatherproof
and Ideal Wire.

Prices and Samples on Application.

Phillips Insulated Wire Co.

Office and Factory: PAWTUCKET, R. I.

WE MAKE LARGE... **ELECTRIC ROOF SIGNS**



Our 6-foot all-metal grooved letter for roof signs.

consisting of raised or grooved metal letters mounted upon angle iron frame or upon full metal back-ground.

We make any kind of an ELECTRIC SIGN. We prepare your design and make a high-grade sign that will last, that will look well, and that can be read at a good distance and at any angle. You pay us no more than cost of material and labor with a reasonable profit added thereto. Write us.

Haller Machine Co.
127 Fulton Street
CHICAGO

PREDOMINATES
IN
27 States

"IT gives me great pleasure to state, that for 'Gitthereitiveness' your periodical certainly is a winner. As you perhaps are aware, the company I travel for, advertises in all the electrical papers, and it has been a question in my mind whether they reached every central station, as their advertising manager would have our company believe. So, for one year I have kept account of the electrical papers and periodicals subscribed for and received by the manager or superintendent of electric light companies in twenty-seven states, (which has been my territory), and in summing it up, I find that your periodical predominates, three to one. I do not get in many telephone plants, but when I do, I invariably find the 'Western Electrician' staring me in the face."

The letter from which the above is taken, is dated May 8, 1905, and is on file in this office.

WANTED, FOR SALE *and similar* **WANT COLUMN** *advertisements (50 words or less), $1.50 an insertion; additional words 3c each.* **POSITION WANTED** *advertisements (50 words or less), $1.00 an insertion; additional words 2c each.*

POSITION WANTED.

As engineer and electrician in some small plant. Ten years' experience. Familiar with all branches of the business. Married, 35 years of age, and can furnish recommendations as to ability and character. Address box 545, care of Western Electrician, 510 Marquette Bldg., Chicago.

WANTED.

Most respectable European concern (Electric Company) desires to communicate with inventors and manufacturers for exclusive sale of new article, technical line preferred; representative at present in the States. Write in strict confidence, stating particulars, to Box 546, care of Western Electrician, 510 Marquette Building, Chicago.

WANTED

Second engineer for an eight-hour watch, turbine station. Applicant must be a good, practical, all-around man; level-headed, capable of good judgment. State experience and references. Prefer a man who has been in light and power station. Address Box 544, care of Western Electrician, 510 Marquette Building, Chicago.

FOR SALE

Magnet Wire Machines; inquire
NORTHERN WIRE & CABLE CO.
Milwaukee, Wis.

FOR SALE

Electric light plant in a No. 1 good town of 2,500. Located on main line of the C., B. & Q. R. R., in southwestern Iowa. Plant completely overhauled two years ago. New machinery, new Corliss engine, 20x42, 120 kilowatt and 30 kilowatt Westinghouse generators. Over 5,000 lights wired up. Good city street light contract and motor load. Day and night service. Coal in bins $1.74 per ton. We run retail coal yard in connection with plant. Good reasons for selling. Address box 541, care of Western Electrician, 510 Marquette Building, Chicago.

TELEPHONE ENGINEERS.

Engineers of experience with telephone manufacturers will gain information to their interest by writing to Box 1732 General Post Office, New York City, in regard to business openings. State nature of present work and name of employer as well as age, experience and salary expected.

DEPARTMENT OF THE INTERIOR, Washington, D. C., October 25, 1905. Sealed proposals will be received at the office of the Engineer, United States Reclamation Service, Billings, Montana, until 3 o'clock p. m., December 15, 1905, for installing a telephone system having eight or more telephone stations and 22 miles or more of pole line. Particulars may be obtained by application to the Chief Engineer of the Reclamation Service, United States Geological Survey, Washington, D. C., or to Robert S. Stockton, Engineer, Huntley, Montana. E. A. Hitchcock, Secretary.

REPAIRS

We are Headquarters for
ELECTRICAL REPAIR WORK We operate the largest repair shops in America and have exceptional facilities for quick work. We repair **all kinds** of electrical apparatus and save our customers **weeks** in time in comparison with sending the work to the manufacturers direct. We have just reduced our prices and ask you to get our quotations on

Armatures Rewound, Commutators Refilled, Transformers Rewound, Etc.

Send for our monthly "Bargain Sheet," showing net prices on our stock of second-hand dynamos, motors, meters, transformers and supplies. Every article a bargain.

GREGORY ELECTRIC CO.
54-62 S. Clinton Street - CHICAGO

THE TELEPHONE HAND-BOOK
BY
HERBERT LAWS WEBB.
Price $1.00.
A complete and practical work in handy pocket size.
PUBLISHED BY
THE ELECTRICIAN PUBLISHING CO.,
Suite 510 Marquette Building, Chicago.

CENTRAL STATIONS
CONTRACTORS AND ELECTRICIANS
Should read our special offer on back cover of Western Electrician of November 11. Write us, mentioning this ad and you will learn something to your interest. And by the way, get your orders in early for TWO BALLS ADJUSTERS. This season's rush is phenomenal.
THE VOUGHT-BERGER CO., . . LA CROSSE, WIS.

ALWAYS READY AND DOES THE WORK. WILL MAKE THE SOLDER FLOW WHERE YOU WANT IT, AND STAY WHERE YOU PUT IT. IN COLLAPSIBLE TUBES AND TIN BOXES.
"NEW IDEA" SOLDERING PASTE SAMPLE FREE
NEW IDEA SOLDERING PASTE CO., 214 Hibbard Ave., Detroit, Mich.

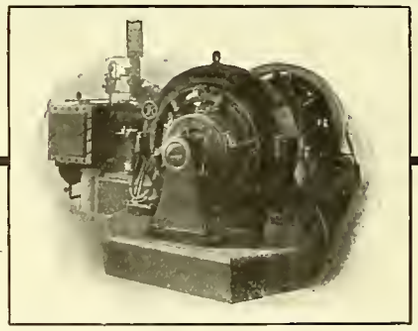
Copley-Senior Carbon Brush
Uniform throughout, a feature lacking in all other brushes
FOR GENERATORS AND MOTORS
Thoroughly and Permanently Self-Lubricating
Will not Cut Will not Spark Carry more Load
GUARANTEED
COPLEY-SENIOR CARBON CO.
GEO. W. COPLEY, Pres't and Gen'l Mgr.
465 GREENWICH STREET - NEW YORK

90% of the Air Hammers used are Boyer or Keller,
of the Air Drills used are Boyer, Keller or "Little Giant."
Why? Because they do more work, use less air, require less repairs, represent basic patents and are not liable to infringement.
THE KIND YOU HAVE ALWAYS USED — MANUFACTURED BY
Chicago Pneumatic Tool Company
Fisher Building, CHICAGO 95 Liberty Street, NEW YORK

The more a man advertises, the greater his business. The greater his business, the more he advertises.

As a Practical Book for Practical Men Spangenberg's Book Ranks First
All the engineering information you should have; all you really need is contained in this book in plain, practical and concise form.
Spangenberg's Steam and Electrical Engineering
Is a complete library covering the subject in all its various branches and contains 672 pages. The only book ever published containing 1025 questions and answers. Written so you can understand it. $3.00 is the price, and it is sold with the understanding that it may be returned if not satisfactory, and your money will be refunded immediately. Out of 10,000 books sold only two have been returned. This fact speaks for itself.
CUT OUT AND MAIL TO-DAY
GEO. A. ZELLER BOOK COMPANY
42 S. Fourth Street St. Louis, Mo.

Bound in Silk Cloth. Size 6x9. 672 pages. 645 Illustrations.
I accept your offer to send me, express prepaid, one of Spangenberg's Steam and Electrical Engineering, price $3.50, and enclose $2 as first payment. The balance, $1.50, I agree to remit in 50 cent monthly installments, money or express order or Stamps.
Name .....
Street or Box No. .....
City and State .....



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As Good as The Best— "And Then Some."

Ball Compound Engine

Northern Dynamos

Northern Direct Current Apparatus possesses all the characteristics of economical, convenient operation common to excellent electric dynamos and motors and
Many exclusive meritorious features that make it worth your while to get acquainted by reading Bulletin No. 2546
NORTHERN ELECTRICAL MFG. CO.,
Engineers Manufacturers.
425 Monadnock Block, Chicago, Ill. Madison, Wis., U. S. A.

Second-Hand Machinery

1 24x18 Ideal Automatic Engine.
2 66-in. x 20-ft. Return Tubular Boilers built for 130 lbs. working pressure.
We also have on hand the following leather belts all in good condition:
67 ft. of 18 inch double ply.
73 ft. of 34 inch double ply.
48 ft. of 14 inch double ply.
108 ft. of 24 inch double ply.
85 ft. of 34 inch triple ply.
The above is all in first-class operating condition and is offered subject to prior sale.
Springfield Light, Heat & Power Company
Springfield, Ill.

Send 2c stamp for new catalogue No. 6 of
KLEIN'S TOOLS
For Electrical Workers and Line Builders.
MATHIAS KLEIN & SONS.
81 W. Van Buren St. Chicago, Ill.

"AMERICAN" STORAGE CELLS
ARE THE BEST. Send for descriptive Circular.
AMERICAN BATTERY CO.,
ESTD 1894. 171 S. Clinton St., Chicago.

Locations for Industries
Erie Railroad
Chicago to New York
The Erie Railroad Company's Industrial Department has all the territory traversed by the railroad districted in relation to resources, adaptability, markets and advantages for manufacturing, and can advise with manufacturers in relation to the most suitable locations. For full information address
LUIS JACKSON
Industrial Commissioner, Erie Railroad Company
21 Cortlandt Street, New York

ELECTRICAL AND OTHER INDUSTRIES ARE OFFERED LOCATIONS WITH
Satisfactory Inducements,
Favorable Freight Rates,
Good Labor Conditions,
Healthful Communities,
ON THE LINES OF
THE ILLINOIS CENTRAL R. R.
AND THE
YAZOO & MISSISSIPPI VALLEY R. R.
For full information and descriptive pamphlet address
J. C. CLAIR,
Industrial Commissioner
1 Park Row, Chicago, Ill.

STUDENTS
Will find that the WESTERN ELECTRICIAN can help them wonderfully in the study of electricity. Subscribe now. $3.00 per year, in advance.
ELECTRICIAN PUBLISHING CO.,
Suite 510 Marquette Bldg., CHICAGO.

CHICAGO EDISON COMPANY REPAIR SHOPS
76 MARKET STREET, CHICAGO. TELEPHONE MAIN 1280
FIRST CLASS EQUIPMENT THROUGHOUT
High-Grade Machine Work of All Kinds
Correspondence Solicited.
Dynamos, Armatures, Motors, Arc Lamps, Fans, Instruments.

A Book Proposition

We want to dispose of our shelf-worn books. Most of them are works usually to be found in scientific libraries, and we believe you will approve the plan by which you can secure some of them practically without cost. The list follows:

	List Price	Sale Price
Mechanical Manual, by E. L. Hohson, Philadelphia, Pa..	.50	.20
Secret Letter and Telegraph Code, by Charles Larrabee, New York, 1884	.60	.20
Electricity, Magnetism and Electric Telegraphy, by Thomas D. Lockwood, New York, 1890	2.50	1.00
Handbook of Patent Law, by Charles B. Mann, Baltimore, 1884	.50	.20
A Treatise on Electro Metallurgy, by Walter G. McMillan, F. C. S., London, 1890	3.50	1.75
Laboratory Manual of Physics and Applied Electricity, Vols. 1 and 2, by Edward L. Nichols, New York, 1894..	6.25	2.50
Condensers, by "Power," New York, 1900	.50	.20
Aluminum, Its History and Occurrence, Properties, Metallurgy and Applications, by Joseph W. Richards, M. A., Philadelphia, 1890	6.00	2.75
Electric Light Installations, Vol. 3. Application by Sir David Salomons, M. A., New York, 1890	1.50	.75
Press Working of Metals, by Oberlin Smith, New York, 1896	3.00	1.75
Outlines of Industrial Chemistry, by F. H. Thorp, Ph. D., New York, 1898	3.50	1.75
Evolution of the Electric Incandescent Lamp, by Franklin Leonard Pope, Elizabeth, N. J., 1889	1.00	.50
Power Catechism, New York, 1889	2.00	.75
Electric Light Installations, Vol. 2, Apparatus, by Sir David Salomons, M. A., London, 1894	2.25	1.25
Electricity Simplified, by T. O'Connor Sloane, Ph. D., New York, 1897	1.00	.50
How to Become a Successful Electrician, by T. O'Connor Sloane, Ph. D., New York, 1899	1.00	.50
Dynamo Electric Machinery, by Silvanus P. Thompson, D. Sc., American edition, New York, 1902	5.00	2.75
Polyphase Electric Currents and Alternating Current Motors, by Silvanus P. Thompson, New York, 1898	3.50	1.75
How to Run Engines and Boilers, by E. P. Watson, New York, 1901	1.50	.75
Drum Armatures and Commutators, by F. Marten Weymouth, London, 1893	3.00	1.50
Handbook for Street Railway Engineers, by H. B. Andrews, C. E., New York, 1902	1.25	.60
Electric Transformation of Power, by Phillip Atkinson, Ph. D., New York, 1893	2.00	1.00
Mechanical Engineers' Pocket Book, by D. Kinnear Clark, M. I. C. E., New York, 1893	3.00	1.25
The Electrical Transmission of Energy, by Arthur Vaughan Abbott, C. E., New York, 1900	4.50	2.00
Telephone Systems of the Continent of Europe, by A. R. Bennett, London, 1895	4.50	2.00
Motor Power and Gearing for Electrical Machinery, by E. T. Carter, C. E., London, 1896	5.00	2.25
Textbook on Gas, Oil and Air Engines, by Bryan Donkin, London, 1896	7.00	3.25
Practical Application of the Indicator, by Lewis M. Ellison, Chicago, 1897	2.50	1.00
Alternating and Interrupted Electric Currents, by Prof. G. Forbes, M. A., London, 1895	1.00	.50
Original Papers on Dynamo Machinery, by John Hopkinson, M. A., New York, 1893	1.00	.50
Patented Telephony, Chicago, 1897	1.50	.60
Turbine Wheels, by Prof. W. P. Trowbridge, New York, 1890	.50	.20
Researches or Fresh Light on the Dynamic Action and Ponderosity of Matter, by "Waterdale," London, 1892..	2.00	.60
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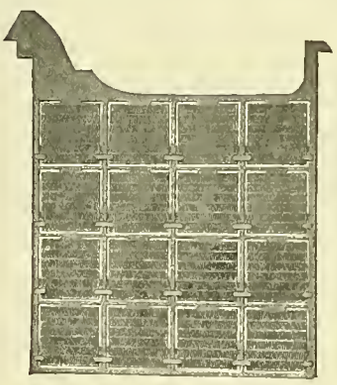

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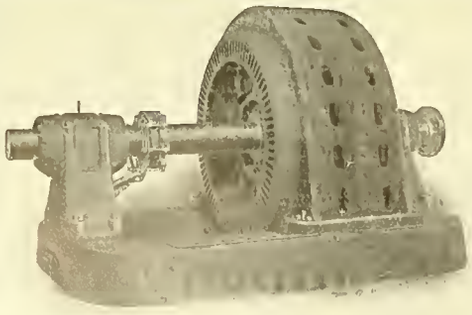

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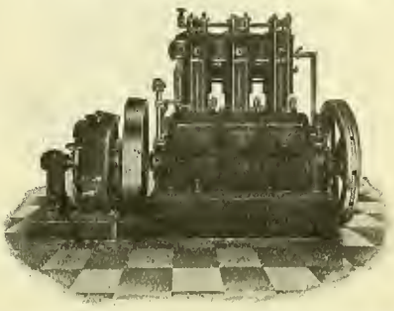

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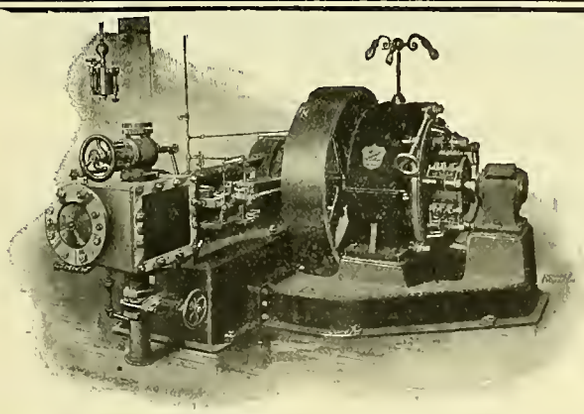

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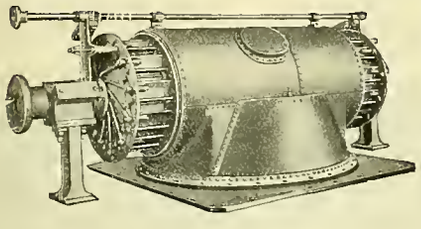

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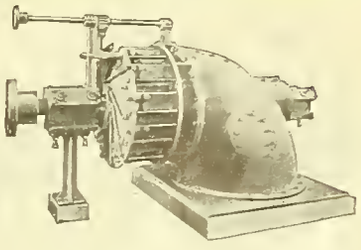

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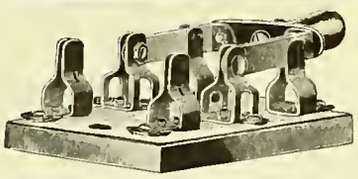

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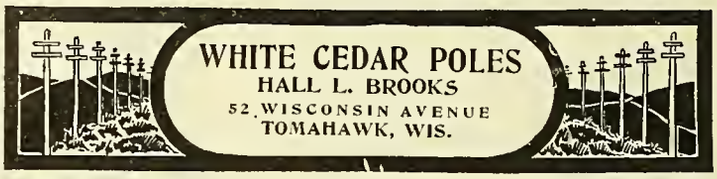

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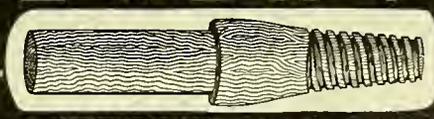

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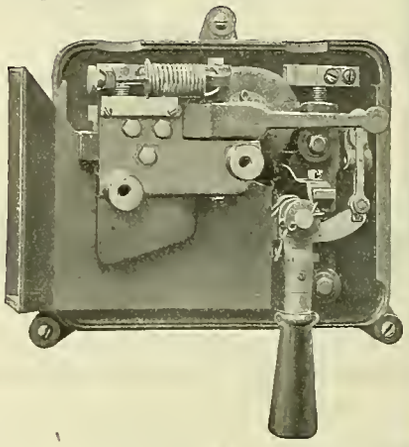

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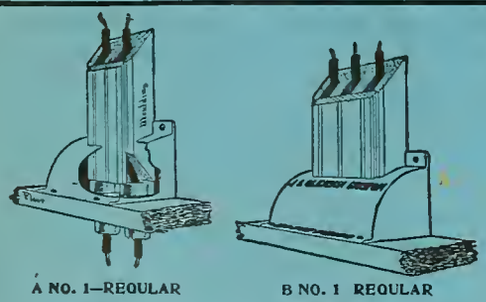

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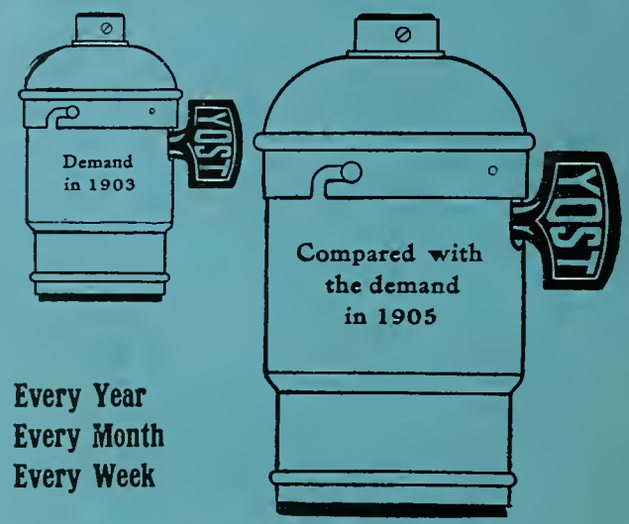

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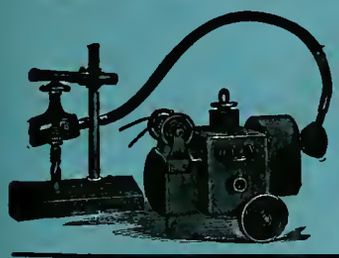
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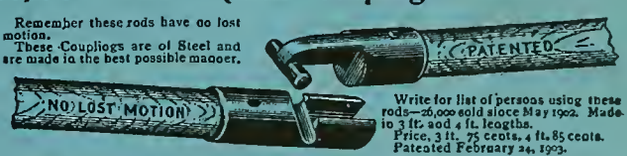

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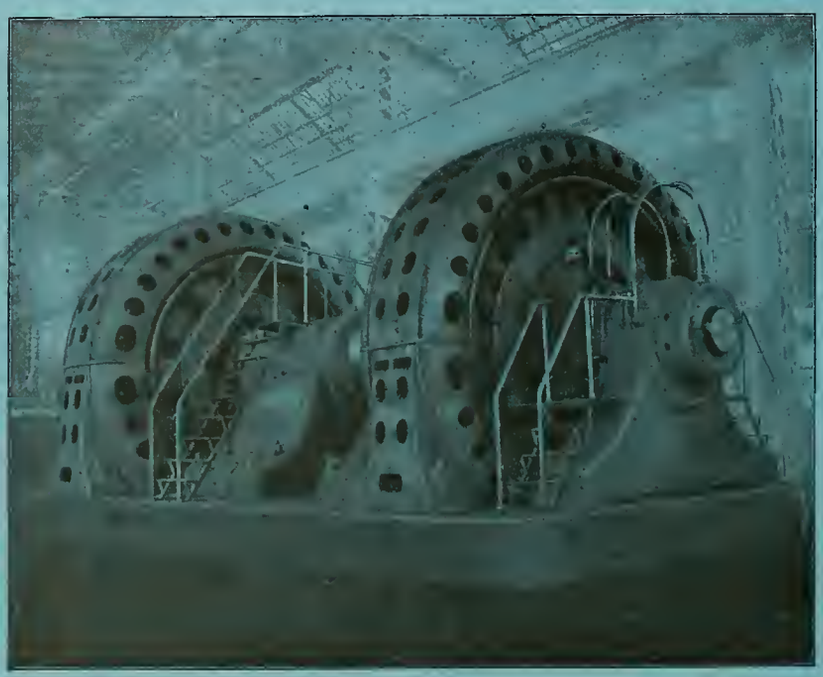

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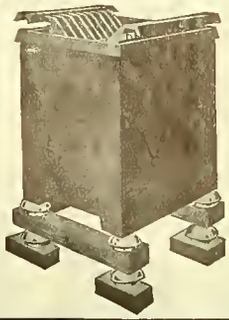

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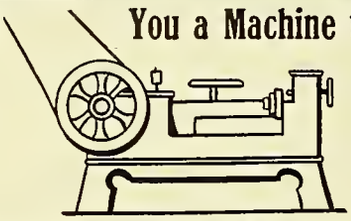
We Will Build You a Machine to Do It  = PROFIT

We don't ask you what "*It*" is, but whatever you make that necessitates the forming and assembling of small parts can be handled entirely by machinery, and we'll furnish the machine. We will design a machine for making *any* electrical specialty and do it for you on the "No Risk to You Basis." Send us a sample of what you make, and we will send you a proposition as to what we can make. You don't pay for the machine until it suits you. Here is a chance to kill competition. C. H. M'CIEHAN & CO., Designers and Mechanical Experts, 11 Broadway, New York.

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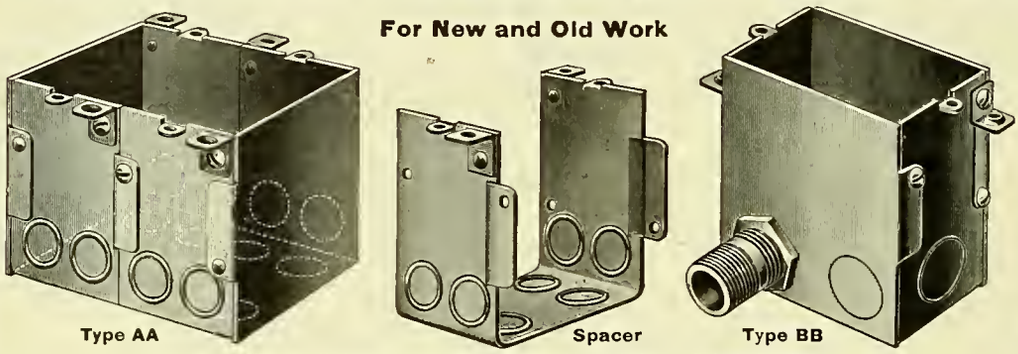

Type AA Spacer Type BB

Approved by the Underwriters National Electrical Association. (Patents Pending.)
Takes all Standard Switches and Receptacles

Designed whereby a **2-gang** box can be converted into any number of gangs by releasing the clamping screws and inserting "Spacers." These gangs are easily assembled with the aid of a screw-driver, and fit together snugly, making a perfect and solid gang box for any required number of switches.

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Are you ever delayed in obtaining German Silver Wire. It may interest you to know that we carry the only complete stock of German Silver Wire in the West.

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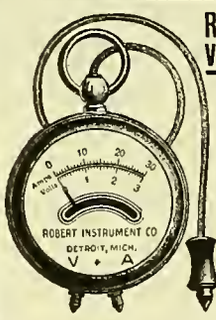

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List Price, $6.00 including leather case.

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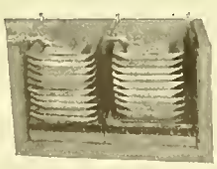

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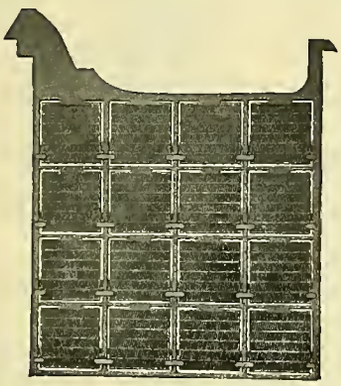

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This Trade-Mark guarantees quality.

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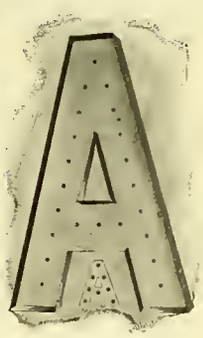

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consisting of raised or grooved metal letters mounted upon angle iron frame or upon full metal back-ground.

We make any kind of an ELECTRIC SIGN. We prepare your design and make a high-grade sign that will last, that will look well, and that can be read at a good distance and at any angle. You pay us no more than cost of material and labor with a reasonable profit added thereto. Write us.

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Lowest internal resistance of any storage battery in the world.

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Western Electric Co.
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Kuhlemeyer, John

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Wesco Supply Co.

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Wesco Supply Co.
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Ginssware, Electric.
Addison Glass Co.

Globes, Reflectors and Shades.
Addison Glass Co.
Haller Machine Co.
Phœnix Glass Co.
Wesco Supply Co.
Western Electric Co.

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Replogle Governor Works.

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Amer. District Steam Co.

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Incandescent Electric Light Manipulator Co.
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Insulating Machinery.
Alton Machine Co.

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Chicago Edison Co.
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Munsell & Co., Eugene.
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New York Insulated Wire Co.
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Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Vulcanized Fibre Co.
Wesco Supply Co.
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Gregory Electric Co.
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Westinghouse El. & Mfg. Co.

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Edison Decorative & Miniature Lamp Dept.
Electric Appliance Co.
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McCandless, H. W
St. Marys Incan. Lamp Co.
Sunbeam Incan. Lamp Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

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Inc. El. Lt. Manipulator Co.

Lamps, Vapor.
Cooper Hewitt Elec. Co.

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Haller Machine Co.

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Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
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Patent Attorneys.
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Stevens & Co., Milo B.

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Phosphor Bronze Sm. Co. Ltd.

Pipe Bending Machines.
Chicago Pneumatic Tool Co.

Platinum, Wire and Sheet.
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Sandwich Pole Changer Co.

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Berthold & Jennings.
Brooks, Hall L.
Fowler, John H.
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Lindsley Bros. Co.
Loud's Sons Co., H. M.
Mueller Company, William.
Pacific Coast Pole Co.
Pilisbury-Watkins Co.
Pittsburg & L. S. Iron Co.
Porter Cedar Company.
S. E. Missouri Cypress Co.
Sterling & Son, W. C.
Torrey Cedar Co.
Western Lumber & Pole Co.
Wilson Co., Jas. I. M.
Worcester Co., C. H.

Polish (Metal).
Hoffman, Geo. W.

Porcelain Specialties.
Pass & Seymour, Inc.
Peru Electric Mfg. Co.

Portables.
Plume & Atwood Mfg. Co.

Power Transmission Machinery.
Allis-Chalmers Company.
Jeffrey Mfg. Co.

Protectors, Telephone Exchange.
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Continuous Rail Joint Company of America.

Railway Supplies.
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Chicago Edison Co.
Gregory Electric Co.
Southwestern Elec. Co.

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General Electric Co.
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Westinghouse El. & Mfg. Co.

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Highland Park College.

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Western Display Co.

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Pass & Seymour.
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Crolius & Son, E. R.
New Idea Soldering Paste Co.
Western Electric Co.

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Speaking Tubes.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Co.

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Pass & Seymour, Inc.

Speed Indicators.
Weston Electrical Inst. Co.

Stokers.
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Chicago Pneumatic Tool Co.
Dayton Mfg. Co.
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General Storage Battery Co.
Gould Storage Battery Co.
National Battery Co.
Smith Storage Battery Co.
Universal Elec. Stor. Bat. Co
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Automatic Electric Co.
Bissell Co., The F.
Central Electric Co.
Electric Appliance Co.
International Tel. Mfg. Co.
Kellogg Switchb. & Sup. Co.
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Transformers.
Allis-Chalmers Company.
(Bullock El. Mfg. Co.)
Central Electric Co.
Crocker-Wheeler Co.
Electric Appliance Co.
Ft. Wayne Elec. Works, Inc
General Electric Co.
Kuhlman Electric Co.
La Fayette Elect'l. Mfg. Co.
National Electric Co.
Stanley—G. I. Elec. Mfg. Co.
Wagner Electric Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Trucks, Electric Car.
General Electric Co.
Westinghouse El. & Mfg. Co.

Turbines, Steam.
Allis-Chalmers Co.
General Electric Co.
Westinghouse Machine Co.

Turbine Water Wheels.
Leffel & Co., Jas.

Vulcanized Fibre.
Vulcanized Fibre Co.

Wire Rope Machinery.
Alton Machine Co.

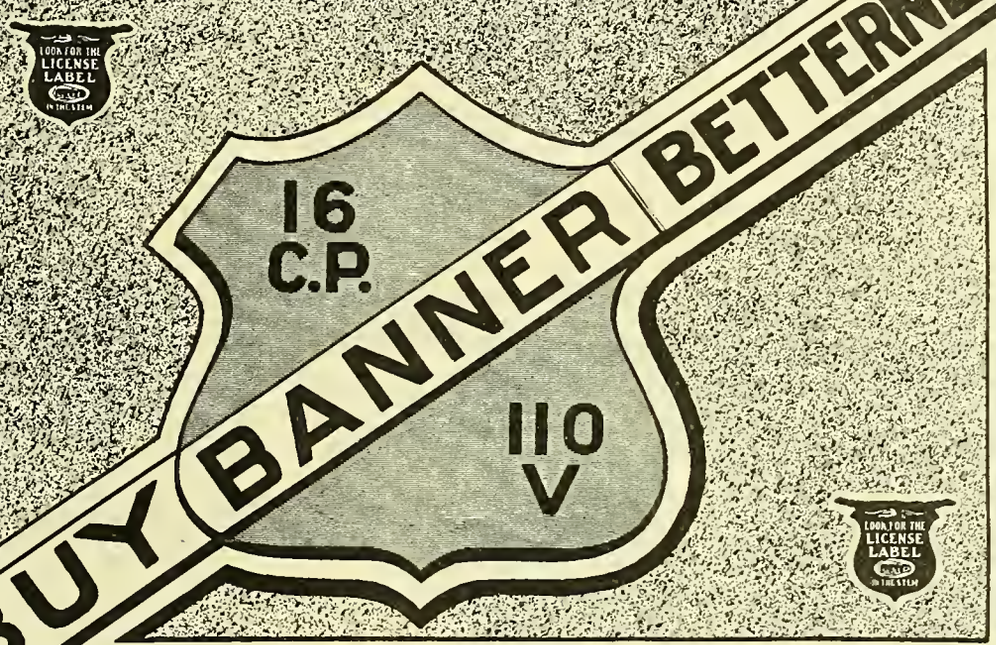
Wires and Cables—Magnet Wires.
American Electrical Works.
Belden Mfg. Co.
Bissell Co., The F.
Central Electric Co.
Crescent Ins. Wire & Cble. Co.
Electric Appliance Co.
General Electric Co.
Hazard Manufacturing Co.
Indiana Rub. & Ins. Wire Co.
India Rubber & Gutta Percha Insulating Co.
Kellogg Switch. & Sup. Co.
Manhattan Elec. Supply Co.
National India Rubber Co
New York Insulated Wire Co.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co
Roebling's Sons Co., J. A.
Safety Ins. Wire & Cable Co.
Simplex Electrical Co.
Standard Underground Cable Co.
Wesco Supply Co.
Western Electric Company.

Woodwork, Telephone.
Telephone Woodworking Co.

For Alphabetical Index of Advertisements See Page 3.

The Banner Label is the strongest guarantee of lamp excellence that you can get.

We don't mean that the label is what makes the lamp valuable; it was Banner Lamps that made the Banner Label famous.



The only way for you to find out to what extent our claims are supported by facts, is to buy Banner Lamps.

Order a trial lot. Test! Compare!

THE BANNER ELECTRIC CO.

YOUNGSTOWN, OHIO.

St. Marys Incandescent Lamp Company
VS.
THE LAMP TRUST

The spontaneous endorsement and substantial appreciation we are receiving from buyers of incandescent lamps in our efforts to give them a **"square deal"** is far beyond our expectations. The American people do resent monopolies, and, more than the monopolies, they resent the monopolistic methods. We are making for buyers

A WIDE OPEN LAMP MARKET

We are here with a hundred-thousand dollar Pennsylvania corporation, a great factory finely equipped with modern machinery, and the highest skilled men in lamp making—and it's to your interest, quite as much as to ours, for you to write us and

GET THE NON-TRUST PROPOSITION ON INCANDESCENT LAMPS

Send to us to-day. Tell us when you will be in the market and for what quantity of lamps, and at least be informed.

St. Marys Incandescent Lamp Company
ST. MARYS, PENNSYLVANIA

William M. Rothschild, President

BITUMINIZED FIBER CONDUIT
FOR UNDERGROUND CONSTRUCTION

The American Conduit Company has a corps of experts in underground construction and is prepared to furnish supervision of work if desired. We would prefer to co-operate with contractors in underground construction, but if desired will submit estimates and bids and take contracts for completed underground systems in any part of the United States and Canada.

American Conduit Co.

Main Offices: 1005-6 Manhattan Building, Chicago

Other Offices:

170 Broadway, New York. 336 Macy St., Los Angeles.

A. C. MOTOR CONTROLLERS

We are prepared to furnish A. C. controlling apparatus for any purpose for which the A. C. motor is used.

We have developed a large number of types for different purposes and will be pleased to furnish you with information and quotations on receipt of your requirements.

THE

Cutler-Hammer Mfg. Co.

Milwaukee

New York Boston Chicago Pittsburg

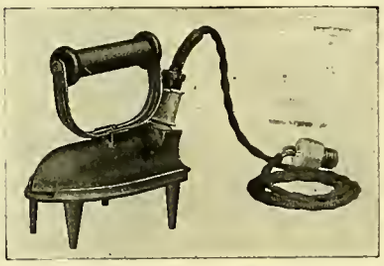
General Electric Company

ELECTRIC HEATING DEVICES

Organize A Heating Department

Increase Your Day Load By Advocating Electric Heating Devices

Start With Our Electric Flat-Irons



Six-Pound Electric Flat-Iron

Supplied in following sizes:

3 pounds, 250 watts, 95-125 volts
6 pounds, 500 watts, 95-125 volts
8 pounds, 600 watts, 95-125 volts

Designed On Correct Electric and Thermal Principles

Renewable Resistance Unit of High Efficiency and Durability

Only Enough Metal To Carry Heat From Resistance Unit to Work

Sales Offices in All Large Cities

Principal Office SCHENECTADY, N. Y.

Chicago Office: Monadnock Building

777

FREE to CENTRAL STATIONS

50 FEET "ONEIDA" GALVANIZED CHAIN

EXPRESS PREPAID

Our flexible steel chain (American pattern) herewith illustrated will outwear cord, cable or rope many times over. Give it a trial for raising and lowering Arc Lamps suspended from Mast Arms.

You will use no other attachment after making this test as "Oneida" Galvanized Chain is absolutely uniform in strength.

HEAVILY GALVANIZED! RUST PROOF!

You need have no fear of your lamps falling to the street as happens so unexpectedly when strands of cable give way or a rope has rotted out.

MANUFACTURED BY

Oneida Community, Ltd.

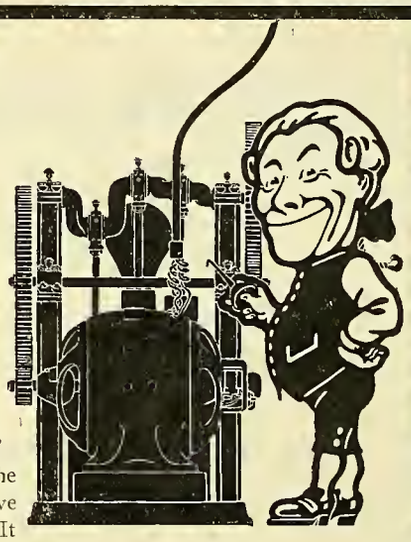
ONEIDA, NEW YORK.

Branch Factory, Niagara Falls, Ont. Canada

Address all inquiries to Sales Dept.

ELECTRICITY

For Little Things As Well As Big



A FEW SUGGESTIONS

The Edison Light is Not Expensive.

THE EDISON LIGHT is the cheapest of all artificial illuminants, including convenience, cleanliness and effectiveness. But even without these added considerations it is cheap enough for anyone.

The Edison service is available to the smallest as well as the largest user. So cheap is the service that it can be afforded in the smallest homes. In fact, here its advantages are more apparent than almost anywhere else. However small the rooms, or closely crowded, the atmosphere remains pure and unchanged.

Perhaps no greater blessing can be brought into any home than the Edison light. It would be a better Christmas present than many other gifts costing far more.

The Convenience of the Edison Service.

When speaking of home lighting one should not forget the convenience of the closet light which may be automatically connected or disconnected on opening or closing the door; or the porch light burning brilliantly in all kinds of weather.

Nothing so much as electric light adds to the attractive cheerfulness of the dining room or parlor, and then there is the convenient reading lamp at the head of the bed, or the hall light controlled individually from the head or foot of the stairs.

A writer in the November *Ladies' Home Journal* states that "burglars avoid an electrically lighted house," "that, other things being equal, a burglar will always pass a house lit by electricity."

A Christmas Suggestion.

The Christmas list for 1905 should contain some of the new electric heating devices. An electric hair curler, or handkerchief iron; or a heating pad (taking the place of the troublesome hot water bottle), or foot warmer; a coffee pot, cereal dish, chafing dish or any other of a hundred devices.

The smaller articles make convenient traveling companions, and in these days when electric light is to be found everywhere there are few places in which they cannot be used in the socket of an ordinary incandescent lamp.

Small Power for the Household.

The small motor operating an electric fan or a sewing machine costs very little to buy and insignificantly little to run from hour to hour. It brings great good at low cost.

Sanitary Labor-Saving Cleaning.

The convenient, efficient, cheap and, what is more important, thoroughly sanitary vacuum cleaning system, operated by an electric motor, should be known to every householder.

The same system may be used for cleaning clothes. In connection with the Edison System this is one of the approaching solutions of the servant problem.

A Good Substitute for Sunlight.

The arc light for the brilliant illumination of large areas is the most satisfactory substitute for sunlight that has been found. Its extensive use by shopkeepers and others makes the streets wonderfully attractive at night.

Modern Publicity.

The electric sign is the most modern and effective of advertising methods. It illuminates the store-front and at the same time tells impressively the story desired to the passing public. Large signs in more exposed positions are seeable great distances. In no other way can so many people be reached in a manner so cheap and at the same time so effective.

It has been said that without the electric light—without the Edison System—New York City would be a fourth rate village. If Electric Power be included we are inclined to agree with this opinion.

Competition also exists between communities. Omitting the convenience, cleanliness, cheapness and all else the Edison System stands for, brilliant illumination of the streets, show windows and stores, creates an enormous volume of business. Imagine our great Opera House and the hundred playhouses of New York, without electric lights—these things make New York increasingly attractive and, in consequence, increasingly prosperous.

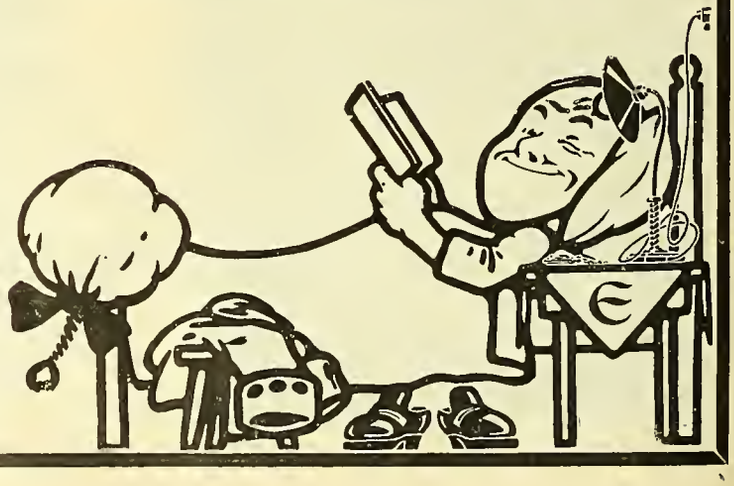
Electric Power for Any Purpose.

More than 100,000 horsepower in electric motors are supplied from the mains of The New York Edison Company. During October, 4,457 horsepower were contracted for.

There is no application of power that cannot be accomplished with an electric motor. Whether power is desired for the smallest sewing machine or the largest and fastest elevator; for the small or great printing press, or an electric pump; for a jeweler's lathe or the largest manufacturing establishment; a motor, large or small, directly attached to the machine which it operates is now available. With the Edison System behind it, 1 horsepower, 1,000 horsepower or 10,000 horsepower may be obtained with equal facility.

Any kind of information bearing upon these subjects can be obtained, quickly and without cost, by directing a note to the General Offices of

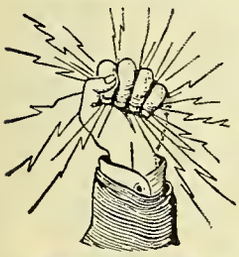
THE NEW YORK EDISON COMPANY



FRANK N. PHILLIPS, Pres. EUGENE R. PHILLIPS, V. P. C. H. WAGENSEIL, Treas. C. R. REMINGTON, Jr., Sec.

AMERICAN ELECTRICAL WORKS,

PROVIDENCE, R. I.



BARE AND INSULATED ELECTRIC WIRE,

ELECTRIC LIGHT LINE WIRE,
INCANDESCENT AND FLEXIBLE CORDS,
Railway Feeder and Trolley Wire,
AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.
CABLES FOR AERIAL AND UNDERGROUND USE.

NEW YORK STORE, W. J. Watson, 26 Cortlandt St.
CHICAGO OFFICE, F. E. Donohoe, 135 Adams St.
MONTREAL BRANCH, Eugene F. Phillips' Electrical Works.
MAIN OFFICES AND FACTORIES, PHILLIPSDALE, R. I.

"Little" Giant Storage Batteries

are constructed for all purposes to which storage batteries are adaptable. They retain their charge for long periods. Have greatest output for size and weight. Our Sparking Batteries have hard wood cases, thoroughly acid proof. Every battery guaranteed.

MANUFACTURED BY

Chicago Pneumatic Tool Company

Fisher Building, CHICAGO 95 Liberty Street, NEW YORK

Copley-Senior Carbon Brush

Uniform throughout, a feature lacking in all other brushes

FOR GENERATORS AND MOTORS

Thoroughly and Permanently Self-Lubricating
Will not Cut Will not Spark Carry more Load

GUARANTEED

COPLEY-SENIOR CARBON CO.

GEO. W. COPLEY, Pres't and Gen'l Mgr.
465 GREENWICH STREET - NEW YORK

FROSTS, SLEETS, THAWS AND FREEZINGS ARE COMING!

Go Over Your Lines and Anchor the Weak Places With

STOMBAUGH GUY ANCHORS

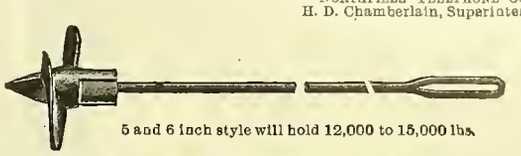
We give herewith the experience of one company

OFFICE OF NORTHFIELD TELEPHONE COMPANY,
NORTHFIELD, VT., Dec. 5, 1904.

Gentlemen:—Yours of Nov. 30th received and contents noted. We have used your Anchors and have no doubt that they will prove satisfactory.

On the night of Nov. 20th this section was visited by the most severe storm we have had for years. On our lines running East and West there was from one to two inches of ice. Those poles guyed by the Stombaugh Guy Anchor are still standing, and we think that this is as good a test of their worth as we could have had.

Very truly yours,
NORTHFIELD TELEPHONE COMPANY,
H. D. Chamberlain, Superintendent.



5 and 6 inch style will hold 12,000 to 15,000 lbs.

W. N. MATTHEWS & BRO.

203 N. 2nd St. MANUFACTURERS ST. LOUIS

NATIONAL CODE STANDARD

WEATHER-PROOF TRADE MARK "O.K." LINE AND HOUSE WIRES

"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Ideal Wire.

Prices and Samples on Application.

Phillips Insulated Wire Co.

Office and Factory: PAWTUCKET, R. I.

NOVELTY CABLE SLEEVE—Made also in two and three way branches.

SPLICES AND POT HEADS

Can be made by any man who can handle a soldering iron, better and cheaper than by any lead joint wiper. And, tho' absolutely permanent, they can be opened at any time for inspection or repair and again restored. How much money would this have saved *your* exchange? Details in Catalogue 125-A.

TOLEDO, OHIO THE F. BISSELL COMPANY

Made by THE F. BISSELL COMPANY TOLEDO, O.

NOVELTY CABLE POT HEAD

As Sure As The Sun

Edison Primary Batteries

Formerly Edison--Lalande

One of their distinctive features is the sure and constant current delivery. They are so constructed that internal resistance grows less with use, polarization is completely obviated, and they work at full strength until all the energy of every element is exhausted. It will pay you to investigate their other points of superiority. Write for booklet No. 7.

EDISON MFG. CO. Factory: Orange, N. J.
New York: 31 Union Sq. Chicago: 304 Wabash Ave.

PREDOMINATES IN 27 States

"IT gives me great pleasure to state, that for 'Gitthereitiveness' your periodical certainly is a winner. As you perhaps are aware, the company I travel for, advertises in all the electrical papers, and it has been a question in my mind whether they reached every central station, as their advertising manager would have our company believe. So, for one year I have kept account of the electrical papers and periodicals subscribed for and received by the manager or superintendent of electric light companies in twenty-seven states, (which has been my territory), and in summing it up, I find that your periodical predominates, three to one. I do not get in many telephone plants, but when I do, I invariably find the 'Western Electrician' staring me in the face."

The letter from which the above is taken, is dated May 8, 1905, and is on file in this office.

WANTED, FOR SALE *and similar* **WANT COLUMN** *advertisements (50 words or less), $1.50 an insertion; additional words 3c each.*
POSITION WANTED *advertisements (50 words or less), $1.00 an insertion; additional words 2c each.*

POSITION WANTED

With an electric light company as manager or superintendent, in a town of from 2,500 to 25,000; twenty years' experience; proficient, energetic and honest; references, prominent central station officers. Address Box 551, care Western Electrician, 510 Marquette Building, Chicago.

POSITION WANTED

By an all around electrician. Four years' experience, age 23 and married. Thoroughly acquainted with outside and inside work, both D. C. and A. C. arc lamps, meters, etc. Can furnish A1 references. Address Box 548, care of Western Electrician, 510 Marquette Building, Chicago.

WANTED.

A man experienced in testing and installing alternating current and direct current machinery. Write fully, giving age, qualifications and salary expected. Address Box 550, care of Western Electrician, 510 Marquette Building, Chicago.

WANTED

An experienced electrician and superintendent to take charge of an up-to-date factory in the manufacture of jump-spark coils. Only a fully competent man wanted. Address Box 549, care of Western Electrician, 510 Marquette Bldg., Chicago.

WANTED

By a prominent company, an electrical engineer thoroughly familiar with electrical and mechanical design of railway or stationary D. C. motors.

Must be a technical graduate of several years' practical experience. Write fully, giving age, qualifications, experience and salary expected. Address Box 547, care of Western Electrician, 510 Marquette Bldg., Chicago.

FOR SALE

At a bargain. One 30 K. W. Warren Alternator, single phase, 16,000 alternations, 2,300 volts, marble switchboard, 4 H. P. Wagner motor, 4,000 No. 4 copper wire, 6 or 8 Transformers and many other electrical appliances. Address A. OTTO, Fredonia Kansas.

FOR SALE

Magnet Wire Machines; inquire
NORTHERN WIRE & CABLE CO.
Milwaukee, Wis.

FOR SALE—A Paying Plant

A Central Station Electric Light Plant in good Illinois town, 2,500 population, new machinery, 10-year street light contract. About $5,000 cash required, balance can be paid out of profits. This is a good opportunity. Address Box 552, care Western Electrician, 510 Marquette Bldg., Chicago.

TELEPHONE ENGINEERS.

Engineers of experience with telephone manufacturers will gain information to their interest by writing to Box 1732 General Post Office, New York City, in regard to business openings. State nature of present work and name of employer as well as age, experience and salary expected.

BARGAINS IN NEW DYNAMOS

2 bi-polar 25 light, 125 volts, compound wound, $58.00 each.
2 bi-polar 50 light, 125 volts, compound wound, $78.00 each.
All the above, speed 1200. Complete with pulley, sliding base and rheostat. Boxed F.O.B. St. Louis, Mo.

STAR DYNAMO CO., - Jefferson City, Mo

DEPARTMENT OF THE INTERIOR, Washington, D. C., October 25, 1905. Sealed proposals will be received at the office of the Engineer, United States Reclamation Service, Billings, Montana, until 3 o'clock p. m., December 15, 1905, for installing a telephone system having eight or more telephone stations and 22 miles or more of pole line. Particulars may be obtained by application to the Chief Engineer of the Reclamation Service, United States Geological Survey, Washington, D. C., or to Robert S. Stockton, Engineer, Huntley, Montana. E. A. Hitchcock, Secretary.

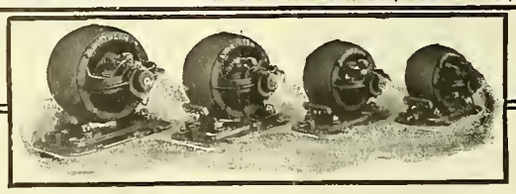
TO-DAY
Write for easy terms on
Roberison-Thompson Indicator
Willis Planimeter
Victor Reducing Wheel
Jas. L. Robertson & Sons
198 Fulton St., New York

SPEER HIGH-GRADE CARBON BRUSHES

SPEER CARBON CO.
ST. MARYS, PA.

PATENTS

PROTECT YOUR IDEAS. No patent, no fee.
Consultation free. Established 1864.
Milo B. Stevens & Co., 848 14th St., Washington.



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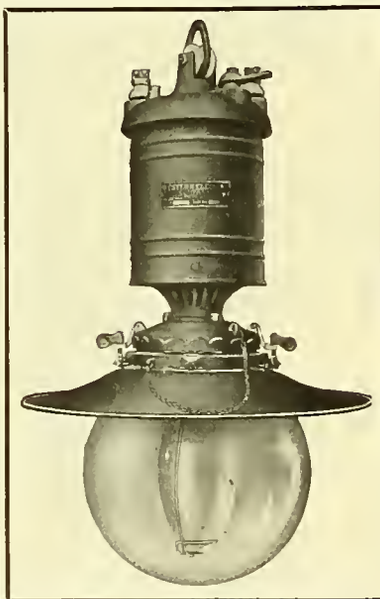
NORTHERN SMALL MOTORS

Compact....Efficient....Superior

High type of construction....susceptible of good speed variation....multipolar....form-wound armatures....simple....hardy....trustworthy.

Booklet No. 3325

NORTHERN ELECTRICAL MFG. CO.
Engineers...Manufacturers Madison, Wis., U. S. A.
425 Monadnock Block, Chicago, Ill.



WHAT HAS BEEN

satisfactory service proves them to be

STANDARD

OUR SERIES ENCLOSED ALTERNATING ARC LAMPS

WESTERN ELECTRIC CO.

CHICAGO NEW YORK
OTHER LARGE CITIES

We are Headquarters for ELECTRICAL REPAIR WORK We operate the largest repair shops in America and have exceptional facilities for quick work. We repair **all kinds** of electrical apparatus and save our customers **weeks** in time in comparison with sending the work to the manufacturers direct. We have just reduced our prices and ask you to get our quotations on

Armatures Rewound, Commutators Refilled, Transformers Rewound, Etc.

Send for our monthly **"Bargain Sheet,"** showing net prices on our stock of **second-hand** dynamos, motors, meters, transformers and supplies. Every article a bargain.

GREGORY ELECTRIC CO.
54-62 S. Clinton Street - CHICAGO

Second-Hand Machinery

1 24x18 Ideal Automatic Engine.
2 66-in. x 20-ft. Return Tubular Boilers built for 130 lbs. working pressure.
We also have on hand the following leather belts all in good condition:
57 ft. of 18 inch double ply.
73 ft. of 34 inch double ply.
48 ft. of 14 inch double ply.
108 ft. of 24 inch double ply.
85 ft. of 34 inch triple ply.
The above is all in first-class operating condition and is offered subject to prior sale.

Springfield Light, Heat & Power Company
Springfield, Ill.

WATER-Tight Push Buttons for use in damp places We are prepared to supply anything electrical.

Catalogue No. 21 is a 700 page encyclopaedia of "Something Electrical for Everybody"

Manhattan Electrical Supply Co.

32 Cortlandt Street NEW YORK
188 Fifth Avenue CHICAGO

Water-Wheel Governors

Our new mechanical governors co-operate with the inertia effect on the water and the momentum of the plant.
They have cut the cost of good government in two. Guaranteed in every particular.

REPLOGLE GOVERNOR WORKS
AKRON, OHIO
WRITE FOR DESCRIPTIVE MATTER W.

Locations for Industries

Erie Railroad

Chicago to New York

The Erie Railroad Company's Industrial Department has all the territory traversed by the railroad districted in relation to resources, adaptability, markets and advantages for manufacturing, and can advise with manufacturers in relation to the most suitable locations. For full information address

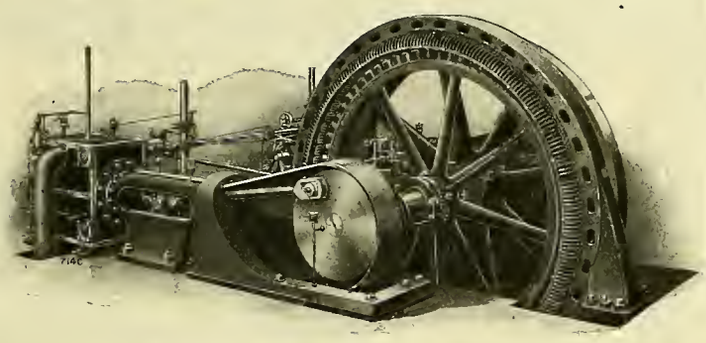
LUIS JACKSON
Industrial Commissioner, Erie Railroad Company
21 Cortlandt Street, New York

CHICAGO EDISON COMPANY REPAIR SHOPS
76 MARKET STREET, CHICAGO. TELEPHONE MAIN 1280
FIRST CLASS EQUIPMENT THROUCHOUT
High-Grade Machine Work of All Kinds Correspondence Solicited.
Dynamos, Armatures, Motors, Arc Lamps, Fans, Instruments.

ELECTRICAL REPAIRING

We Guarantee All Work

DYNAMOS, ARMATURES, MOTORS, ARC LAMPS, INSTRUMENTS, GENERAL REPAIRING. Correspondence Solicited.
NEW AND SECOND-HAND MACHINERY FOR SALE
SOUTHWESTERN ELECTRIC CO., ST. LOUIS.



500 K. W. Engine Type Alternating Current Generator.

Direct and Alternating Current

Electrical Machinery

Built in all Capacities and Types

NATIONAL ELECTRIC COMPANY
MILWAUKEE U. S. A.

The "REFLECTRIC"

is furnished FREE to customers by live Central Stations.
Write for booklet.

WESTERN DISPLAY COMPANY, SOLE MANUFACTURERS
ST. PAUL, - - MINN.

The Business Man's Train

BETWEEN
CHICAGO and NEW YORK
IS

"The Pennsylvania Special"

Pioneer 18-Hour Train which runs every day over
THE PENNSYLVANIA NEW YORK SHORT LINE

Leaving, Chicago, Union Station 2:45 P. M. Arriving New York 9:45 next morning.
Returning, Leave New York 3:55 P. M. Arrive Chicago 8:55 A. M.

Train is equipped with Vestibuled and Electric Lighted Library, Smoking, Dining, Sleeping and Compartment Observation cars.

Seven Other Daily Trains
CHICAGO to NEW YORK

For time of trains Pittsburg, Baltimore, Washington, and Philadelphia, call at City Office, 248 South Clark Street or address

G. G. BELTZHOOVER, District Pass. Agent
Chicago, Ill

C. L. KIMBALL, Asst. Gen'l Pass. Agent
Chicago, Ill

THE ARNOLD COMPANY
ENGINEERS–CONSTRUCTORS
ELECTRICAL – CIVIL – MECHANICAL
MARQUETTE BUILDING
CHICAGO

BYLLESBY, H. M. & Co.
(Incorporated)
ENGINEERS
Design, Construct and Operate Railway, Light Power, Hydraulic and Gas Plants. Examinations and Reports.
New York Life Building - CHICAGO, ILL

HUMPHREY, HENRY H.,
CONSULTING ENGINEER,
Central Lighting Stations.
Electric Power Transmission.
SUITE 1505 CHEMICAL BLDG., ST. LOUIS.

RUEBEL & WELLS,
CONSULTING, MECHANICAL AND ELECTRICAL ENGINEERS,
Suite 301 Chemical Building,
ST. LOUIS, U. S. A.

BADT, F. B.
WILLIS, G. M.
Experts. Consulting Engineers.
1504 Monadnock, Chicago

CORNELL, T. S.
Electrical, Mechanical and Civil Engineer,
136 S. BURDICK ST., ROOM 2,
KALAMAZOO, MICH.

IT WILL PAY
engineers not represented in this department to carry a card regularly.

YOU DON'T KNOW
how many customers you fail to get by not having your name in this Directory.

A WEEKLY REPRESENTATION
in this "Directory" enables engineers to keep before all possible customers.

A LITTLE CARD
in this Directory may bring a big customer.

ROBERT W. HUNT & Co.,
ENGINEERS
1121 The Rookery, Chicago. 66 Broadway, New York.
Monongahela Bank Bldg., Pittsburg.
Norfolk House, Cannon St., London.

Long Distance Phone Central 2443.
SCHOTT, W. H.,
ENGINEER AND CONTRACTOR.
SPECIALTIES—Central Station Heating Plants Water Works Steam Plants, Electric Light, Gas and Street Railway Plants.
1220-21 MARQUETTE BUILDING, CHICAGO.

W. E. BAKER H. B. BISHOP
BAKER, W. E. & CO.
ENGINEERS
ELECTRIC RAILWAYS,
27 William St., NEW YORK

General Electric Securities Co.
Specialty made of financing Electric Light, Telephone, Street Railway, Gas and Water Works Properties. Purchase properties outright. Place entire Bond Issues and Negotiate Loans on same.
1509 Chemical Bldg., St. Louis, Mo.

KOHLER BROS.,
Contracting Electrical Engineers,
Lighting, Power, Railways,
1804-1806-1808-1810-1812 Fisher Building,
CHICAGO.

STANTON, LE ROY W.
Consulting Telephone Engineer
Plans, Specifications and Supervision of Installation of Complete Telephone Plants
Special Reports on Telephone Properties and Apparatus
411 Electrical Bldg., Cleveland, Ohio

EMPIRE
MINIATURE
LAMPS
Send for Circular
H. W. McCANDLESS & CO.
Licensed Manufacturers
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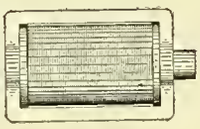

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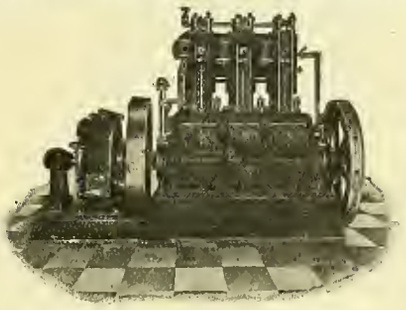

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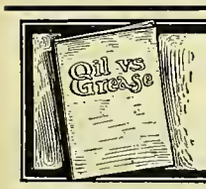

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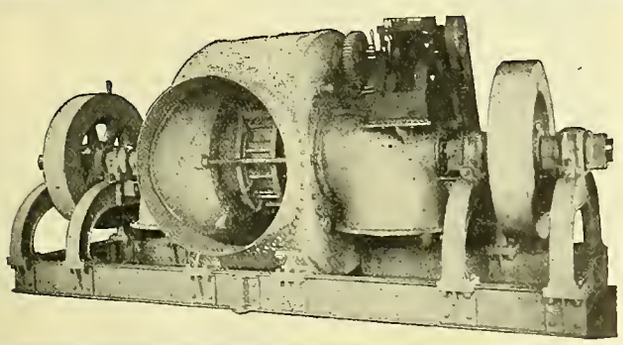

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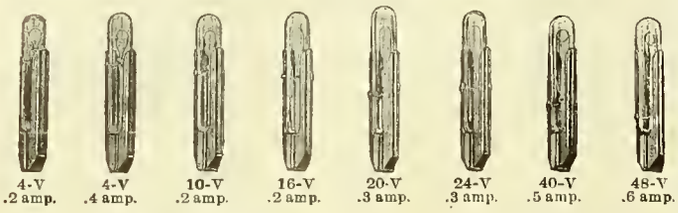

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4	.2	.2
4	.2	.4
5	.2	.15
6	.2	.15
10	.2	.1
12	.2	.1
14	.2	.1
16	.2	.1
20	.3	.1
24	.3	.075
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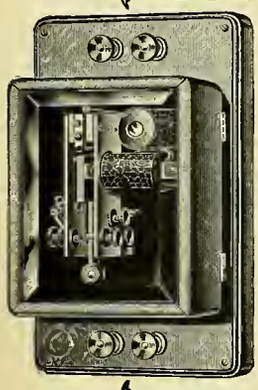

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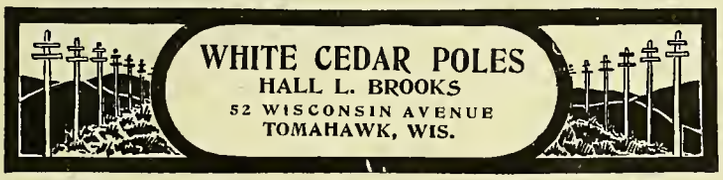

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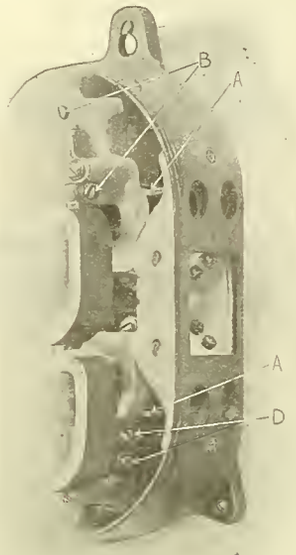

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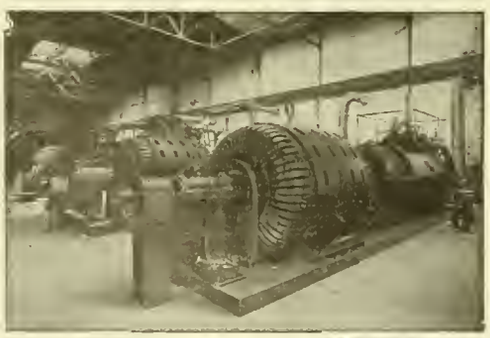

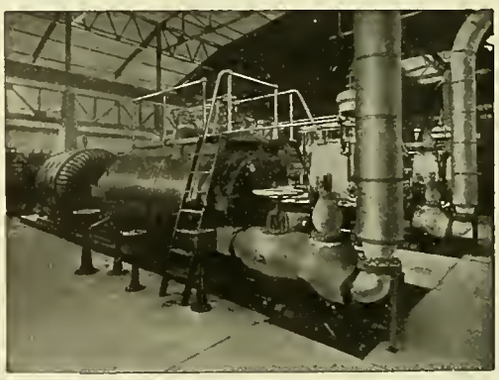

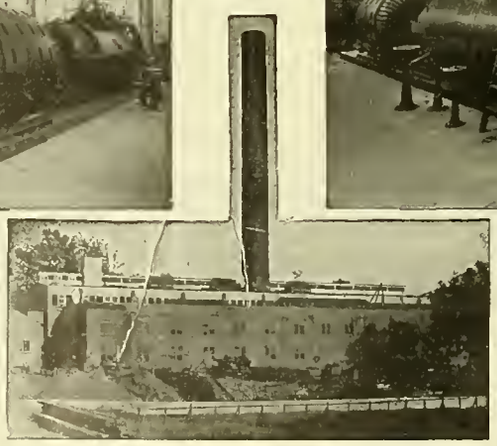

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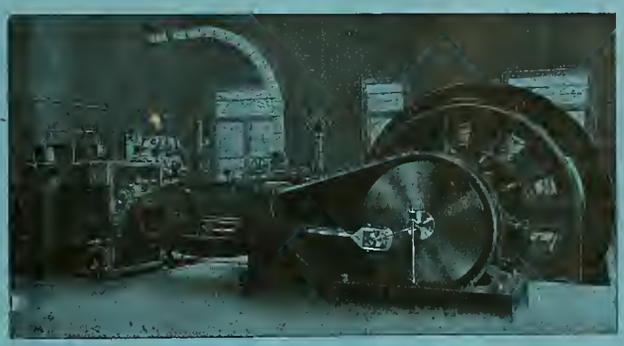

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FOR LIGHTING AND POWER

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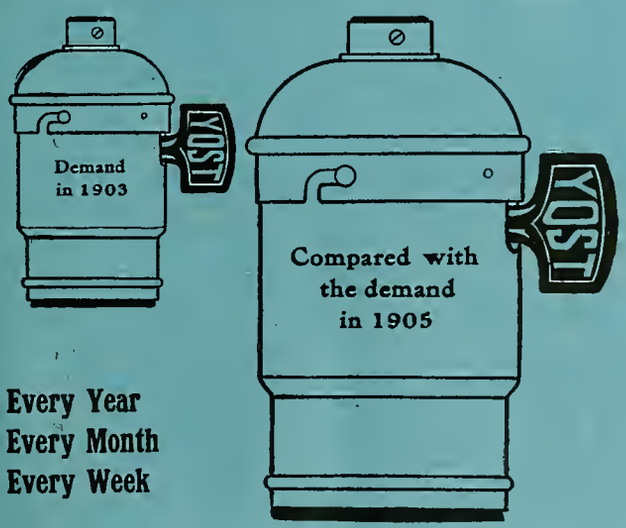

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Vol. XXXVII. $3.00 Per Annum. Copyright, 1905, by Electrician Publishing Company, Chicago. CHICAGO, DECEMBER 2, 1905. Entered at Chicago Postoffice as mail matter of the second class. 10 Cents a Copy. No. 23.

Technology (Juneteenth) Mass. Inst. of Tech. Boston Mass.

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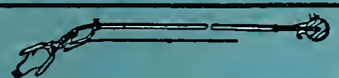
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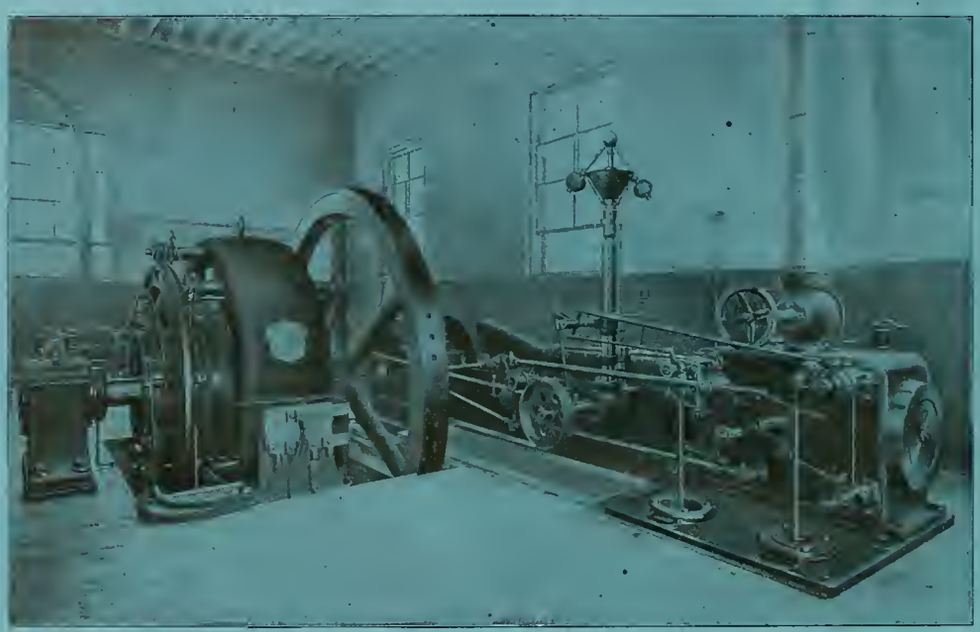

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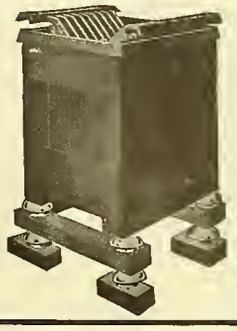

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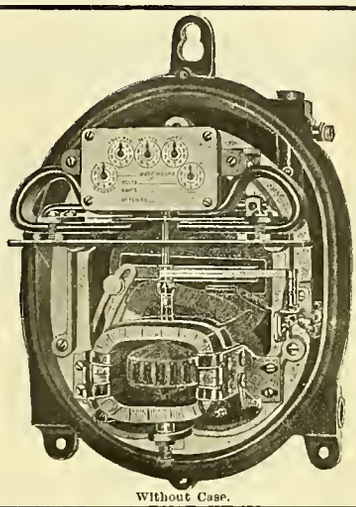

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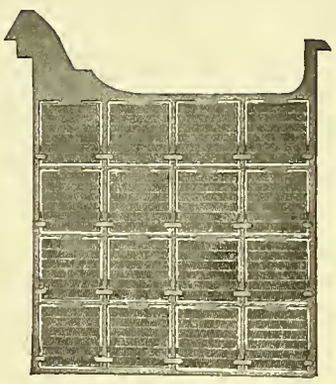

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The cipher code enables correspondence to be carried on completely by telegraph.

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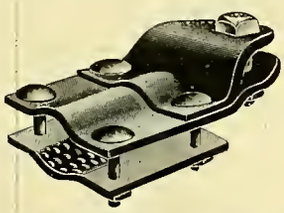

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WORKS: DEPEW, N. Y.

Bulletins.

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Westinghouse El. & Mfg. Co.

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No, in spite of what you may think to the contrary, it is not "utter nonsense" to mention "hurdles" and Buckeye Lamps in the same breath! We were fully aware that the word "hurdles" would catch your eye so we put it there on purpose (for there are so many plain, matter-of-fact lamp ads that DO NOT catch your eye!)

Now, we simply mentioned "hurdles" because there is no question but that this "Buck" jumped 31 "hurdles" before it became the "stamp of quality." Think of it, every Buckeye lamp goes through

31 RIGID INSPECTIONS!

Do you realize what this means? These 31 rigid inspections give you a lamp as perfect as it is possible to make an incandescent lamp. That is why we say

"BETTER BUY BUCKEYE!"

BUCKEYE ELECTRIC CO.

MAIN OFFICE AND WORKS:
CLEVELAND, OHIO

PITTSBURG OFFICE:
1102 EMPIRE BUILDING

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A trial order will convince you of their SUPERIORITY. Order direct or from stocks of following agents:

Dunham, Carrigan & Hayden, San Francisco. Casstarphen Electric Co., Denver. Hide Leather & Belting Co., Indianapolis. H. F. Reynolds Electric Co., Marion, Ind. Henry L. Walker Co., Detroit, Mich. B. & C. Electrical Construction Co., Utica, N. Y. The Post Glover Electric Co., Cincinnati. The Erner-Hopkins Co., Columbus, Ohio. Union Electric Co., Pittsburg. Duncan-Hobson Co., Dallas-Houston, Texas. Lee Bros., Memphis, Tenn. Chas. E. Sharp, Special Agent Republic of Mexico, Security Bldg., St. Louis.

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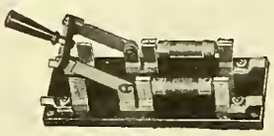
WILLARD STORAGE BATTERIES

FOR ALL PURPOSES
Manufactured by
THE WILLARD STORAGE BATTERY CO.
CLEVELAND, OHIO

Hill Switches

Are the Standard

250 Volt — Style B. Single Break — 600 Volt



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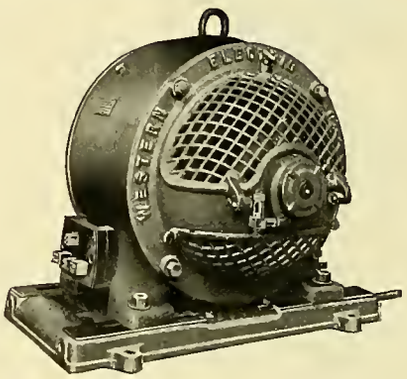
250 Volt — Style A Double Break — 600 Volt

411

W. S. Hill Electric Co.
NEW BEDFORD. MASS.

The
Various Uses



for which motors are manufactured require that they be of convenient size, high efficiency, and of great flexibilty. The performances of our motors under severe conditions prove their adaptability.

WRITE FOR INFORMATION

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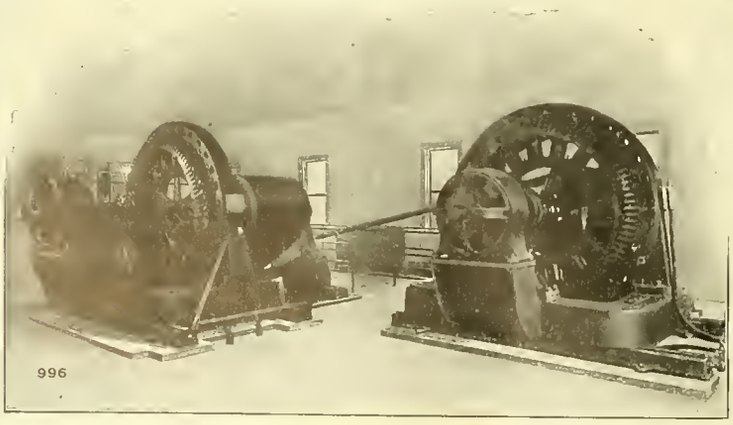
CHICAGO NEW YORK
Other Large Cities

GENERATING SETS

Generators and Motors. Complete Lighting Equipments for Stationary or Marine Use
Search Lights, any candle-power. Electrical Repair Work Guaranteed
BENTON & SON, Manufacturers, LA CROSSE, WISCONSIN



996

Perfect Ventilation Accessibility of Parts

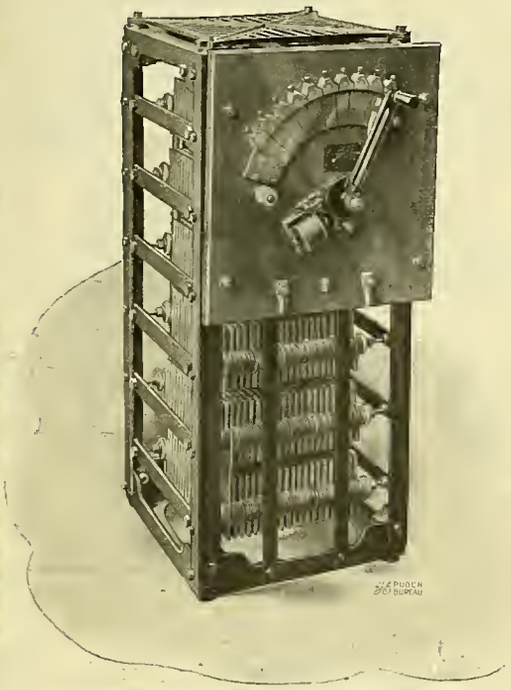
Belt-Driven Alternating Current Generators

Two 250 K. W., 450 R. P. M., 3 Bearing National Alternating Current Generators, installed in the plant of the Western Gas & Investment Co., at Somerset, Wis.

National Electric Company
MILWAUKEE

New York Chicago Philadelphia Atlanta
New Orleans Denver Cleveland Seattle San Francisco

General Electric Company



Speed Regulating Rheostat Mach. Type RA.—Floor Style

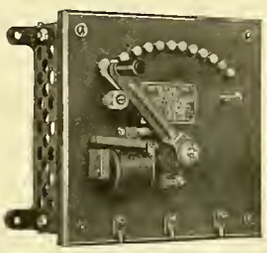
SPEED REGULATING RHEOSTATS

MACHINE TYPE RA.
FOR CONTINUOUS SERVICE

Adjustable friction band brake holds contact arm in any position: a most durable construction.

Speed reduction 50 per cent at normal full load, or 25 per cent half load over a range of 10 steps.

No-voltage coil automatically returns contact arm to starting position should voltage fail or shunt field of motor be broken.



Rheostat Mach. Type RA.—Wall Style

In sizes $\frac{1}{8}$ to 20 h. p.

Larger sizes built to order.

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SCHENECTADY, N. Y.

Chicago Office: 782
MONADNOCK BUILDING

FREE to CENTRAL STATIONS

50 FEET

"ONEIDA" GALVANIZED CHAIN

EXPRESS PREPAID

Our flexible steel chain (American pattern) herewith illustrated will outwear cord, cable or rope many times over. Give it a trial for raising and lowering Arc Lamps suspended from Mast Arms.

You will use no other attachment after making this test as "Oneida" Galvanized Chain is absolutely uniform in strength.

HEAVILY GALVANIZED! RUST PROOF!

You need have no fear of your lamps falling to the street as happens so unexpectedly when strands of cable give way or a rope (or cord) has rotted out.

MANUFACTURED BY

ONEIDA COMMUNITY, LTD.

ONEIDA, NEW YORK.

Branch Factory, Niagara Falls, Ont. Canada

Address all inquiries to Sales Dept.

Bituminized Fibre Conduit

For Underground Construction

COMBINES the **GOOD FEATURES** of other conduits.
ELIMINATES the **BAD FEATURES** existing in many kinds.
HAS VALUABLE FEATURES not found in any other duct.

The American Conduit Company has a corps of experts in underground construction and is prepared to furnish supervision of work if desired. We would prefer to co-operate with contractors in underground construction, but if desired will submit estimates and bids and take contracts for completed underground systems in any part of the United States or Canada.

AMERICAN CONDUIT COMPANY

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CHICAGO.

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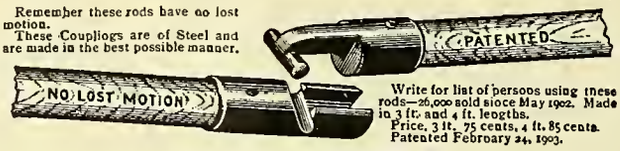
336 Macy Street, Los Angeles

Cope's Patent Quick Coupling Conduit Rod

Remember these rods have no lost motion.
These Couplings are of Steel and are made in the best possible manner.



Write for list of persons using these rods—26,000 sold since May 1902. Made in 3 ft. and 4 ft. lengths.
Price, 3 ft. 75 cents, 4 ft. 85 cents.
Patented February 24, 1903.

T. J. COPE

3244 North Fifteenth Street PHILADELPHIA, PA.

BOSSERT'S BOXES

Drawn steel. One blow of a hammer gives clean round hole. No filing.
SAVE TIME, BOXES AND MONEY
Be up to date. Use them. Write for bulletin giving full particulars.
Bossert Electric Construction Co., UTICA N.Y.

"Flexduct" is that high standard required in all high-class work. It is very flexible, a high insulation and indestructible

FLEXIBLE CONDUIT

"Flexduct" the National Code Standard. It does not deteriorate, always usable to highest degree

OSBURN FLEXIBLE CONDUIT COMPANY,

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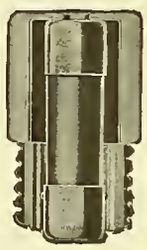

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NATIONAL NOARK STANDARD FUSE PLUGS

When the fuse is blown—give it a push from the top, through the opening provided, and out it comes.

Reliability and Efficiency

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And you might also add

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For a standard fuse may be used with this or any other form of **"Noark" National Standard Devices.**

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The Saying { *"A Place for Everything And Everything in its Place"*

APPLIES TO

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PUT THEM WHERE THEY BELONG

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277 Broadway, New York

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HIGHEST GRADE NUERNBERG

They give more light, whiter light and less dust than any other carbon. Their quality is uniform and always of the highest grade. Diameter and straightness perfect. Grand prize St. Louis World's Fair, 1904

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A. C. MOTOR CONTROLLERS

We are prepared to furnish A. C. controlling apparatus for any purpose for which the A. C. motor is used.

We have developed a large number of types for different purposes and will be pleased to furnish you with information and quotations on receipt of your requirements.

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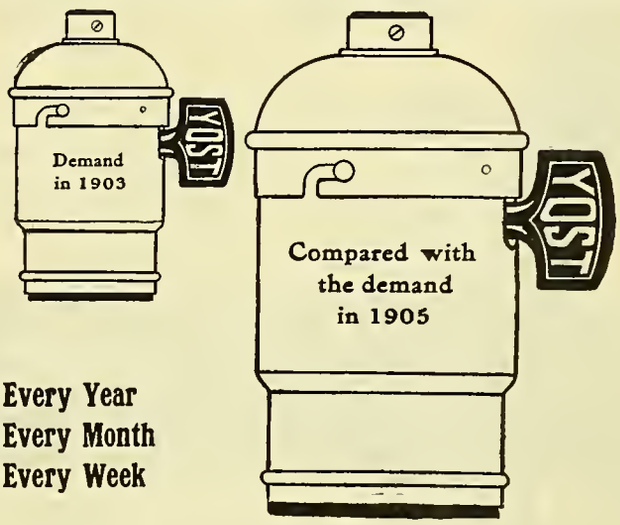

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shows a decided increase in the demand for

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demonstrating they are of

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Is there **one good** reason why **you** do not use **YOST SOCKETS?**

The Yost Electric Mfg. Co.

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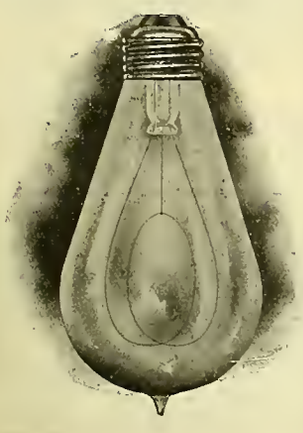

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THE SUNBEAM

THE LAMP OF QUALITY

LOOK FOR THE LICENSE LABEL IN THE STEM

Sunbeam Incandescent Lamp Co.

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Christmas Tree Outfits

Connected up ready to attach to any lamp socket. Can be used year after year. Approved by Board of Fire Underwriters.

8-16-24 or 32 Lights

CARRIED IN STOCK BY

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Copley-Senior Carbon Brush

Uniform throughout, a feature lacking in all other brushes

FOR GENERATORS AND MOTORS

Thoroughly and Permanently Self-Lubricating

Will not Cut Will not Spark Carry more Load

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The only article that will PREVENT SPARKING. Will keep the Commutator in good condition and PREVENT CUTTING.

Absolutely Will Not Gum The Brushes.

It will put that high glose on the Commutator you have so long sought after.

50 Cents per Stick. $8.00 per Dozen.

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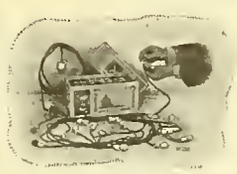
Edison Ready-to-Use Electric Decorative Lighting Outfits

YOU HAVE JUST TIME ENOUGH



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For fuller details write our nearest district office or

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Main Lamp Sales Offices: HARRISON, N. J.

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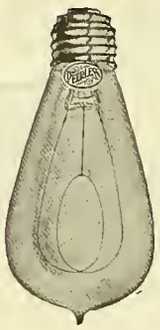

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A practical test and our contract prices will show you how you can save money.

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IS THERE ONE GOOD REASON why you should not see for yourself whether our claims of superiority are true or not? We believe you owe it to yourself to investigate. WE ARE SATISFYING thousands of others. WHY NOT YOU?

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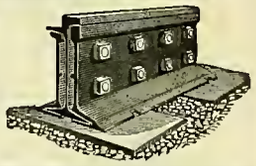
Highest Award at Paris Exposition, 1900, Buffalo, 1901, and St. Louis, 1904.



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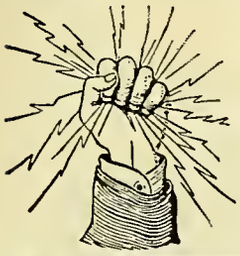

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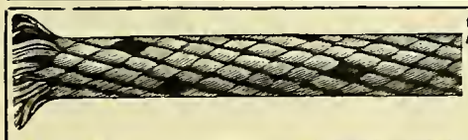

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WE WILL SHIP ON 30 DAYS TRIAL
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IF SATISFACTORY PAY FOR THEM, OTHERWISE, RETURN CHARGES COLLECT
WE PREPAY FREIGHT ON INITIAL ORDERS

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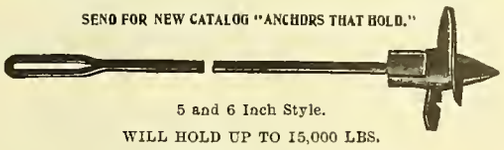

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THE ONLY **PERFECT FIXTURE HANGER** ON THE MARKET

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Improved Swing, etc.

For T. H. ARC LAMPS

Complete Stock of all Parts. Send for Catalog 2312

The Turner Brass Works
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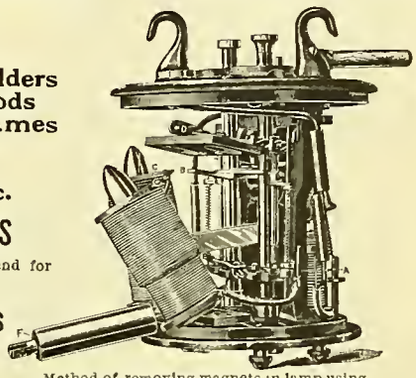

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The best protection for the lamp.
Easily put on and will not shake off, or partly off, or shift to one side.

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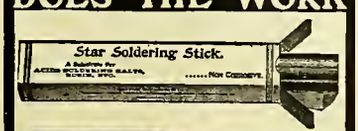

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We also make the famous Crolius Commutator Clamp and eliminate sparking and all commutator troubles. Send for sample.

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SMALL EXPENDITURE BUT LARGE SAVING.

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WITH our automatic machinery. For instance, we can make a machine that will take the stock from which lamp sockets are made and automatically turn out the finished socket and key—assembled and ready for use.

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You will, of course, wish to be represented in it, so why not reserve space NOW and receive a much better location than it will be possible to obtain later on?

Let us know your wishes TODAY.

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NORTHERN DYNAMOS **SIMPLE COMPACT**

We build them for direct connection to any type of engine, or to be driven by belt. Northern Apparatus readily adapted to any service

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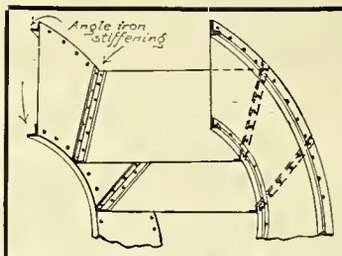

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(Sole makers in this country of the Green Fuel Economizer) 21

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Condensers, by "Power," New York, 1900	.50	.20
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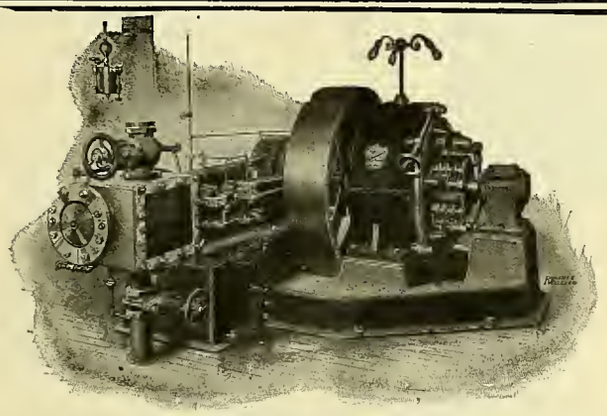

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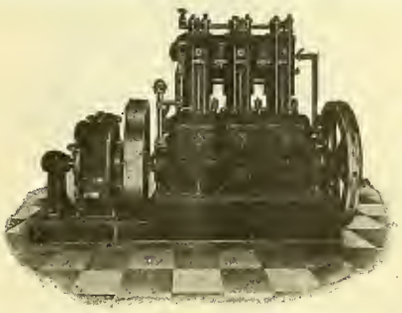

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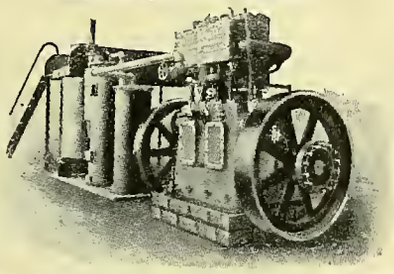

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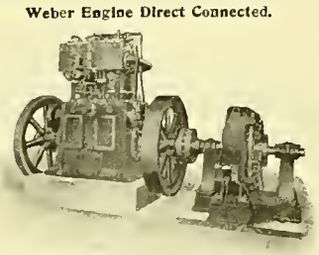

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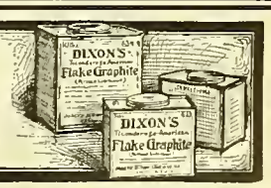

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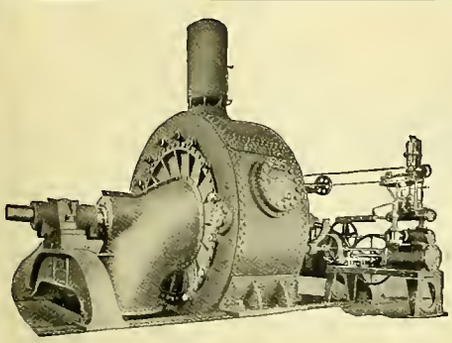

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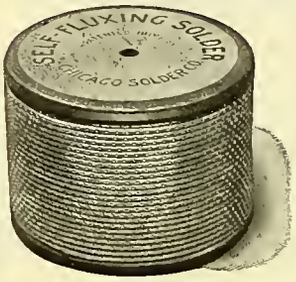

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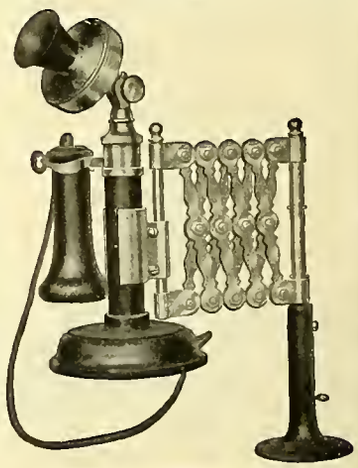

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4	.2	.2
4	.2	.4
5	.2	.15
6	.2	.15
10	.2	.1
12	.2	.1
14	.2	.1
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20	.3	.1
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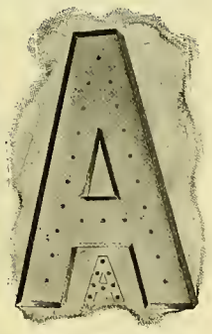

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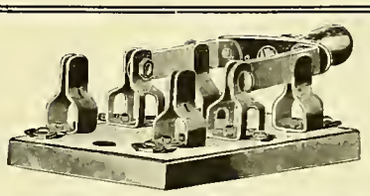

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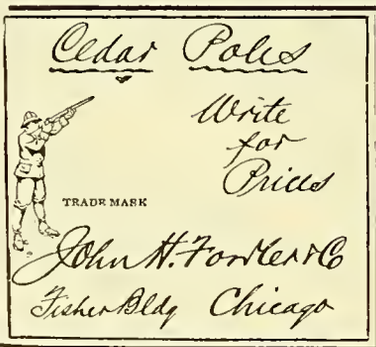

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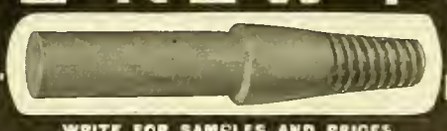

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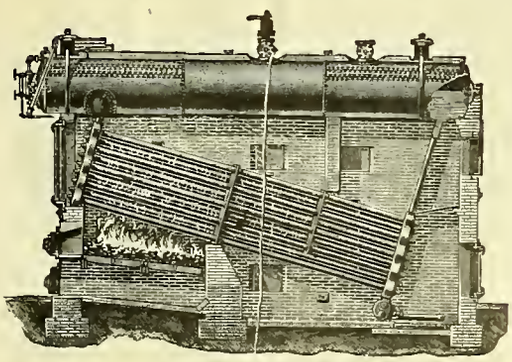

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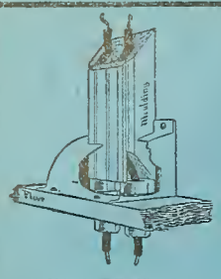
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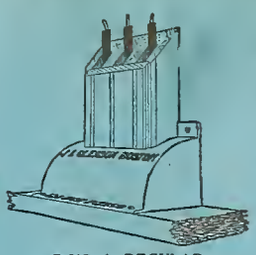
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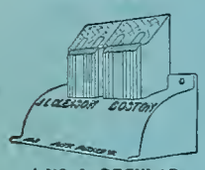
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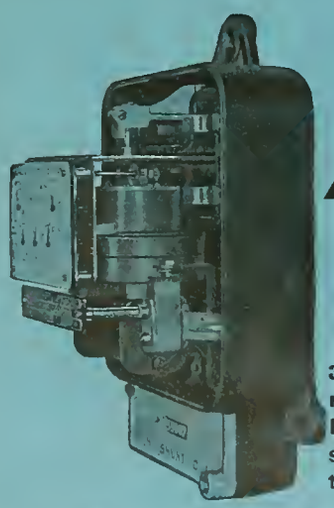

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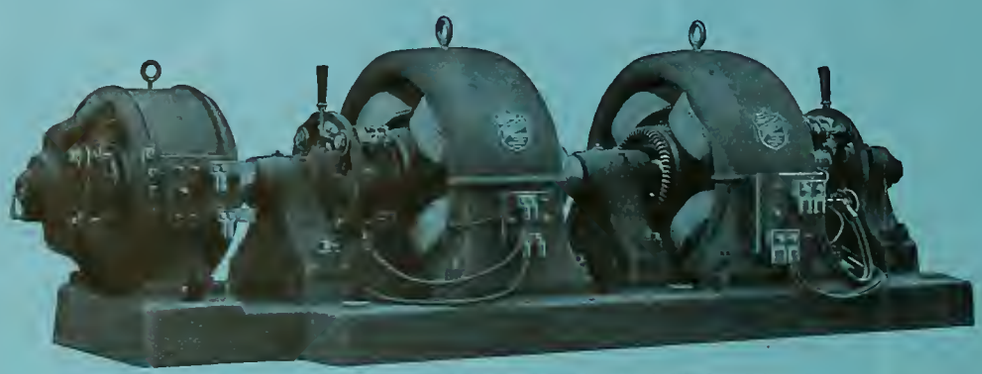

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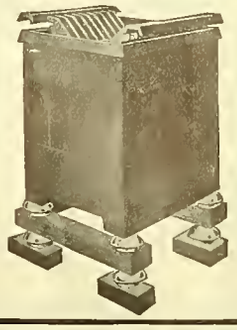

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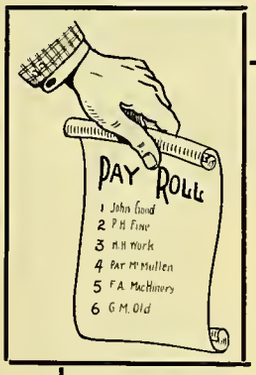

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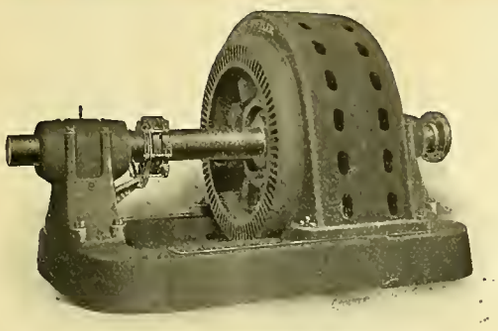

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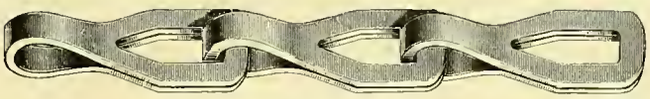

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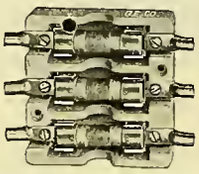

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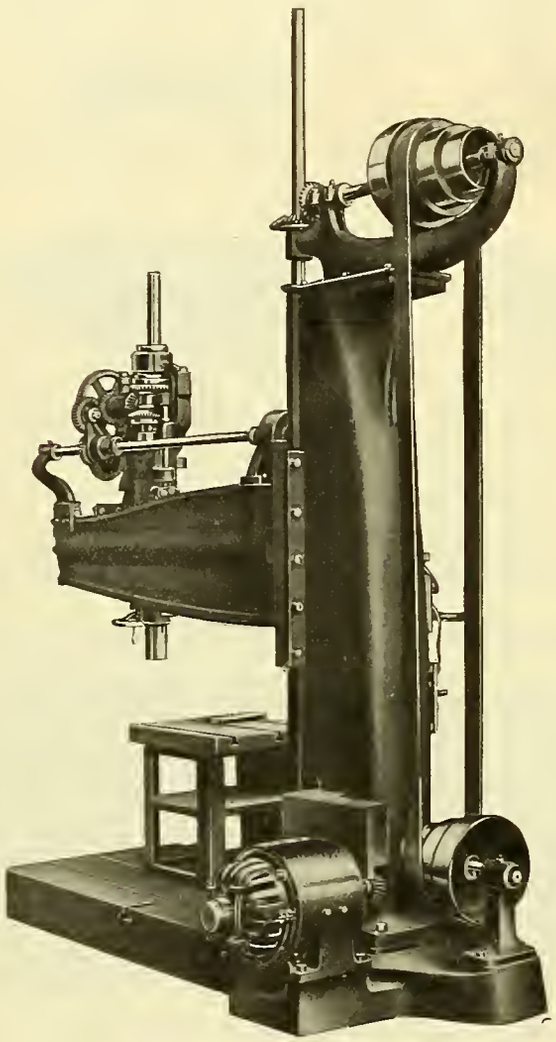

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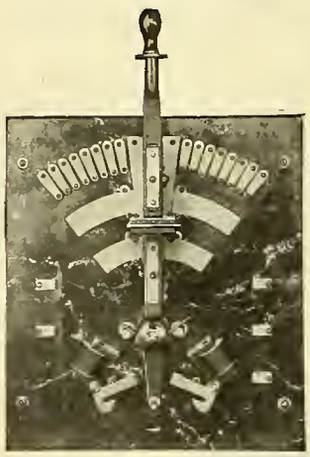

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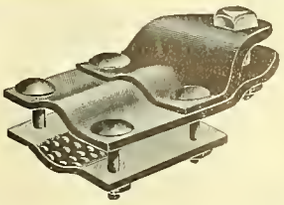

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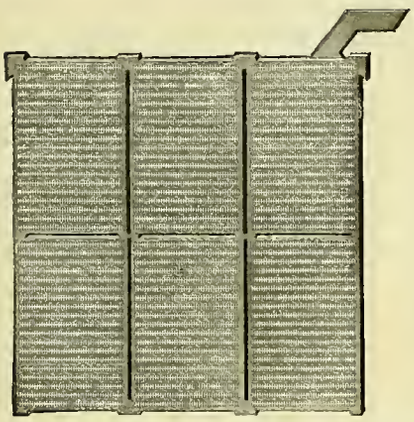

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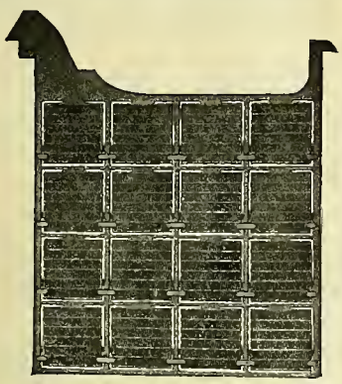

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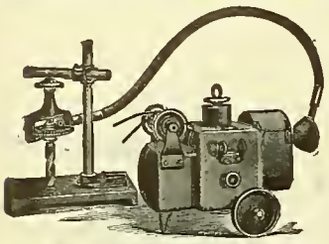

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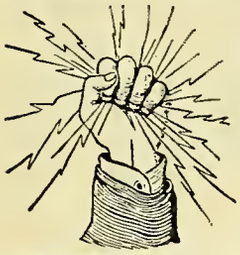

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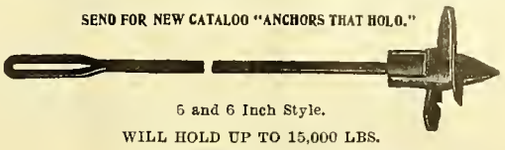

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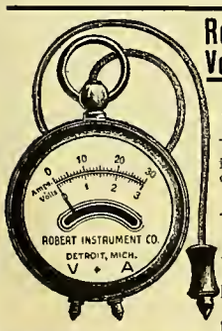

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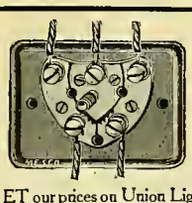

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Electrician and mechanic of 19 years' experience in the electrical field with excellent references as to ability and moral standing will accept a reasonable offer. My specialty is construction work, either telephone or electric light. Address Box 555 care of Western Electrician, 510 Marquette Bldg. Chicago.

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Energetic young man of technical training having considerable station experience in meter and transformer testing. Must have had actual experience with modern induction wattmeters. Position of responsibility, $90 a month. Address Box 553, care Western Electrician, 510 Marquette Building, Chicago.

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An experienced electrician and superintendent to take charge of an up-to-date factory in the manufacture of jump-spark coils. Only a fully competent man wanted. Address Box 549, care of Western Electrician, 510 Marquette Bldg., Chicago.

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To purchase good second-hand 230 or 240 volt, 60 cycle, single phase, 10 or 12 K. W., belt driven A. C. generator, complete with necessary exciter. Address, stating price, Texas Tie and Lumber Preserving Co., Somerville, Texas.

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Assistant engineer, by a company manufacturing electrical railway material in Central Ohio, an assistant in engineering department capable of designing, testing and drafting. A technical graduate with practical knowledge of shop requirements preferred. Apply, stating age, salary expected, experience and references. Address Box 556, care of Western Electrician, 510 Marquette Bldg., Chicago.

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A young man with a good electrical education and knowledge of telephone line construction. Should be familiar with locating new pole lines and transmission standards. Work located in Western Pennsylvania. No application considered unless age and salary expected are stated. Address Box 557, care Western Electrician, 510 Marquette Bldg., Chicago.

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Engineers of experience with telephone manufacturers will gain information to their interest by writing to Box 1732 General Post Office, New York City, in regard to business openings. State nature of present work and name of employer as well as age, experience and salary expected.

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57 ft. of 18 inch double ply.
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The above is all in first-class operating condition and is offered subject to prior sale.

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Springfield, Ill.

DEPARTMENT OF THE INTERIOR, Washington, D. C., October 25, 1905. Sealed proposals will be received at the office of the Engineer, United States Reclamation Service, Billings, Montana, until 3 o'clock p. m., December 15, 1905, for installing a telephone system having eight or more telephone stations and 22 miles or more of pole line. Particulars may be obtained by application to the Chief Engineer of the Reclamation Service, United States Geological Survey, Washington, D. C., or to Robert S. Stockton, Engineer, Huntley, Montana. E. A. Hitchcock, Secretary.

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Uniform throughout, a feature lacking in all other brushes

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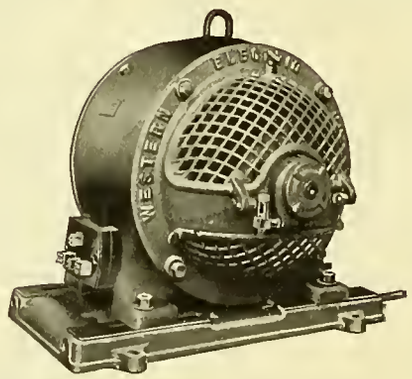

for which motors are manufactured require that they be of convenient size, high efficiency, and of great flexibilty. The performances of our motors under severe conditions prove their adaptability.

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Other Large Cities

NEW COMPANY ABOUT READY

LAST OF MACHINERY INSTALLED BY DECEMBER 15.

Will Produce a Dry Battery Eighty Per Cent. Better Than Anything Known.

On the 10th of December all the machinery for the Central Electric Manufacturing company will be in the city and the new plant will be in operation by the 15th.

On December 7 the stockholders will hold their first meeting and elect the officers of the corporation, and Carl Jaeger, the manager of the new concern, has just finished wiring the building and making ready for the last of the machinery. The new dry battery to be manufactured by this company will revolutionize that industry. This new product will be known as the Black Hawk dry cell battery.

Carl Jaeger and his brother, who is also an electrician in Germany control the patents.

From 60 to 80 per cent. more efficacy is claimed for this new battery above anything ever produced. The principal ingredient in its composition is a new discovery and must be imported from Germany.

The battery will have a longer life, greater voltage and higher amperage than anything on the market. They claim it is impossible for one of these batteries to become "dead" before using.

Two kinds will be manufactured, those intended for immediate use and others intended for dealers who would desire to keep them upon their shelves for any length of time.

The United States government is now working a test of these batteries, and if the company can produce what they claim, the government alone will use thousands upon thousands each year.

The company will start out with about twenty men and they feel certain the number will be increased to 100 by next summer.

The capital—$30,000—is all paid up and owned by local people, who feel sanguine of having one of the largest institutions in Rock Island in a very few years.

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December 14, 15, 16 and 17, the Wabash will sell excursion tickets from Chicago to Canada at one fare for the round trip, good to return until January 6, 1906. Write for details. F. H. TRISTRAM, A. G. P. A., 311 Marquette Bldg., Chicago, Ill.

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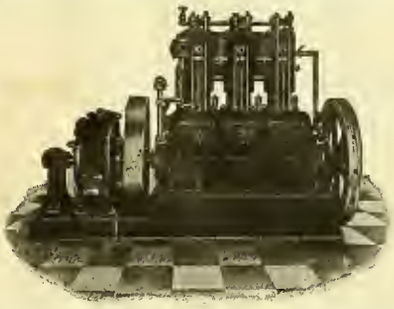

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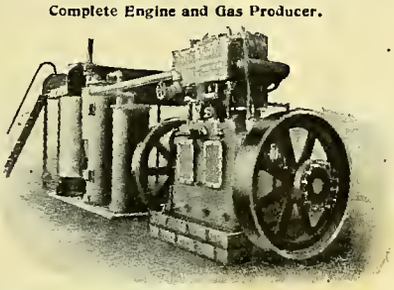

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BROOKS ELEVATOR COMPANY.

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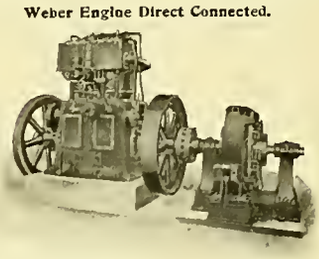

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Write for Catalogue. P. O. BOX, 381 KANSAS CITY, MO.

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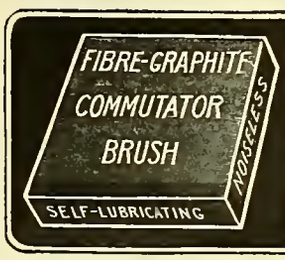

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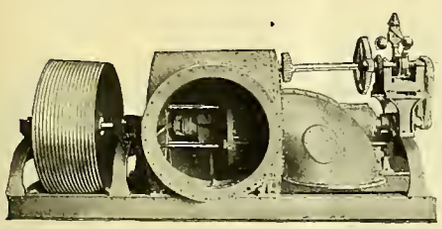

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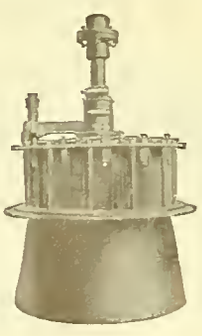

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The lamps are rounded off on the front end, thereby forming a small but effective convex lens which focuses all the light rays into the most desirable position.
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This is due partly to the lens effect, and also to the fact that the filaments are manufactured by a special process which produces a uniform and long-lived filament.
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4. GENUINE PLATINUM is used where the circuit is carried through the glass.
5. These lamps have a nearly perfect VACUUM.
This gives them long life, and it is obtained through the use of our improved vacuum pumps.
6. Each lamp is given a careful individual test for voltage, candle power, mechanical perfection and size.

Table of Voltages.

Voltage	Approximate Candle power	Amperes
3	.2	.2
4	.2	.2
4	.2	.4
5	.2	.15
6	.2	.15
10	.2	.1
12	.2	.1
14	.2	.1
16	.2	.1
20	.3	.1
24	.3	.075
30	.3	.085
40	.5	.085
48	.6	.075

We also manufacture the old-fashioned TIP lamps, and can sell them at a lower figure than any other lamp. Our prices for the tipless lamp are the lowest on the market.

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Boyle Heights	800	" "
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Garvanza	400	" "
Prospect Park	500	" "
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Olive Street	7,000	" "
Total	19,300	

Our automatic system adopted also in the following cities:

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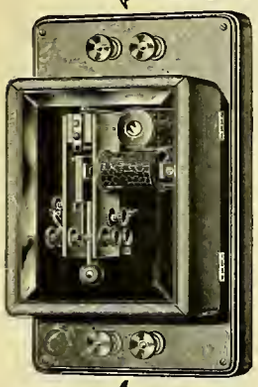

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The most efficient and the only reliable ringer on the market.

Measures only 9x6x5 inches; weighs only 4 lbs. We use no primary battery for the vibrator; actual consumption of current from the main batteries practically unnoticeable. Will ship on 30 days' trial, returnable at our expense if not satisfactory in every respect.

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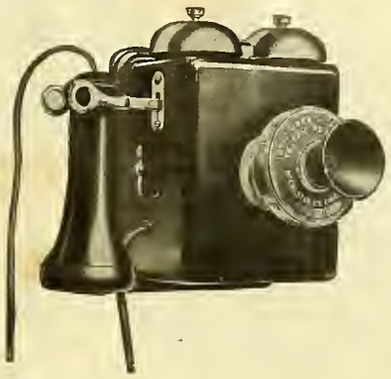

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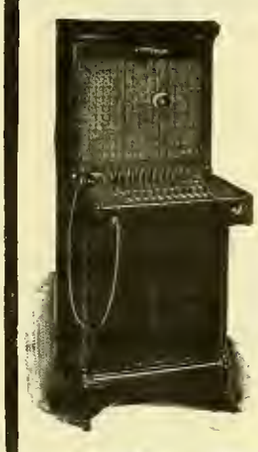

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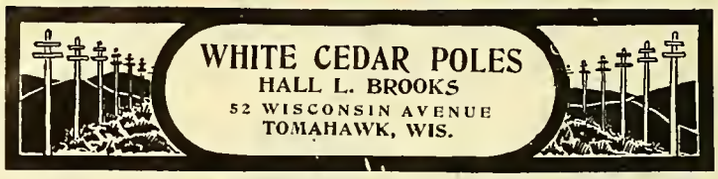

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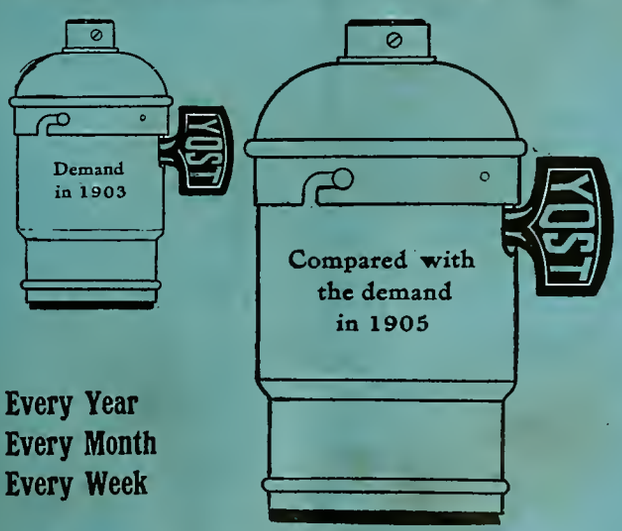

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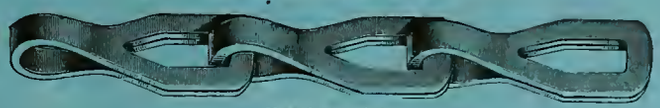
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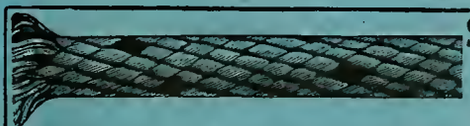
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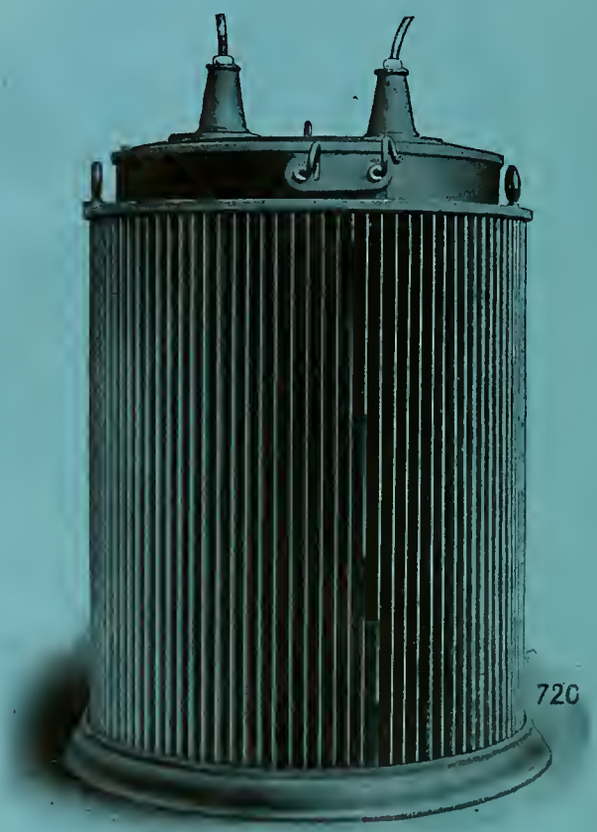

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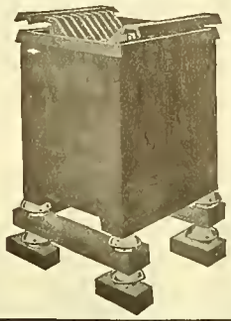

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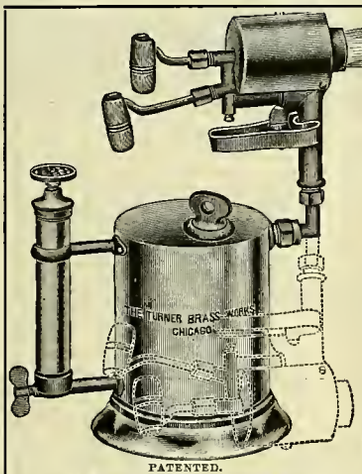

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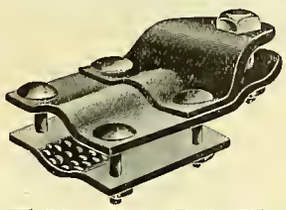

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It is the most complete and valuable book we have published.

It is full of illustrations, and contains much valuable information of the latest inventions and devices known to the science, and uses of electricity.

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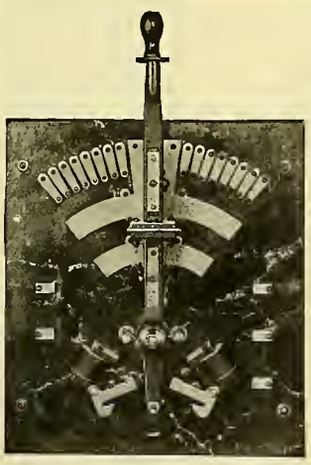

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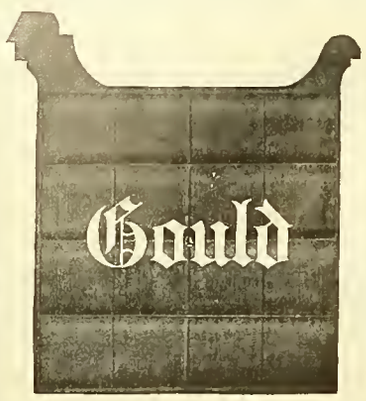

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WORKS: DEPEW, N. Y.

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Telephones, Telephone Material and Switchboards.
American El. Telephone Co
Automatic Electric Co.
Bissell Co., The F.
Central Electric Co.
Electric Appliance Co.
International Tel. Mfg. Co.
Kellogg Switchb. & Sup. Co
Manhattan Elec. Supply Co.
Stromberg-Carlson Tel. M. Co
Vought-Berger Co
Wesco Supply Co.
Western Electric Co.

Time Switches.
Bissell Co., The F.

Toggle Bolts.
(See Bolts, Toggle.)

Tools.
Klein & Sons, Mathias.

Tools, Pneumatic.
Chicago Pneumatic Tool Co.

Transformers.
Allis-Chalmers Company. (Bullock El. Mfg. Co.)
Central Electric Co.
Crocker-Wheeler Co.
Electric Appliance Co.
Ft. Wayne Elec. Works, Inc.
General Electric Co.
Kuhlman Electric Co.
La Fayette Elect'l. Mfg. Co.
National Electric Co.
Stanley—G. I. Elec. Mfg. Co.
Wagner Electric Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Trucks, Electric Car.
General Electric Co.
Westinghouse El. & Mfg. Co.

Turbines, Steam.
Allis-Chalmers Co.
General Electric Co.
Westinghouse Machine Co.

Turbine Water Wheels.
Leffel & Co., Jas.

Typewriters.
Oliver Typewriter Co.

Vulcanized Fibre.
Vulcanized Fibre Co.

Wattmeters.
Duncan Elec. Mfg. Co.

Wire Rope Machinery.
Alton Machine Co.

Wires and Cables—Magnet Wires.
American Electrical Works.
Belden Mfg. Co.
Bissell Co., The F.
Central Electric Co.
Crescent Ins. Wire & Cble. Co.
Electric Appliance Co.
General Electric Co.
Hazard Manufacturing Co.
Indiana Rub. & Ins. Wire Co
India Rubber & Gutta Percha Insulating Co.
Kellogg Switch. & Sup. Co.
Manhattan Elec. Supply Co.
National India Rubber Co
New York Insulated Wire Co.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co
Roebling's Sons Co., J. A.
Safety Ins. Wire & Cable Co.
Simplex Electrical Co.
Standard Underground Cable Co.
Wesco Supply Co.
Western Electric Company.

Woodwork, Telephone.
Telephone Woodworking Co

For Alphabetical Index of Advertisements See Page 3.

STANDARD OF THE WORLD

ELECTRA CARBONS

"TRADE MARK"

HIGHEST GRADE NUERNBERG

They give more light, whiter light and less dust than any other carbon. Their quality is uniform and always of the highest grade. Diameter and straightness perfect. Grand prize St. Louis World's Fair, 1904

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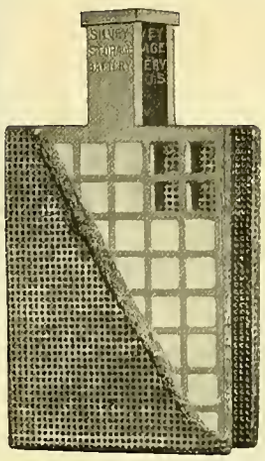
Is Money an Object to You

Automatic Machinery

affords the best way of **cheapening** the cost of making small **assembled articles.**

Our specialty is making machines that make and assemble small articles in large quantities. If you turn out less than **50,000** assembled "parts" **per day,** you are losing money. If you don't believe it, put it up to us to furnish the proof. Send us a sample and we'll surprise you. It **costs you nothing** if we fail to duplicate your sample automatically. Why not **try us?**

C. H. M'GIEHAN & CO., 11 Broadway, NEW YORK



A Handsome Young "Couple"

is the SILVEY S. B. Positive and Negative Pair in their new dresses of perforated Sheet Lead. They may not wear a "smile which won't come off," but they do have active material which cannot "shed"

5-10-20 Ampere Hour Storage Battery Couples

where small current is required.

Catalogue No. 131 describes it.

THE DAYTON MFG. CO.
Dayton, Ohio

The recent installation of Improved and Patented Machinery enables us to make

SWEEPING REDUCTIONS IN BRUSH PRICES

NATIONAL CARBON COMPANY - Cleveland, Ohio

Universal Electric Storage Battery Co

MANUFACTURERS OF THE

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We can save you space and weight in your battery installations. The Morrison type of plate with its metallic surface and completely enclosed active material, insures

LONG LIFE, LOW RESISTANCE,
FREEDOM FROM BUCKLING,
WITH DECREASED WEIGHT OF
GRID AND INCREASE OF
ACTIVE MATERIAL.

BATTERIES FOR
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GENERATING SETS

Generators and Motors. Complete Lighting Equipments for Stationary or Marine Use
Search Lights, any candle-power. Electrical Repair Work Guaranteed

BENTON & SON, Manufacturers, LA CROSSE, WISCONSIN

WILLARD STORAGE BATTERIES

FOR ALL PURPOSES

Manufactured by

THE WILLARD STORAGE BATTERY CO.

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BROCKSMITH DYNAMO CASTINGS

Castings, Punchings, Materials and Blue Prints for constructing the Brocksmith Dynamo, Motor, Dynamotor, Motor-Generator, Single-Phase Rectifier, A. C. Generator, etc.

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Cope's Patent Quick Coupling Conduit Rod

Remember these rods have no lost motion. These Couplings are of Steel and are made in the best possible manner.

Write for list of persons using these rods—25,000 sold since May 1902. Made in 3 ft. and 4 ft. lengths. Price, 3 ft., 75 cents, 4 ft. 85 cents. Patented February 24, 1903.

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Drawn steel. One blow of a hammer gives clean round hole. No filing.

SAVE TIME, BOXES AND MONEY

Be up to date. Use them. Write for bulletin giving full particulars.

Bossert Electric Construction Co., UTICA, N.Y.

NOVELTY CABLE SLEEVE—Made also in two and three way branches.

SPLICES AND POT HEADS

Can be made by any man who can handle a soldering iron, better and cheaper than by any lead joint wiper. And, tho' absolutely permanent, they can be opened at any time for inspection or repair and again restored. How much money would this have saved *your* exchange? Details in Catalogue 125-A.

Made by THE F. BISSELL COMPANY TOLEDO, O.

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On receipt of 10 CENTS we will send you a

Western Electrician Moonlight Schedule for 1906.

Every lighting man should have one.

Electrician Publishing Company.

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"Little" Giant Storage Batteries

are constructed for all purposes to which storage batteries are adaptable. They retain their charge for long periods. Have greatest output for size and weight. Our Sparking Batteries have hard wood cases, thoroughly acid proof. Every battery guaranteed.

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As a Practical Book for Practical Men Spangenberg's Book Ranks First

All the engineering information you should have; all you really need is contained in this book in plain, practical and concise form.

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is a complete library covering the subject in all its various branches and contains 672 pages. The only book ever published containing 1035 questions and answers. Written so you can understand it.

$3.60 is the price, and it is sold with the understanding that it may be returned if not satisfactory, and your money will be refunded immediately. Out of 10,000 books sold only two have been returned. This fact speaks for itself.

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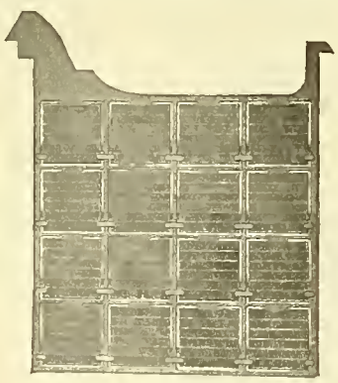

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FOR STREET RAILWAYS, CENTRAL STATIONS, TELEPHONE SYSTEMS, ETC.

Ask for catalogue and bulletin on 'A WATER POWER SYSTEM'

National Battery Company

ELECTRIC STORAGE BATTERIES

BUFFALO, N. Y.

Accumulator"

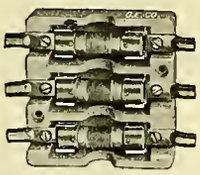
General Electric Company

ENCLOSED FUSES AND CUT-OUTS

(National Electrical Code Standard)

These fuses and cut-outs stand every test and meet every specification determined upon by the Underwriters' Committee after two years of investigation and over 1,000 tests. Write for further information about our complete line.

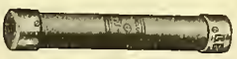
Three to Two Wire Double Branch, 3-30 Amp., 250 Volt Cut-Out.



Three Wire Main Line, 31-60 Amp., 250 Volt Cut-Out.

Single Pole, 3-30 Amp., 600 Volt Cut-Out.

Single Pole, 201-400 Amp., 600 Volt Cut-Out.



30 Ampere, 600 Volt Fuse.

600 Ampere, 250 Volt Fuse.

General Electric Enclosed Fuses blow with an unvarying and lifelong accuracy obtained by the use of a special alloy fuse metal. All fuses are indicating.

The fuses have maximum strength, owing to the use of a special filler and the best quality of fiber for the enclosing tube.

General Electric Cut-Outs have maximum strength and minimum weight, and are easy to install, re-fuse and keep clean.

Chicago Office: Monadnock Bldg. **Principal Office: SCHENECTADY, N. Y.** Sales offices in all large cities

807

"Diamond H" Switches

Trade H Mark

This Trade-Mark guarantees quality.

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CONTRACTORS—WIREMEN

HERE'S WHAT YOU'VE BEEN WAITING FOR

THE ONLY PERFECT FIXTURE HANGER ON THE MARKET

It simplifies your work. Assures perfect wiring. No more loose work. Convenient to install. Is solid and holds the support perpendicular. Requires no cutting. Only requires two screws to fasten. The only thing for pipe work in flat or residence. Applicable for pipe work, open work and mill construction. A **TIME** and **LABOR SAVER.** Made of malleable iron.

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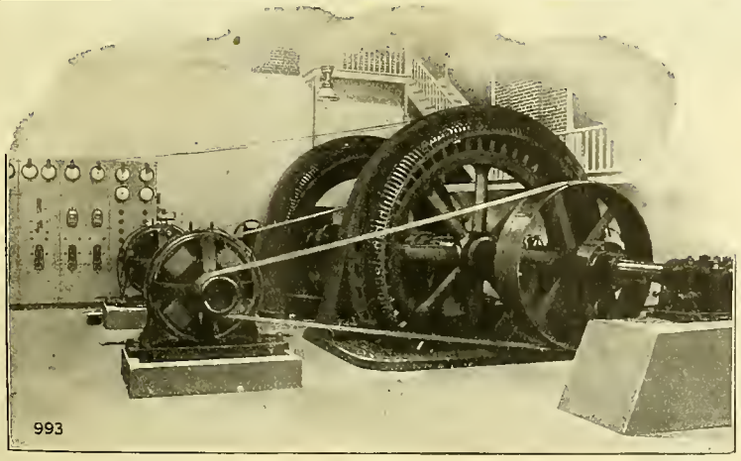

993

Water-Wheel Alternating Current Generators

BUILT IN ALL CAPACITIES

NATIONAL ELECTRIC COMPANY

MILWAUKEE, - - - - U. S. A.

The New Spring Shade-Holder

which we are now furnishing with **Prismo Zenith Lamps**, is quite an improvement over the old style screw-holder. It holds the shade in place by means of a spring instead of screws, which permits of a more rapid adjustment of the shade and at the same time holds it more securely in place. It is adapted to all sockets, key and keyless, and adds greatly to the convenience of the **Prismo Lamp**.

Electric Appliance Company
Chicago and San Francisco

PEERLESS LAMPS LEAD

LOOK FOR THE LICENSE LABEL

all others in **EFFICIENCY, LENGTH OF LIFE, CURRENT CONSUMPTION and SUSTAINED CANDLE POWER.**

A practical test and our contract prices will show you how you can save money.

The Wesco Supply Co.
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Of all Qualities, in any Form at Lowest Prices
EUGENE MUNSELL AND CO.
NEW YORK and CHICAGO

That Is.

Micanite, Linotape, M. I. C. Compound, Empire Cloth and Paper. For Years the Standard.

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You can make **$25.00, $50.00 or $75.00** per week selling **RECO Sign Flashers** to the merchants of your city. Easy to sell. Write for particulars and Electric Sign pointers.

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Standard Size-Increased Capacity
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The insulation is the most important part of your machine—be sure you buy only the best. Cheap insulation cannot be good insulation.
IF IT'S MICABOND YOU CAN BE SURE YOU HAVE THE BEST—OUR GUARANTEE IS BEHIND IT
CHICAGO MICA CO. : : : Valparaiso, Ind.

ALWAYS READY AND DOES THE WORK. WILL MAKE THE SOLDER FLOW WHERE YOU WANT IT, AND STAY WHERE YOU PUT IT. IN COLLAPSIBLE TUBES AND TIN BOXES.
"NEW IDEA" SOLDERING PASTE SAMPLE FREE
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CENTURY ELECTRIC CO.
MANUFACTURERS OF
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VOLT - AMMETERS
POCKET SIZE
For testing Batteries and Battery Circuits, Locating Faults, Grounds, etc.
RELIABLE. ACCURATE.
Send for Circular.
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YOU HAVE JUST TIME ENOUGH

to lay in a stock of these popular outfits, which afford by far the safest and most beautiful method of illuminating Christmas trees or other inflammable decorations. Useful for interior adornment all the year around. Always ready—always complete.

For fuller details write our nearest district office or

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Main Lamp Sales Offices: HARRISON, N. J.
OFFICES IN ALL THE PRINCIPAL CITIES
744

WANTED

You Who are Troubled with Sparking and Cutting of Commutators to Use

The only article that will PREVENT SPARKING. Will keep the commutator in good condition and PREVENT CUTTING.

Absolutely Will Not Gum The Brushes . . .

It will put that high gloss on the commutator you have so long sought after.

50 Cts. per Stick. $5.00 per Dozen
For Sale by all Supply Houses, or
FREE, Sample Stick.

K. McLENNAN & CO.,
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BRACEY-FORSE ELECTRICAL CONSTRUCTION CO.

GENERAL CONTRACTING IN ALL BRANCHES OF ELECTRICAL WORK.

SPECIAL TELEPHONE SWITCHBOARDS BUILT TO ORDER.

ST. LOUIS, MO.

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To everyone sending us the correct solution to the following puzzle, we will send free of charge a beautiful souvenir.

You Can DRIVE it Down; You Can TWIST it Round;
BUT YOU CAN'T PULL IT UP.

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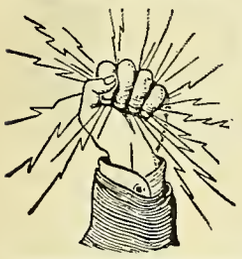
FRANK N. PHILLIPS, Pres. EUGENE R. PHILLIPS, V. P. C. H. WAGENSEIL, Treas. C. R. REMINGTON, Jr., Sec.

AMERICAN ELECTRICAL WORKS,

PROVIDENCE, R. I.



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ELECTRIC LIGHT LINE WIRE,
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Railway Feeder and Trolley Wire,
AMERICANITE, MAGNET, OFFICE AND
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Send 2c stamp for new catalogue No. 6 of
KLEIN'S TOOLS
For Electrical Workers and Line Builders.
MATHIAS KLEIN & SONS.
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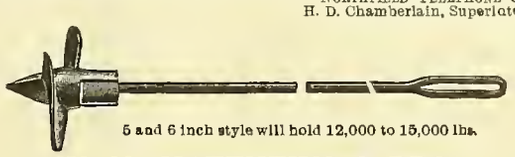
FROSTS, SLEETS, THAWS AND FREEZINGS ARE COMING!
Go Over Your Lines and Anchor the Weak Places With
STOMBAUGH GUY ANCHORS
We give herewith the experience of one company

OFFICE OF NORTHFIELD TELEPHONE COMPANY,
NORTHFIELD, VT., Dec. 5, 1904.

Gentlemen:—Yours of Nov. 30th received and contents noted. We have used your Anchors and have no doubt that they will prove satisfactory.

On the night of Nov. 20th this section was visited by the most severe storm we have had for years. On our lines running East and West there was from one to two inches of ice. Those poles guyed by the Stombaugh Guy Anchor are still standing, and we think that this is as good a test of their worth as we could have had.

Very truly yours,
NORTHFIELD TELEPHONE COMPANY,
H. D. Chamberlain, Superintendent.



5 and 6 inch style will hold 12,000 to 15,000 lbs.

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203 N. 2nd St. MANUFACTURERS ST. LOUIS

Grimshaw

Raven White Core

Raven Black Core

ALL OUR WIRES pass inspection and carry the above **TRADE-MARKS** on our tags. We also manufacture **Grimshaw** and **Competition Tapes** and **Splicing Compounds.**

NEW YORK INSULATED WIRE COMPANY,

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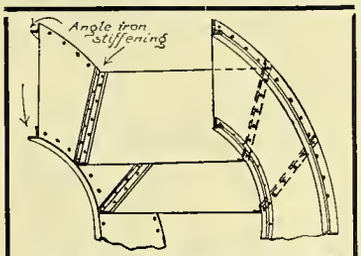
Represented by E. B. LATHAM & Co., New York. AMERICAN ELECTRIC SIGN Co., Boston. W. N. MATHEWS & BRO., St. Louis. S. J. CONGER, San Francisco.



OF INTEREST TO FAN USERS ONLY

The above is a radial section of a portion of the fan wheel of a

GREEN-MATTEAWAN FAN

It shows the **angle iron stiffening** rings which we apply to both the inner and outer edges of the side plates, where other makers use flat bars. This stiffening makes a more rigid and truer running wheel and enables us to reduce the clearance between the inner edge of the side plates and the housing. The result is that there is less leakage of air back past the wheel and more air at the discharge, for the same expenditure of power. As we announced some time ago we have worked out new designs for all our FANS, BLOWERS and EXHAUSTERS with the object of reducing the amount of power required for driving such apparatus.

Send for our Booklet "WE." on this subject, and, if you do not already have a copy, ask for our Book on Fuel Economy.

THE
GREEN FUEL ECONOMIZER CO.
MATTEAWAN, NEW YORK

(Sole makers in this country of the Green Fuel Economizer) 21

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Insulated Wire of All Kinds

Bare Copper Wire

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AGENCIES AND BRANCHES

New York Chicago Cleveland San Francisco Philadelphia Atlanta

NATIONAL CODE STANDARD

WEATHER-PROOF
TRADE MARK
"O.K."
LINE AND HOUSE WIRES

"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Ideal Wire.

Prices and Samples on Application.

Phillips Insulated Wire Co.

Office and Factory: PAWTUCKET, R. I.

Do It Today

Tomorrow Never Comes

We suggest that you reserve space NOW for an attractive advertising announcement in the

WESTERN ELECTRICIAN'S ANNUAL NEW YEARS NUMBER

It will be one of the handsomest and most instructive issues of an Electrical Journal ever published.

You will, of course, wish to be represented in it, so why not reserve space NOW and receive a much better location than it will be possible to obtain later on?

Let us know your wishes TODAY.

Western Electrician
510 Marquette Bldg.
Chicago

WANTED, FOR SALE *and similar* **WANT COLUMN** *advertisements (50 words or less), $1.50 an insertion; additional words 3c each.* **POSITION WANTED** *advertisements (50 words or less), $1.00 an insertion; additional words 2c each*

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We want a salesman for the city of Chicago and territory within a radius of 200 miles. Must be acquainted with electrical trade. Excellent opportunity. Address with particulars Morris Elec. Co., Inc., Wilmington, Del.

WANTED

Draftsmen—We have positions now open for draftsmen. Call or address Western Electric Co., Chicago, Ill.

WANTED.

A man experienced in testing and installing alternating current and direct current machinery. Write fully, giving age, qualifications and salary expected. Address Box 550, care of Western Electrician, 510 Marquette Building, Chicago.

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An experienced electrician and superintendent to take charge of an up-to-date factory in the manufacture of jump-spark coils. Only a fully competent man wanted. Address Box 549, care of Western Electrician, 510 Marquette Bldg., Chicago

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To purchase good second-hand 230 or 240 volt, 60 cycle, single phase, 10 or 12 K. W., belt driven A. C. generator, complete with necessary exciter. Address, stating price, Texas Tie and Lumber Preserving Co., Somerville, Texas.

WANTED

Running engineer in water and light plant, noon until midnight run, must be young, married, and have reasonable education for advancement. $50 with house, water and lights free. Must be here ready for business January 1st. Mayfield Water and Light Co., Mayfield, Ky.

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One-half interest in well-established electrical contracting and fixture business in Detroit. Good opening for practical man Price $1,500. Address box 558, care of Western Electrician, 510 Marquette bldg., Chicago.

FOR SALE—A Paying Plant

A Central Station Electric Light Plant in good Illinois town, 2,500 population, new machinery, 10-year street light contract. About $5,000 cash required, balance can be paid out of profits. This is a good opportunity. Address Box 552, care Western Electrician, 510 Marquette Bldg., Chicago.

Second-Hand Machinery

1 24x18 Ideal Automatic Engine.
2 66-in. x 20-ft. Return Tubular Boilers built for 130 lbs. working pressure.

We also have on hand the following leather belts all in good condition:

67 ft. of 18 inch double ply.
73 ft. of 34 inch double ply.
48 ft. of 14 inch double ply.
108 ft. of 24 inch double ply.
85 ft. of 34 inch triple ply.

The above is all in first-class operating condition and is offered subject to prior sale.

Springfield Light, Heat & Power Company
Springfield, Ill.

PLACE YOUR

"Want" and "For Sale" advertisements in the

WESTERN ELECTRICIAN.

Immediate Returns.

"Practical and to the Point"

IS ALL THAT NEED BE SAID OF

THE TELEPHONE HAND-BOOK

By Herbert Laws Webb.

160 Pages, 133 Illustrations, Cloth, Price $1.00.

The book for those interested in telephony.

ELECTRICIAN PUBLISHING CO.,
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WORKS QUICK AND EASY. KEEPS ITS LUSTER. HOLDS OLD TRADE AND MAKES NEW. DOES NOT DETERIORATE. ESTABLISHED 18 YEARS. SOLD BY AGENTS AND DEALERS ALL OVER THE WORLD

U.S. METAL POLISH

3 OUNCE BOX 10 CENTS
SAMPLES SENT FREE
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POLISHES ALL METALS. Branches New York, Chicago, San Francisco. 295 E. Washington St. Indianapolis, Ind.
HIGHEST AWARD. CHICAGO WORLD'S FAIR, 1893. LOUISIANA PURCHASE EXPOSITION 1904.

NORTHERN Vertical Motors

186

Built in a wide range of sizes for operation where a vertical shaft is required, enabling operation of machine without the use of bevel gears, etc.

WE SHOW A NORTHERN VERTICAL MOTOR AS APPLIED TO A DEEP WELL PUMP.

Leaflet No. 10125 shows a novel application of the Northern Vertical Motor.

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Engineers, Manufacturers
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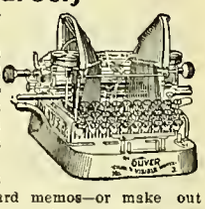

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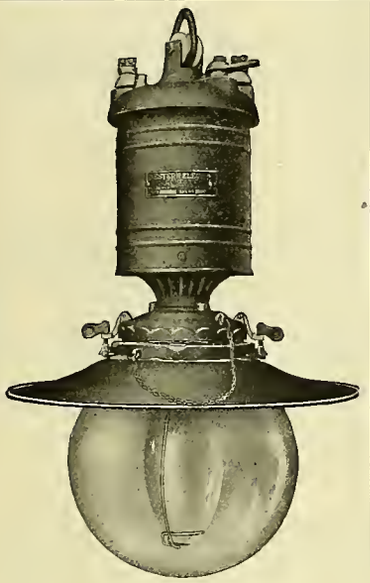

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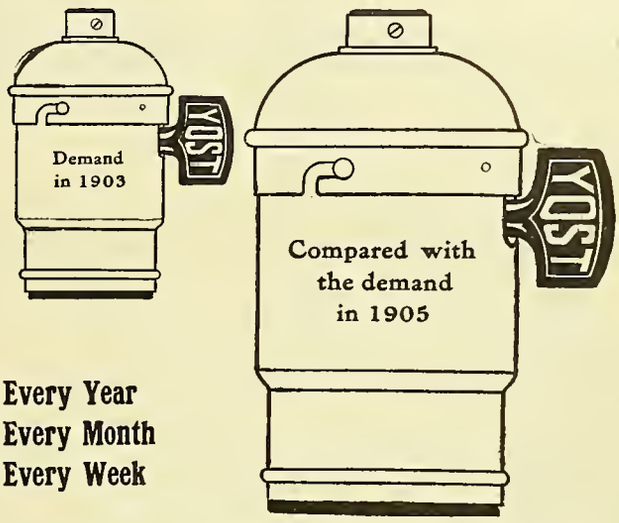

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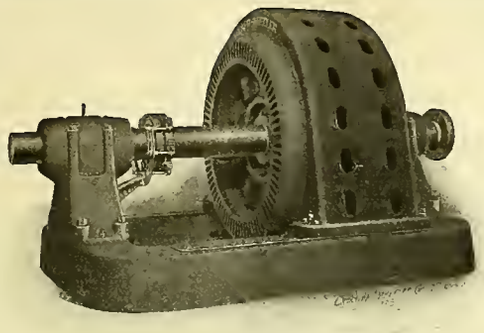

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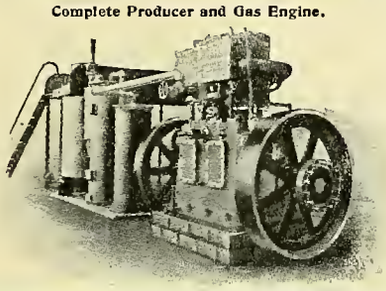

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The ash taken from the run amounted to about 270 pounds.

This should be very satisfactory from your standpoint and the Electric Light Company certainly cannot use it for advertising purposes, in fact do not believe they will ever mention having made this test. yours truly,

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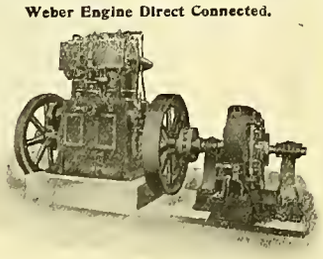

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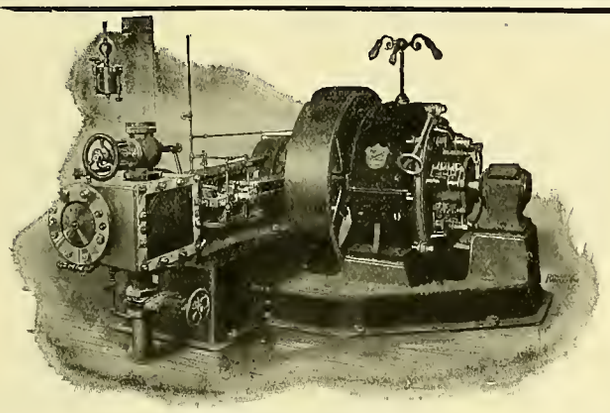

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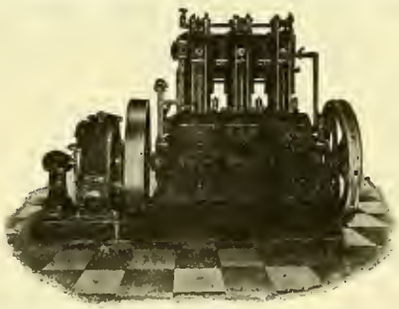

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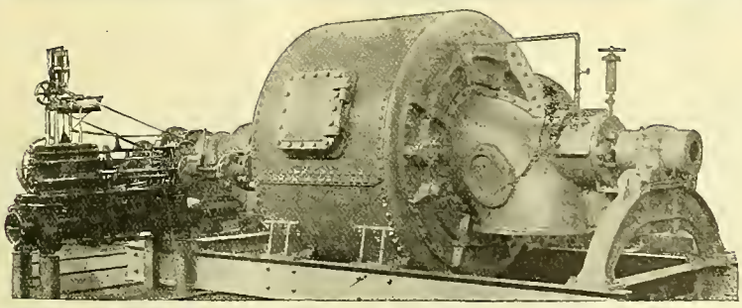

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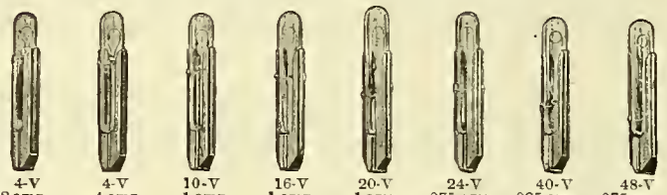

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4	.2	.2
4	.2	.4
5	.2	.15
6	.2	.15
10	.2	.1
12	.2	.1
14	.2	.1
16	.2	.1
20	.3	.1
24	.3	.075
30	.3	.085
40	.5	.085
48	.6	.075

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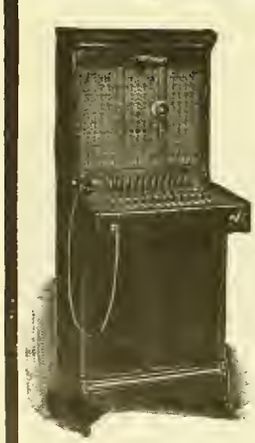

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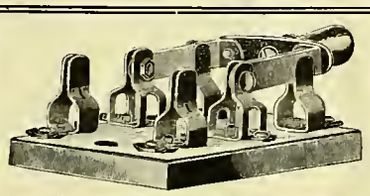

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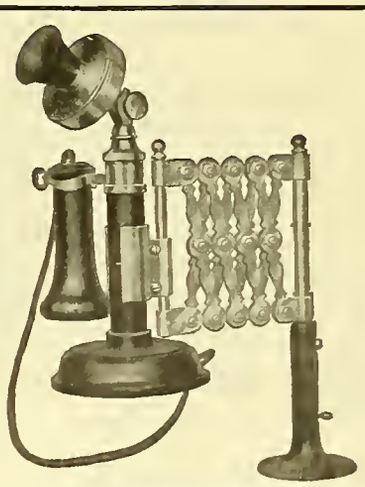

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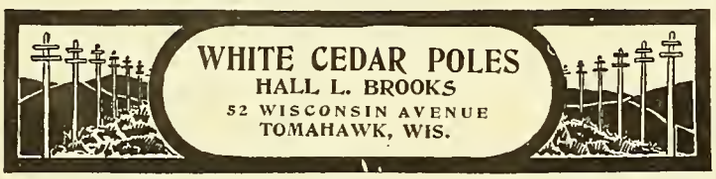

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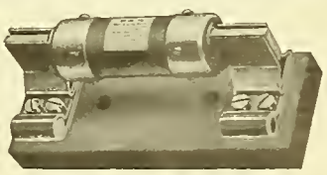
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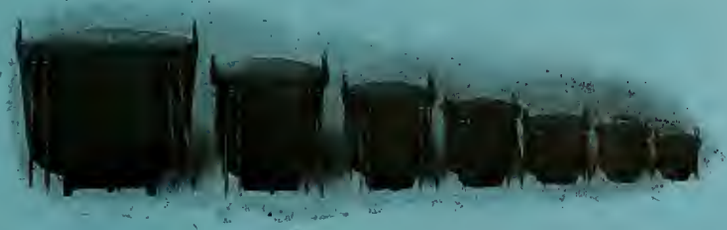

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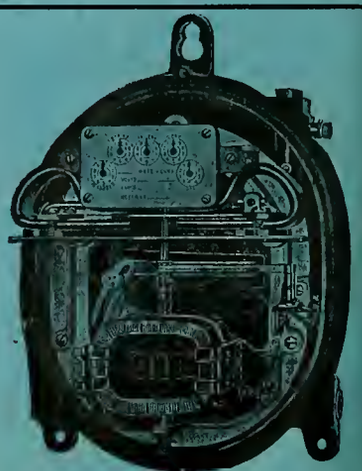

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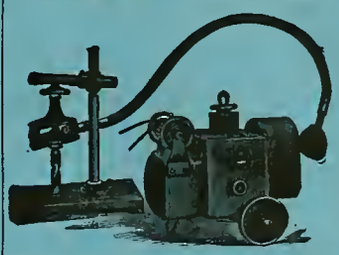

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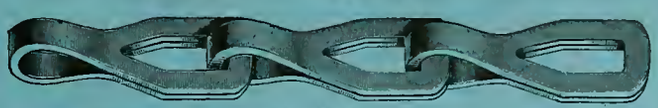

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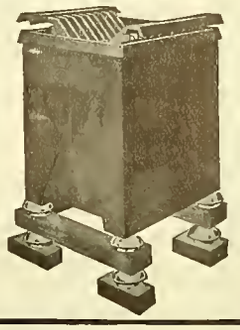

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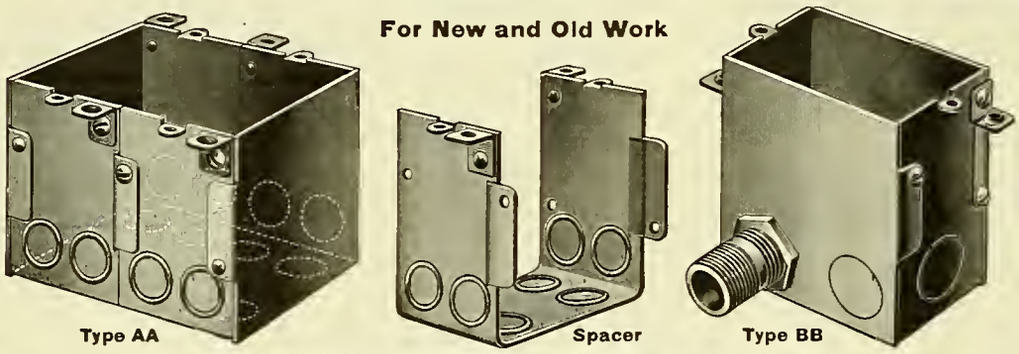

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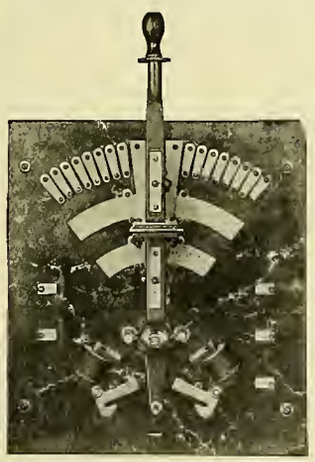

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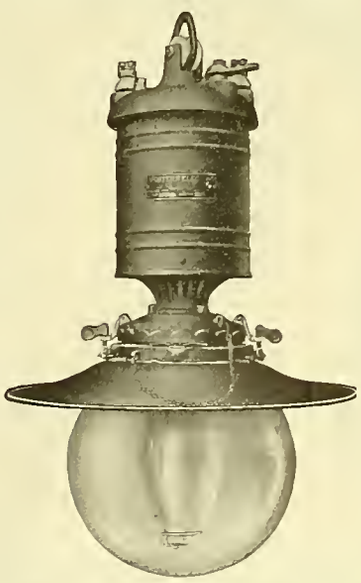

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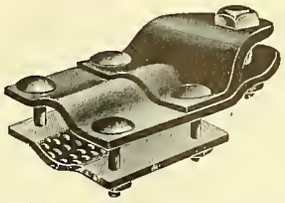

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IT IS EASY TO TURN CORNERS OR TO DEAD-END CABLES with KEARNEY CLAMPS.

It is not easy to do these things by splicing or serving, especially when it is cold and cables are loaded with sleet

Write us for prices.

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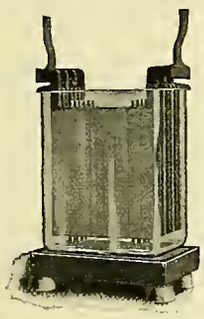

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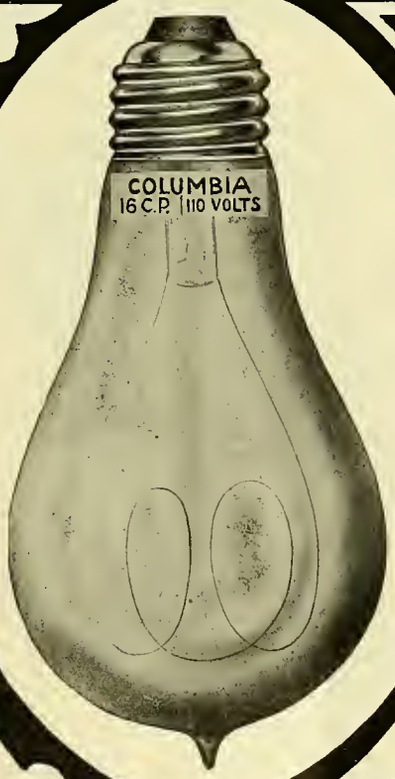

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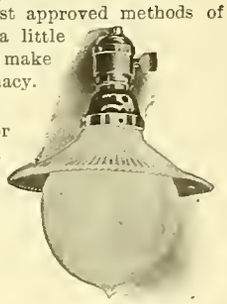

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Patent No. 532,760, Jan. 22, '95.
Patent No. 726,293, April 28, '03.
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Important point—**no "choking" gas.**
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Can be made by any man who can handle a soldering iron, better and cheaper than by any lead joint wiper. And, tho' absolutely permanent, they can be opened at any time for inspection or repair and again restored. How much money would this have saved *your* exchange? Details in Catalogue 125-A.

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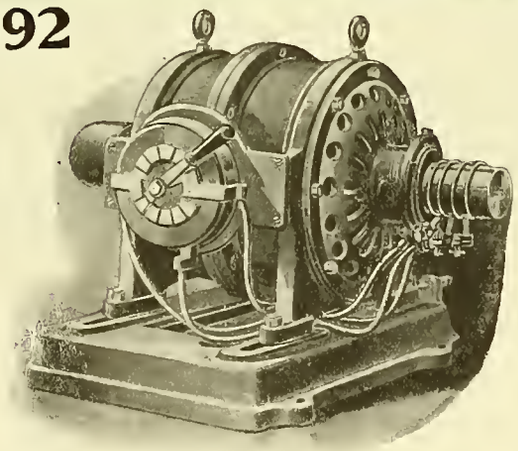
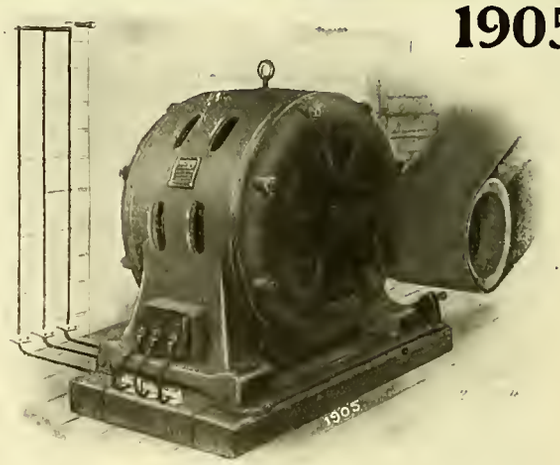
1892



1905



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Induction Motor which was commercially successful was produced in 1892 as part of the S. K. C. System. Many of these early motors are still in daily use after thirteen years of constant service.

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S. K. C. Induction Motors remain markedly superior in points of engineering and manufacture over ordinary apparatus of this class. S. K. C. Induction Motors are adaptable for floor, wall or ceiling use.

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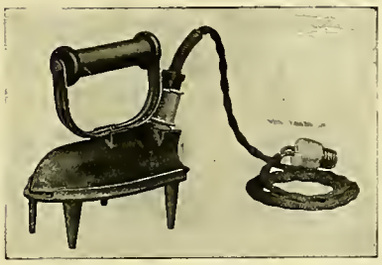

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Also supplied in a traveler's or sewing-room size. Three lbs., 250 watts.

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We Guarantee All Work

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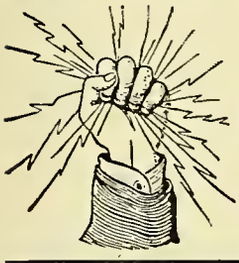

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These Couplings are of Steel and are made in the best possible manner.

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SAVE TIME, BOXES AND MONEY
Be up to date. Use them. Write for bulletin giving full particulars.
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FROSTS, SLEETS, THAWS AND FREEZINGS ARE COMING!
Go Over Your Lines and Anchor the Weak Places With
STOMBAUGH GUY ANCHORS
We give herewith the experience of one company

OFFICE OF NORTHFIELD TELEPHONE COMPANY,
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Gentlemen:—Yours of Nov. 30th received and contents noted. We have used your Anchors and have no doubt that they will prove satisfactory.
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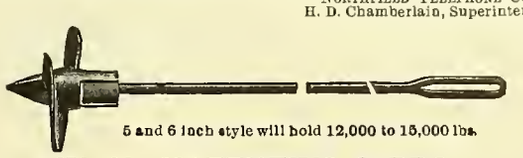
Very truly yours,
NORTHFIELD TELEPHONE COMPANY,
H. D. Chamberlain, Superintendent.



5 and 6 inch style will hold 12,000 to 15,000 lbs.

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For Underground Construction

COMBINES the **GOOD FEATURES** of other conduits.
ELIMINATES the **BAD FEATURES** existing in many kinds.
HAS VALUABLE FEATURES not found in any other duct.

The American Conduit Company has a corps of experts in underground construction and is prepared to furnish supervision of work if desired. We would prefer to co-operate with contractors in underground construction, but if desired will submit estimates and bids and take contracts for completed underground systems in any part of the United States or Canada.

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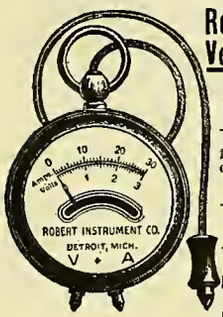

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Accurate, Durable
Guaranteed
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Send for Catalogue
3 Volts
30 Amperes
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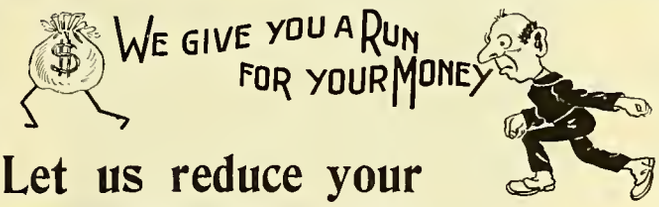

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We can do it by building for you automatic machinery that eliminates hand labor from the manufacture of most anything and reduces the cost of the machine work. We'll take all the risk. If you'll send us a sample of what you make, we'll make quotations.

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You will, of course, wish to be represented in it, so why not reserve space NOW and receive a much better location than it will be possible to obtain later on?

Let us know your wishes TODAY.

Western Electrician
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Our new mechanical governors co-operate with the inertia effect on the water and the momentum of the plant.
They have cut the cost of good government in two. Guaranteed in every particular.

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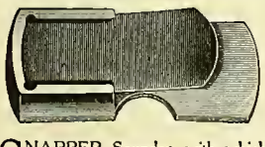

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"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Ideal Wire.

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As superintendent or manager of electric light and power plant. Over ten years experience in construction, operation and management of lighting and water works plants. Address Box 560, care of Western Electrician, 510 Marquette building, Chicago.

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Draftsmen—We have positions now open for draftsmen. Call or address Western Electric Co., Chicago. Ill.

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A man experienced in testing and installing alternating current and direct current machinery. Write fully, giving age, qualifications and salary expected. Address Box 550, care of Western Electrician, 510 Marquette Building, Chicago.

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A Central Station Electric Light Plant in good Illinois town, 2,500 population, new machinery, 10-year street light contract. About $5,000 cash required, balance can be paid out of profits. This is a good opportunity. Address Box 552, care Western Electrician, 510 Marquette Bldg., Chicago.

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1,200 LIGHT ELECTRIC PLANT,

Consisting of 100 horse-power Payne Engines and 60 Kilowatt Edison Dynamo, in perfect condition. Low price for quick purchaser. Apply

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Make your engines do more work.

ROBERTSON-THOMPSON INDICATOR

Willis Planimeter, Victor Reducing Wheel on easy terms

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Second-Hand Machinery

1 24x18 Ideal Automatic Engine.
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We also have on hand the following leather belts all in good condition:

67 ft. of 18 inch double ply.
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The above is all in first-class operating condition and is offered subject to prior sale.

Springfield Light, Heat & Power Company
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We are Headquarters for

REPAIRS

ELECTRICAL REPAIR WORK We operate the largest repair shops in America and have exceptional facilities for quick work. We repair **all kinds** of electrical apparatus and save our customers **weeks** in time in comparison with sending the work to the manufacturers direct. We have just reduced our prices and ask you to get our quotations on

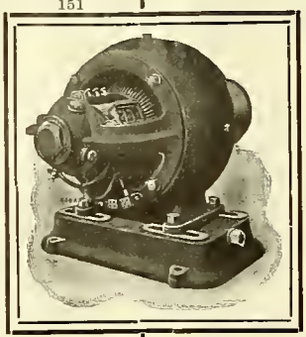
Armatures Rewound, Commutators Refilled, Transformers Rewound, Etc.

Send for our monthly "**Bargain Sheet**," showing net prices on our stock of **second-hand** dynamos, motors, meters, transformers and supplies. Every article a bargain.

GREGORY ELECTRIC CO.
54-62 S. Clinton Street - CHICAGO

NORTHERN SPHERICAL MOTORS

151



Are being standardized by numerous progressive machine manufacturers for equipping their mechanisms because the motors are

Compact, Simple, Economical in Operation, Readily Applied to Any Apparatus and Merge into the General Design of Machinery, Making Efficient, Handsome Unit

We want to discuss this matter with builders and users of machines and machine tools
Motor Bulletin No. 2535

Northern Electrical Mfg. Co.
Engineers, Manufacturers
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3 OUNCE BOX 10 CENTS. SAMPLES SENT FREE

POLISHES ALL METALS. BRANCHES NEW YORK, CHICAGO, SAN FRANCISCO. 295 E. WASHINGTON ST. INDIANAPOLIS, IND.
HIGHEST AWARD. CHICAGO WORLD'S FAIR, 1893. LOUISIANA PURCHASE EXPOSITION 1904.

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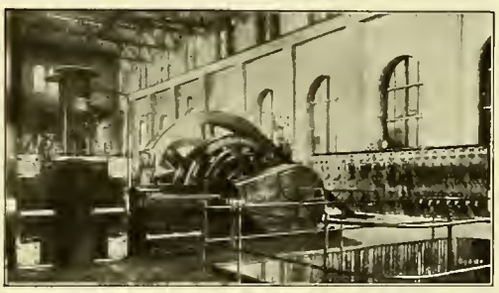
For
ARC LAMP and TROLLEY CORD
Send for Samples and Prices

SAMSON CORDAGE WORKS, - Boston, Mass.

Generators for Isolated Plants



400 K. W. Generator in Power Plant G. H. Hammond Packing Company's Chicago Establishment.

The installation of an Isolated Electric Generating plant for Lighting purposes, should head your list of 1906 improvements.

Write for list of prominent users of Crocker-Wheeler Motors and Generators in and near Chicago.

CROCKER-WHEELER COMPANY

AMPERE, N. J.

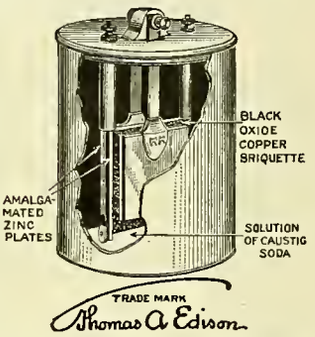
CHICAGO OFFICE, - - - - OLD COLONY BLDG.

You will confer a favor upon the advertiser by telling him—when you write him—that you saw his ad. in the Western Electrician.

ON PRIMARY BATTERIES—Voltage

One type of battery is now universally used for all hard continuous service, such as the operation of railway semaphore and crossing signals, to the exclusion of other types. In this cell the electrodes are of zinc and copper, with a solution of caustic potash and copper oxide for the depolarizer. It has been chosen over all other types because it has a capacity per unit weight greater than any other, either primary or secondary, and the voltage and current keep up to full value until the battery is entirely exhausted. However, the last point does not hold for even all batteries of the copper oxide type, for in many of them the copper oxide, which is a poor conductor of electricity, is loose or does not cover the whole surface of the negative electrode, or is *mixed with foreign matter*, or is one of the lower oxides of copper and not the black oxide.

When current is drawn from a battery possessing any one of these defects the voltage will fall, on account of the deposit of hydrogen on the negative electrode, and for the same reason the Internal Resistance will Rise.



In one type of battery these defects have been avoided; we quote from Carhart's "Primary Batteries": "Recognizing the good qualities of copper oxide as a depolarizer, EDISON has devised a form designed to meet the objections noted above. The copper oxide is employed in the form of a compressed slab, which, with its connecting copper support, serves also as the negative plate.—In recent cells the device has been resorted to of reducing a superficial film of copper on the oxide before it is sent from the factory."

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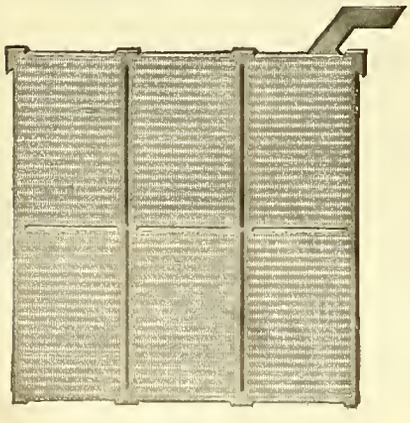

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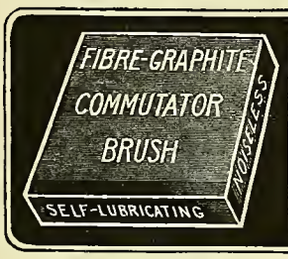

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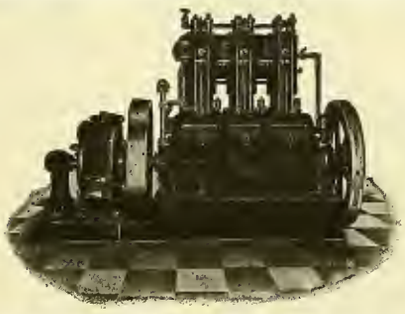

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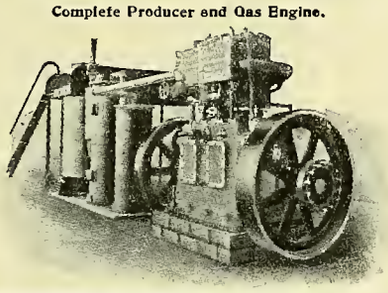

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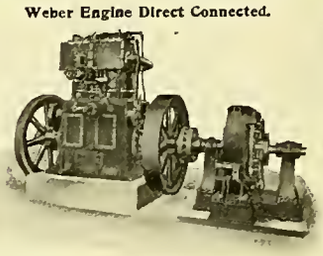

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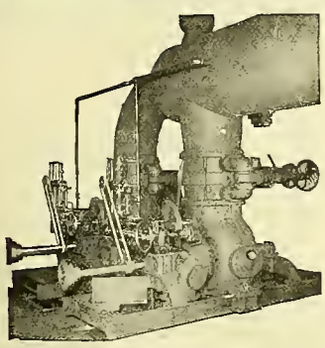

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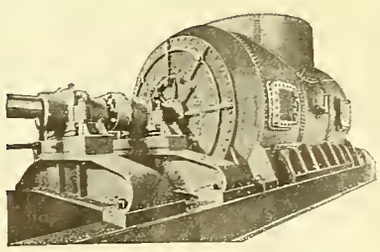

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4	.2	.2
4	.2	.4
5	.2	.15
6	.2	.15
10	.2	.1
12	.2	.1
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16	.2	.1
20	.3	.1
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40	.5	.085
48	.6	.075

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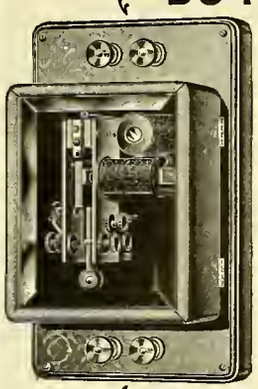

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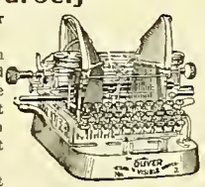

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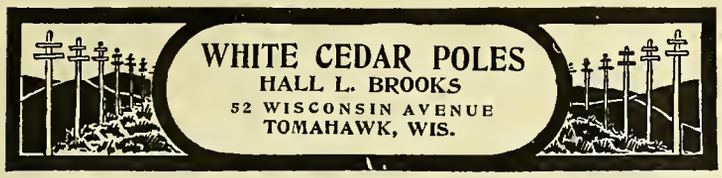

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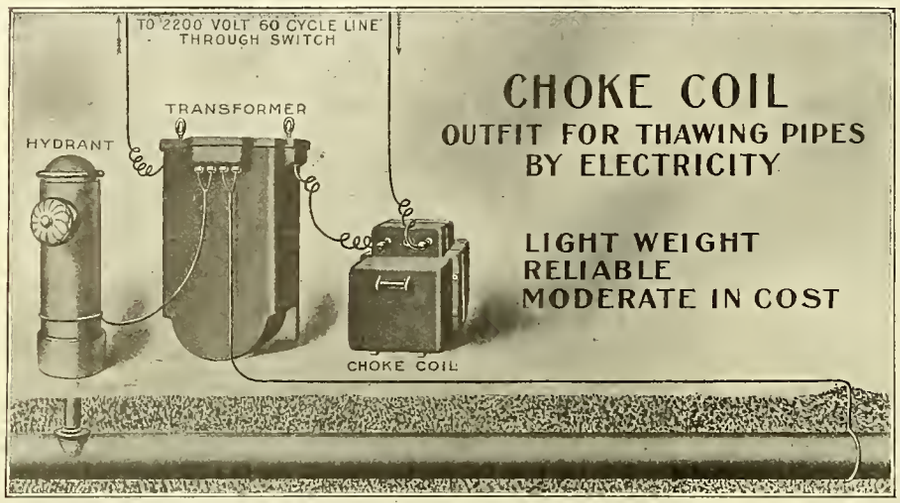

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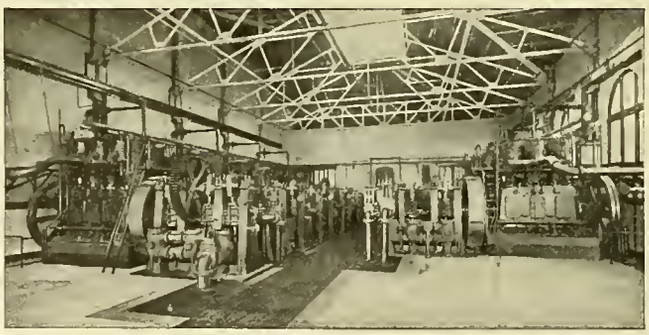

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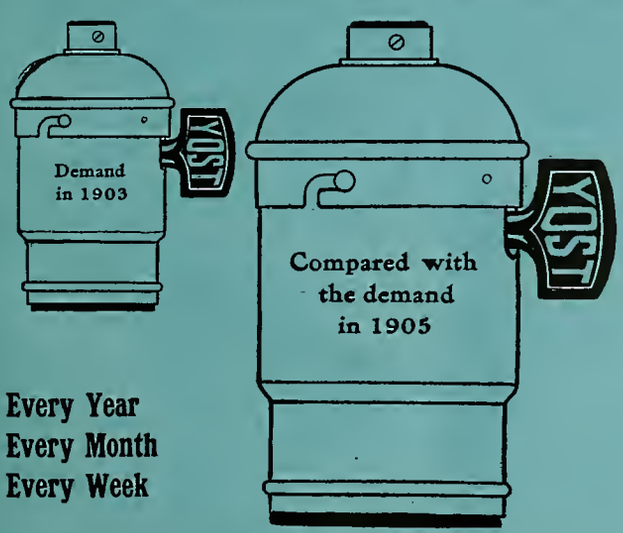

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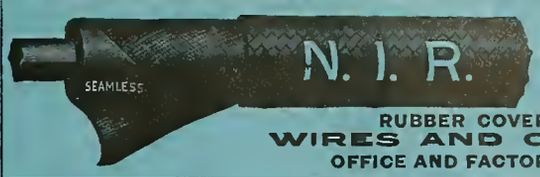

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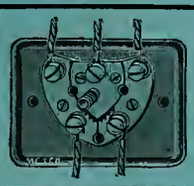

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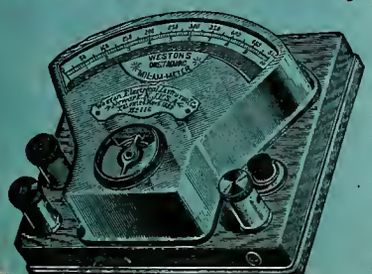

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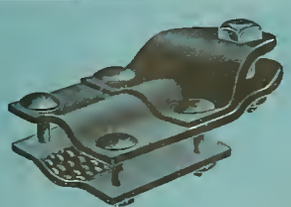

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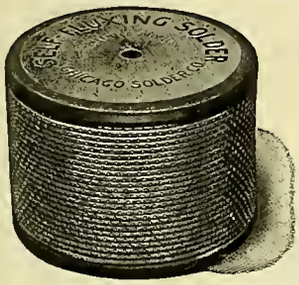

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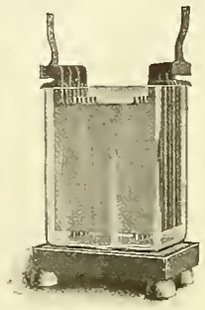

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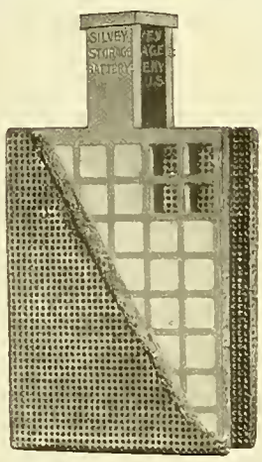

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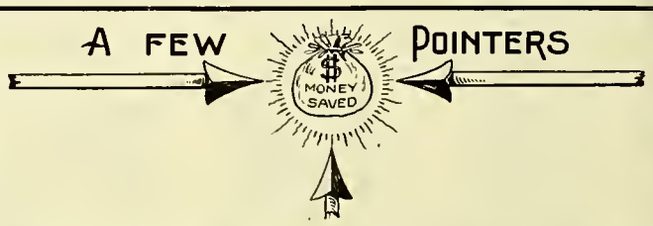

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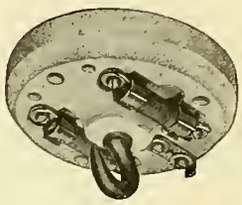

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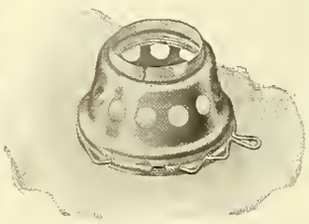

which we are now furnishing with **Prismo Zenith Lamps**, is quite an improvement over the old style screw-holder. It holds the shade in place by means of a spring instead of screws, which permits of a more rapid adjustment of the shade and at the same time holds it more securely in place. It is adapted to all sockets, key and keyless, and adds greatly to the convenience of the **Prismo Lamp**.

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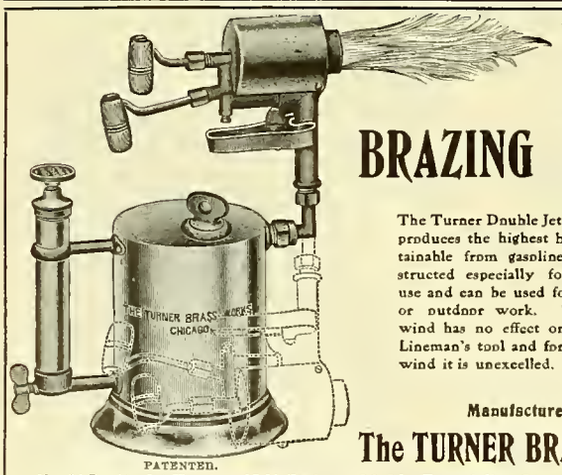

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On the night of Nov. 20th this section was visited by the most severe storm we have had for years. On our lines running East and West there was from one to two inches of ice. Those poles guyed by the Stombaugh Guy Anchor are still standing, and we think that this is as good a test of their worth as we could have had.

Very truly yours,
NORTHFIELD TELEPHONE COMPANY,
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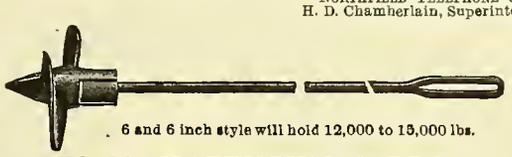

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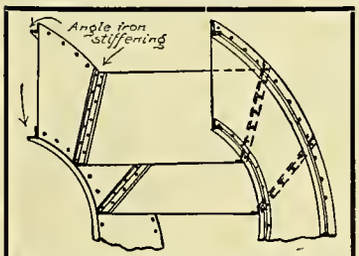

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The letter from which the above is taken, is dated May 8, 1905, and is on file in this office.

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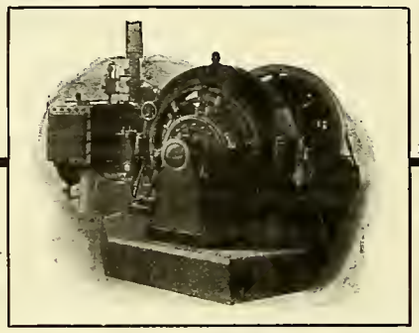

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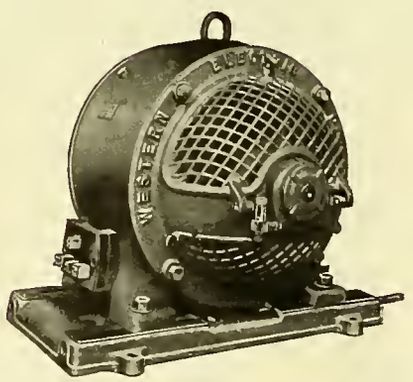

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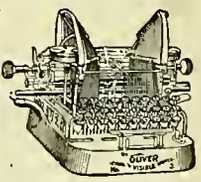

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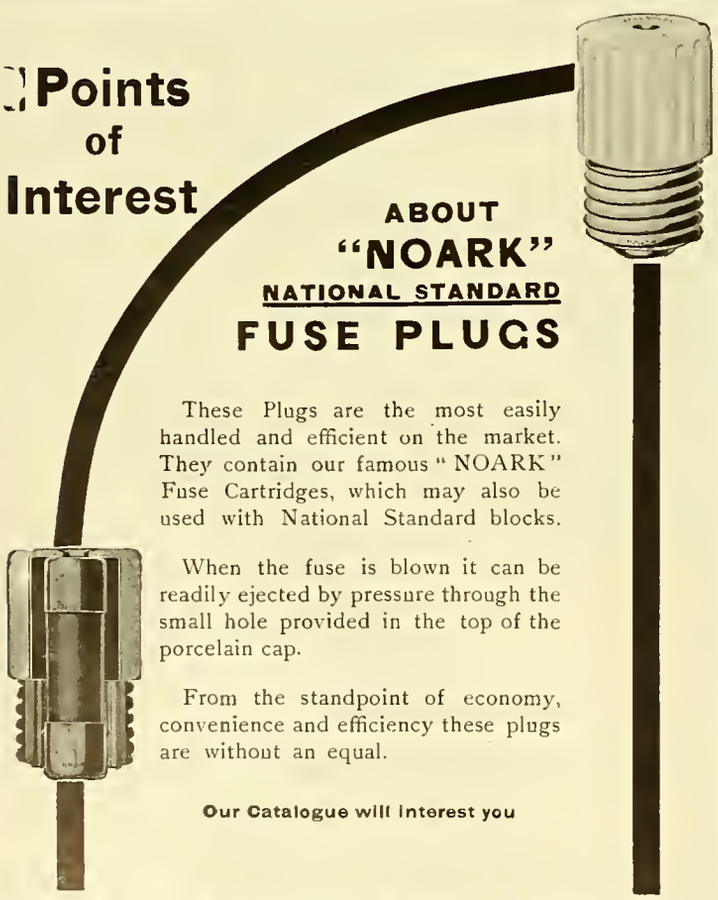

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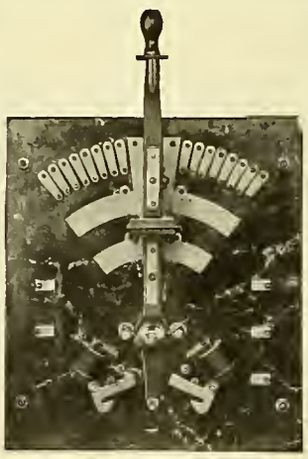
Full Reverse Motor Starter



This starter is adapted to start and operate a motor at full speed in either direction.

It is particularly adapted for use with lathes, planers and other machine tools, whose countershafts operate at a constant speed, but whose direction of rotations it is necessary to change.

Bulletin 12 gives prices and dimensions.

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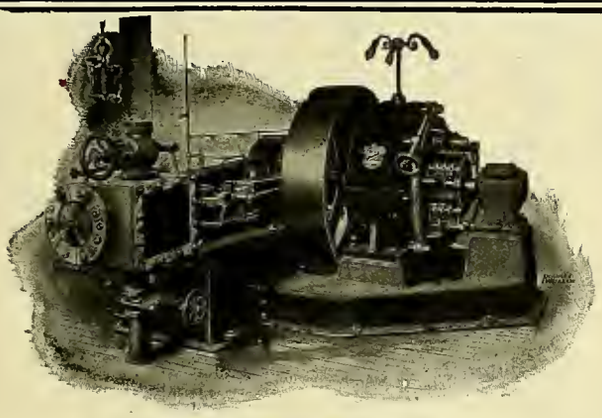

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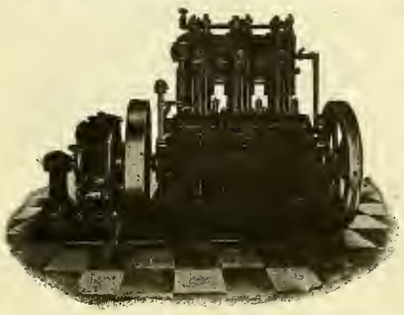

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ONE LB. COAL PER HORSE POWER PER HOUR. EVEN WITH COAL AT $5.00 PER TON COSTS LESS THAN ¼ OF ONE CENT PER H. P. PER HOUR OR NOT OVER $7.50 PER YEAR.

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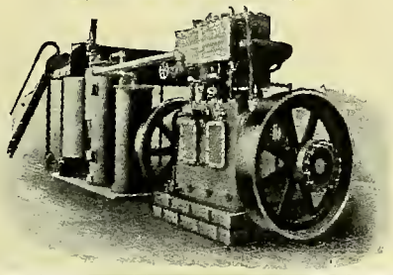

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Gentlemen:—The Electric Light Company made a brake test last Saturday night of our Weber Engine and Gas Producer—brakes were set at 100 H. P.

The result of this test was, in a twelve hours' run, the consumption of 1,100 pounds of pea-anthracite coal or ½ of a pound per H. P. per hour.

The ash taken from the run amounted to about 270 pounds.

This should be very satisfactory from your standpoint and the Electric Light Company certainly cannot use it for advertising purposes, in fact do not believe they will ever mention having made this test. yours truly,

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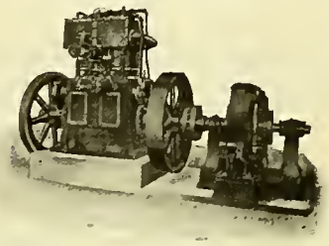

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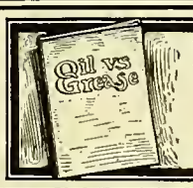

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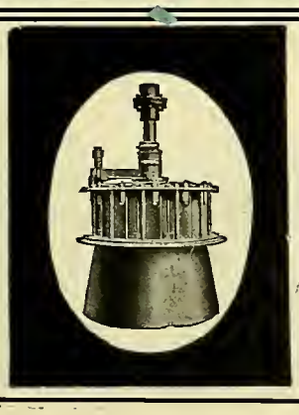

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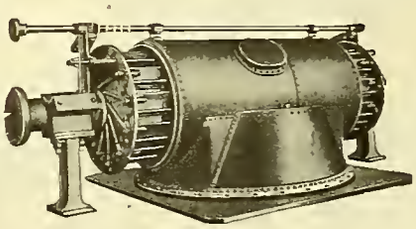

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6. EACH LAMP IS GIVEN A CAREFUL INDIVIDUAL TEST FOR VOLTAGE, CANDLEPOWER, MECHANICAL PERFECTION AND SIZE.

Table of Voltages

Voltage	Approximate Candle power	Amperes
3	.2	.2
4	.2	.2
4	.2	.4
5	.2	.15
6	.2	.15
10	.2	.1
12	.2	.1
14	.2	.1
16	.2	.1
20	.3	.1
24	.3	.075
30	.3	.085
40	.5	.085
48	.6	.075

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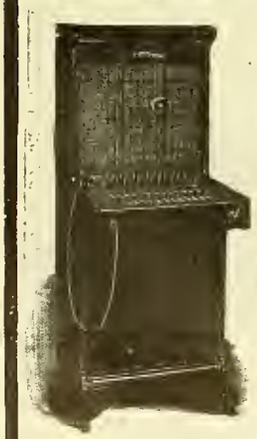

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Caleb L. McKee & Co. says—"That the automatic telephone is a success has been demonstrated beyond a doubt, and the favor with which it has been received by the local public is indicated clearly by the upward movement in the securities of the Columbus Citizens' Telephone Co. At the beginning of the installation of the automatic switchboard the common stock was quoted at about 55 bid while at this time 75 is bid with nothing offered below about 85; the preferred has advanced from par to 107 bid with holders asking 111, and it seems likely to reach a much higher level."

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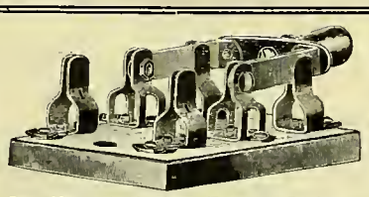

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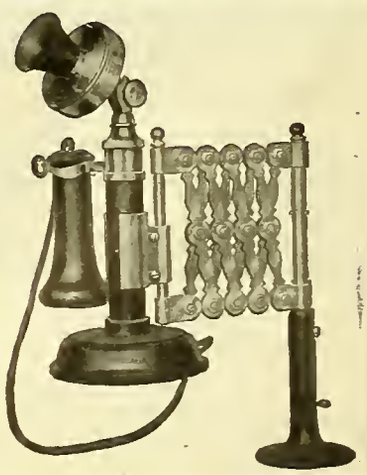

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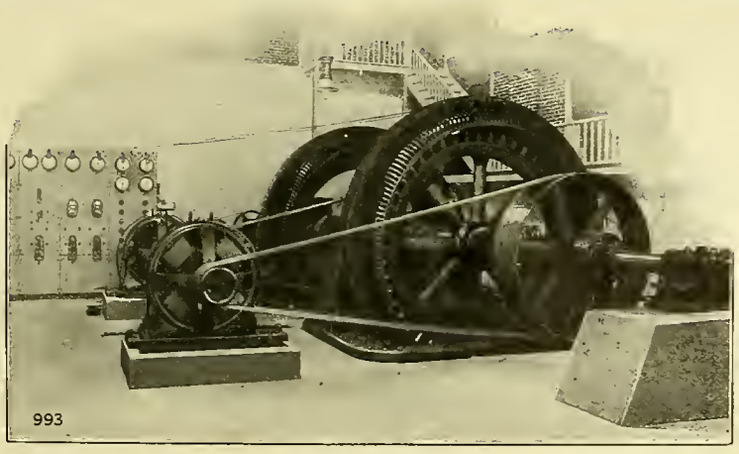

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Water-Wheel Alternating Current Generators

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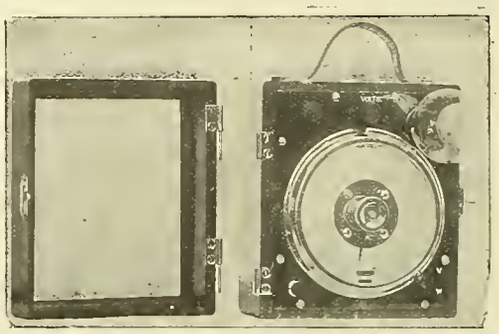
Portable Lamp Testing Volt-Wattmeter

Capacity 150 Volts—150 Watts

Should form part of the equipment of every central station. Can be used on either alternating or direct current circuits without change of calibration. Reverse readings are not necessary on direct currents.



Two concentric scales are provided, one indicating watts, the other volts. By using the switch, cutting the series windings in or out, the wattage of the lamps or the voltage of the circuit can be read.

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ARE BUILT UNDER

United States Letters Patent { No. 543,836 / No. 562,365 / No. 458,162 / No. 530,176 / No. 530,177

Also a number of other patents of somewhat less importance.

These patents cover broadly, among other things, **the commutator type** of single phase constant speed motor, employing the following fundamental features:

1st. Starting as a commutator motor, and short-circuiting the individual armature coils on attaining full speed.

2d. Any single phase motor of the induction type having a coil-wound armature in which rotation is maintained by use of coil connections, which permit the flow of polyphase currents in the armature, while single phase currents are used in the field windings.

We desire to inform the public of the character of these patents, so that the purchasers or users of infringing motors may be fully advised with regard to the matter. We shall prosecute any infringement of these patents. There is no commutator motor **"like the Wagner"** or **"employing the same principles with improvements"** which does not infringe the above patents.
We **do not** employ the **Tesla** principles in our motor.

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The motor will drive a sewing machine equally well, or a dentist's drill, or any other contrivance of like requirements in power. Let us send Bulletin 1071--E.

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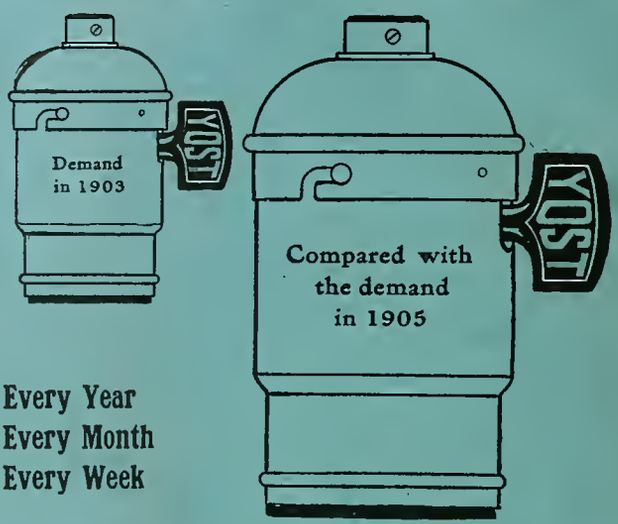

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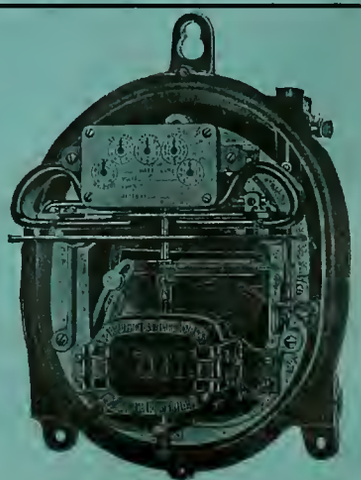

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